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OF THE

INSTITUTIONS IN UNION,

AND

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Journal of the Society of Arts,

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Official Record of the International Exhibitions.

117th Session.] FRIDAY, NOVEMBER 18, 1870. [No. 939. Vol. XIX.

PROCEEDINGS OF THE SOCIETY.

FIRST ORDINARY MEETING.

Wednesday, November 16th, 1870; Lord Henry G. Lennox, M.P., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Armstrong, Robert Williams, Rose-isle, Belleek, Fermanagh.
Bacon, Charles, 155, North-street, Brighton.
Barton, William, Boston, Lincolnshire.
Bartram, R. W., Belvedere-road, Lambeth, S.E.
Beattie, W. G., Engineer's-office, Nine Elms' Works, S.W.
Bindon, the Hon. Samuel Henry, Melbourne, Australia.
Bodkin, William Peter, Merton-lane, Highgate, N.
Bradbury, George Francis, Wellington Works, Oldham.
Bretnall, Henry, 24, Huntley-street, W.C.
Campkin, James, 4, Kingsland-road, E.
Child, Henry, Torr's Animal Charcoal Works, Deptford, S.E.
Dresser, Christopher, Tower Cressy, Notting-hill, W.
Evans, Philip James, Port-house, Brimscombe, Gloucestershire.
Finch, Mark, Vitriol Works, Victoria-docks, E.
Fletcher, Edward, Engineer's-office, North-Eastern Railway, Gateshead.
Gordon, Frederick, Ellerslie, Buckhurst-hill, Essex.
Gould, Frederick, the Elms, Kingston-on-Thames.
Greig, David, Steam Plough Works, Leeds.
Grover, Lieut. George Edward, R.E., 1, Champion-terrace, Shooter's-hill, S.E.
Hamel, Leopold, 25, St. Mary-gate, Nottingham.
Hancock, C. L., Himbey-road, Dudley.
Heller, T. E., Hercules-buildings Parochial Schools, Lambeth, S.E.
Herring, W. Anthony, Iron Foundry, Chertsey.
Higgin, Thomas, Tower-buildings, Liverpool, and Lansdown-house, Huyton.
Hodgson, George, Beehive and Laycock's Mills, Thornton-road, Bradford, Yorks.
Hoefnagel, Alexander, 21, John-street, Crutchedfriars, E.C.
Hoskold, H. D., Mining-offices, Cinderford, Newnham.
Jacob, Arthur, 1, Palace-grove, Bromley, Kent.
Jones, William, 13, Wharf-road, City-road, E.C.
Knight, Robert S., Ph.D., Grove-cottage, Atherstone, Warwickshire.
Lister, S. C., Manningham Mills, near Bradford.
Martin, John C., High-street, Barnes, S.W.
McCarter, John W., City Saw Mills, Foyle-street, Londonderry.
Minns, Charles, 9, Victoria-chambers, Victoria-street, S.W.
Mockford, William George Sharp, Normandy-wharf, Deptford, S.E.
Muir, Andrew, Victoria-bridge Works, Salford, Manchester.
Newlands, B. E. R., F.C.S., Vitriol Works, Victoria docks, E.
Nicholson, E. Chambers, Herne-hill, S.E.
Oakden, Rev. Joseph, St. Stephen's Vicarage, Congleton, Cheshire.
Paget, Arthur, Loughborough.
Powell, Alfred John, M.D., 122, Newington-causeway, S.E.
Richards, Westley, Carlton-club, Pall-mall, S.W.
Richardson, Charles, 6, South-wharf, Paddington, W.
Richardson, William, 6, South-wharf, Paddington, W.
Robertson, S. B., 6, Crown-office-row, Inner Temple, E.C.
Robins, Edward C., 16, Southampton-street, Strand, W.C.
Robins, Sydney, 108, Adelaide-road, South Hampstead, N.W.
Robinson, James, 17, Leamington-road-villas, W.
Roebuck, John Arthur, Q.C., 19, Ashley-place, S.W.
Ruck, George T., 19, St. Dunstan's-hill, E.C.
Russ, William, 9, Victoria-chambers, Victoria-street, S.W.
Scally, J. Dillon, Burton-on-Trent.
Seeley, Charles, M.P., 26, Princes-gate, W.
Smith, Willoughby, 18, Wharf-road, City-road, N.
Soares, Gustavo de Mevielles, 33, Sussex-street, Pimlico, S.W.
Starley, J., Coventry.
Strange, Lieut.-Col. A., F.R.S., 22, Jermyn-street, S.W.
Trendell, A. J. R., South Kensington Museum, W.
Vansittart, Mrs. Henrietta, Maid of Honour-row, Richmond, Surrey.
Walker, Robert Bruce, Gaboon, West Africa.
Welch, Edward J. Cowling, C.E., Eden Works, Eden-street, Hampstead-road, N.W.
Woodfield, W., Easemore Works, Redditch.

AND AS HONORARY CORRESPONDING MEMBERS.

De Geraci, Count Ventimille, Prince of Castel Buono, Palermo, Sicily.
Müller, William, University of Gottingen, Hanover.

The Chairman delivered the following

ADDRESS.

Ladies and Gentlemen,—It now devolves upon me to deliver the opening address of the 117th Session of the Society of Arts. I confess it is with extreme diffidence that I appear before you in this capacity for the third year in succession; diffidence, I may say, accompanied by very considerable surprise, surrounded as I am at the council table by men of vast professional knowledge and practical experience.

As usual, it is my first duty to refer briefly to the various members whom the Society has lost by death during the past year, all of whom have in various ways rendered us signal service.

Obituary.

During the past year, the Society of Arts has had occasion to mourn the loss of several members who have in various ways rendered us signal service.

Mr. John Tidd Pratt was well known for his benevolent exertions on behalf of friendly societies, having given great assistance to the legislature in its efforts to bring about a sound state of things amongst such institutions.

Deputy-Assistant Judge Payne, who expired last March, was one of our oldest members, his connection with the Society dating as far back as 1832. He was for many years one of our treasurers, and also filled the same office in relation to the fund originally raised by the Society for carrying out the Exhibition of 1851.

The Right Hon. Henry Unwin Addington, who died lately, in his 79th year, after being long and usefully employed in the diplomatic service of his country, was appointed permanent Under Secretary for Foreign Affairs, which office he held until his retirement in March, 1864, when the honour of a Privy Councillorship was conferred upon him in acknowledgment of his past great services.

The art-world has suffered a more than ordinary loss during the past year by the deaths of Daniel Maclise and Thomas Creswick. The former, born at Cork, came to London, and during his studies at the Royal Academy took the gold medal twice in succession. When in his 22nd year, his first pictures were exhibited at the British Institution; two years afterwards the Royal Academy elected him an Associate; and in 1841, being then only 30 years of age, he was chosen to the high honour of a Royal Academician. In 1866, the presidency of the Royal Academy was offered to this distinguished artist, and declined by him. Our Society feels a deep debt of gratitude to Mr. Maclise for the active interest which he specially took in the application of fine arts to industry, and for the design which he furnished for the cup which is periodically awarded as part of the Swiney prize. He was buried on the day of the dinner given by the President of the Royal Academy last spring, and no one who, like myself, was present on that occasion will readily forget the genuine regret that was expressed on all sides at his loss, or the eloquent tribute to his memory uttered by his illustrious friend, Charles Dickens, who was destined so soon to follow him.

It was in the delineation of the rocky scenery of the Welsh highlands that Thomas Creswick first attracted general admiration. In later times his "House by the Sands," "The Squally Day," and "Wind on Shore," served to maintain the reputation which he had established for himself, and, in 1867, many of those present will remember his beautiful picture of the "Banks of the Thames." Mr. Creswick served for many years as a member of our Council, and he took a zealous and active interest in the efforts which were made to resuscitate the vigour of the Society.

In Mr. Alfred Davis the Society has lost another kind and zealous friend. Having, by his untiring industry, amassed a large fortune, Mr. Davis displayed in a practical manner the deep interest which he took in the education of the people of this country. Jewish by religion, he undertook the duties of treasurer to the Jews' Free School, an institution which I described last year, and, after several previous liberal gifts, freed the school from debt last year by a splendid donation of £6,000. Mr. Davis also contributed £500 to the school funds of the City of London Middle-class Schools. For some years past he took a lively interest in the educational work of our Society. He gave an annual donation to our funds, and, at his death, established a fresh claim to our gratitude by leaving us a munificent bequest of £2,000.

I must also mention Mr. Alexander Robb, for many years a member, whose legacy of £200 was this day handed over to us.

State Aid to Science.

With regard to State aid to the advancement of science, a conference was held in this room, over which I had the honour to preside. Resolutions were then passed, and a petition was drawn up, the result of which was that the Government has appointed a commission, with the Duke of Devonshire as its president, to consider the whole question of the State aid which is now given in various ways for the promotion of scientific instruction. This commission has been engaged in taking evidence, but I fear it will be yet some time before any report can be issued, owing to the extent of the subject. It will be the duty of this commission to consider not only the direct payments made through the Science and Art Department, but the grants made to universities, colleges, and museums. Is it too much to hope that, as results of these inquiries, some system may be devised which shall apply grants fairly to all localities, and to all classes of the community? If a Minister of the Crown were made responsible for the proper administration of such a system, we might have more reasonable hope of witnessing the advance of sound reform in the management of our scientific museums, and a proper system of circulating superfluous specimens to local museums.

Education.

I need not tell the members of this Society that their Council has for years devoted a large portion of its funds, and much of its time, to the advancement of Education, especially in science and art; and, with this end in view, they have from time to time taken such steps as seemed most desirable for promoting an improved system of primary education, it being abundantly clear that, without such a foundation, all efforts to improve our secondary or scientific education would prove unavailing. During the last session the Council devoted more than usual labour and expense towards the realisation of this object. Inquiries were directed to be made into the state of primary education in certain specimen districts, with a view to ascertain on the spot what obstacles existed there to its improvement and extension. The instructions which were issued for these inquiries, and the reports which arose out of them, were well received by many of those most deeply interested in this subject. Portions of these reports were several times quoted by the Right Honourable the Vice-President of the Council, Mr. Forster, and others during the Educational debates of the last session of Parliament; while traces of the recommendations made by our Educational Committee are to be found in several of the provisions of the Bill which finally obtained the sanction of the legislature. The members of the Society will have observed that our Secretary has lately issued, on the authority of the Council, a circular to those on whom the selection of the new School Boards will devolve. That circular contains recommendations which it is hoped may have some influence in promoting the selection of the most eligible candidates. It has yet to be seen what will be the composition of the new Boards, but I earnestly hope that on this occasion all party spirit will be laid aside, and that but one thing will be looked to by those in whose hands the electoral power rests, viz., the fitness of the persons who are candidates for the onerous duties which they are willing to undertake. The Council of this Society will closely watch the working of this great measure.

The Council of the Society of Arts intend to renew their efforts to establish a national training school, for the cultivation of music amongst all classes of the people. In carrying this out, the evidence taken and the reports published in our *Journal* on this subject in 1865, will be found to be of great practical utility. This scheme was a favourite one with his Royal Highness the Prince Consort, during many years of his valuable life, and the Commissioners of the Exhibition of 1851 having expressed their readiness to assist in carrying it out, the Council of the Society of Arts entertain sanguine hopes that arrangements may be successfully made. The completion of the Royal Albert Hall will greatly facilitate the establishment of such an institution, that building being admirably calculated to afford the necessary accommodation.

In connection with the subject of education, I should mention that we have taken great interest in the extension of naval and military exercises as a part of a system of national elementary education, which will induce habits of order, method, and discipline, which cannot fail to be of great value in all avocations of life. With this view, we promoted last summer a review of schools, where drill forms part of the system of education, at the Crystal Palace, which was so successful that we hope to repeat it the next and following years with beneficial results.

Museum of Natural History.

Questions connected with the progress of art and science demand especial notice from me this year, having regard both to what has been effected during the past twelvemonths and also to what remains to be done in the future. I think on this subject we may congratulate ourselves that Parliament has at length voted a sum of money for the construction of a suitable building for the accommodation of our splendid collections of natural history. This museum will be placed on part of the ground which formed the site of the International Exhibition of 1862. Satisfactory as this arrangement undoubtedly is, I should in some respects have preferred the Thames Embankment site, but Parliament having decided otherwise, I have not a word to say in opposition to it; and certainly I should be the last to complain of any arrangement by which an eligible addition can be made to the open garden spaces of London. Let us hope that, when this museum is finished, it may be opened in the evenings as well as by day, in order that the artizan classes may enjoy additional facilities for visiting that which has always been a most popular object of interest amongst them. It would, I believe, add much to the convenience of the arrangements if means could be devised by which this museum could be brought into connection with the interesting art collections at South Kensington without exposing visitors to the inclemency of our climate.

East London Museum.

The Duke of Buckingham, during his tenure of office as Lord President of the Council, obtained the sanction of Her Majesty's Government for establishing a Museum in the east of London as a national institution, and he authorised the appropriation of part of the temporary structure at South Kensington to be made over as a skeleton for the new building. The Society of Arts made a donation of £100 towards the same object. The building is now fast approaching completion, and will, I hope, be opened in the course of next year. Those who visit the solid brick structure which has been erected to contain these collections, under the direction of Colonel Scott, will not easily recognise the features of their old friends, "the Brompton Boilers." I may mention as an interesting fact that the façade will be decorated with mosaics, representing Arts, Manufactures, and Commerce, these pictures being the work of the female students in the South Kensington Schools of Art.

Victoria Embankment.

The beautification of our metropolis has, in the last twelvemonths, made rapid strides. The Victoria Embankment, whether regarded as an ornament or as a convenience to the public, has been a signal success; and we may hope that any buildings which may be erected in contiguity to it will be of a character less disfiguring than some of those which unfortunately are to be seen in its neighbourhood. It certainly seems but reasonable that, whenever any public company or corporate body applies for Parliamentary powers to enable it to execute any works, or erect any buildings in the metropolis, it should, before coming to Parliament, deposit at the office of the Commissioners of Her Majesty's Works and Public Buildings, plans and elevations, designs and models, in like manner as railway companies are now obliged to deposit plans and sections at the Board of Trade; and that the First Commissioner of Works should report to Parliament on the merit or demerit of the plans and elevations, designs, or models which may be brought under his notice. While on this subject I cannot omit tendering my thanks to my noble friend the Marquis of Westminster, who has succeeded in transforming that district of London where, half a century ago, bull-baiting and badger-hunting took place, into streets of palaces, which recall some of the beautiful architectural features of the ill-fated capital of France.

Food.

At the opening of last session I expressed, on behalf of the Council, a hope that, before a year had passed, the scientific knowledge of our chemists would have discovered some means by which meat could be brought in a raw state to this country from our more distant colonies. But I regret to state that as yet our hopes in this respect have not been realised. This is the more to be regretted because, in many of our colonies and other parts of the world, there exist large herds of cattle and flocks of sheep, from which no addition to the food of our people is at present derived; their wool, tallow, and hides being all that reach this country. While, however, science is still at fault in providing a means of preserving meat in its raw state, specimens of preserved meat in tins have been laid before the Society, which show that great improvement has been effected in this method, and that more still may be expected in this direction. The efforts of preservers have been directed especially towards improving this method of treatment, so as to preserve the meat without destroying its flavour and texture, and thus to render it more palatable and nutritious. I need scarcely add that the Food Committee will continue its valuable labours.

Post-office.

There are, perhaps, few subjects in which the Society of Arts has taken a deeper interest, or has exerted itself more actively, than in the reform of our postal arrangements. A cheaper system of postage for trade samples and other small parcels has long been advocated in this hall, and the reasons for such a change are so evident, and have been so often stated, that they do not require any reiteration on this occasion. This is a Society for the encouragement of commerce, and therefore one of our principal aims has been, by obtaining a reduction in the postal rates for samples, parcels, and printed matter generally, to place our commercial men in a more favourable position for meeting the competition of other nations. In any remarks that I may make on this subject, I wish it to be distinctly understood that I do not cast any reflections on the action of my dear and noble friend, the Marquis of Hartington, who carries out with remarkable administrative ability the duties of Postmaster-General.

The struggle with the Post-office has been a long and obstinate one, but at length public opinion has asserted its sway, and under the direction of the present Postmaster-General certain revised regulations with regard to postage rates were promulgated and came into operation on the 1st of October last. Some of these changes were in the right direction, and one of them has been found beneficial to this Society, but many of them are confused, complicated, and replete with injustice to the commercial world.

By some persons the Post-office is regarded as a source of public revenue, by others as a means by which the country may manage its own communications, charging itself only with the actual cost of distribution. The authorities at St. Martin's-le-Grand would appear to hold the first of these theories, but the Society of Arts decidedly differs from them in this respect. The post-office, according to reliable information, employs some 26,000 officers, and has upwards of 12,000 postal stations, available for the collection and distribution of letters and parcels; and in addition, has 30,000 miles of mail cart delivery. Here, then, we have a vast organisation, ready to carry out such alterations as are rendered necessary by the increased trade and commerce of the country.

Little more than a month has elapsed since the new regulations have been put in force, but it is generally felt that what the Post-office have given with one hand they have taken away with the other. The Post-office authorities must not deceive themselves, but must realise the fact that the question of inland sample and parcel post must yet be revised in a more liberal spirit, and be placed on a broader and more satisfactory basis.

First, however, I would say a word with regard to the change which has introduced a postal card into this country. I will not here dwell upon the fact that these cards are open to grave abuse, both by encouraging prying curiosity into the correspondence of others, and also as having, to a certain extent, placed in the hands of evil-disposed persons an instrument by which, with increased facility and impunity, they may convey to others insulting and offensive communications. This, however, is the abuse, not the use, of the postal card system; it is the principle upon which they are issued to which I would take some exception. The Post-office authorities proclaim to the world that they can afford to carry a letter of 24 grains in weight for ½d., provided that it is written on a stamped card, supplied at the expense of the Post-office, and yet they would have us believe that they could not afford to carry for the same price the same weight, if the public and not the Post-office is at the expense of providing paper and stamp. I have myself seen an arrangement of paper and envelope which would weigh less than these postal cards, but which, under the present regulations, would have to pay double what they are now carried for. Again, although no other card than those issued by the government will, if written upon, pass under a halfpenny stamp, yet any sized card up to 2 oz. may be used, if what is technically called "book-post matter" be printed on the back. I confess my inability to see the principle upon which the Post-office authorities can carry 24 grains of material provided at their own expense for ½d., yet refuse to do so at the same price if the material is provided by the public. I shall probably be asked, "Do you then suggest that weight should be the only test, and, if so, how should we be able to carry the *Times*, and other journals at the reduced rate for which they are now taken?" My reply is, that these cards are, to all intents and purposes, letters; and that the postage of letters and of printed matter and parcels should be regulated on different principles.

The new regulations for the carriage of printed matter are as complicated, unintelligible, and unsound as they could well be. For Sir Rowland Hill's great inland postal reform only two short rules were required, but under the revised regulations which have lately appeared no less than fourteen rules are required to deal with newspapers, eight for the book post, and seven for samples. With regard to the first of these, I would ask on what principle can there be any difference made in the charge for transmission between newspapers and other printed matter of a less ephemeral nature. At present a newspaper weighing 6 oz. passes for one-halfpenny, but for the same weight of other printed matter the charge is three times as great. But if it is from a fear of overwork that these curious distinctions are made, I can only regret that the authorities at the Post-office should have resorted to such vexatious restrictions in order to carry out their object. The refusal to recognise as a newspaper anything which is not published at least every seven days, or which, for the convenience of its readers, is stitched together, seems most arbitrary and unintelligible.

What the Society of Arts intends to agitate for, is the removal of these distinctions, and the establishment of a parcels post, by which a uniform rate of ½d. would be charged for every 4oz. and under, or 2d. a pound for everything up to a specified limit, say, that which prevails in North Germany.

But if there is reason to complain of the changes made in the conveyance of printed matter, how much more so those which have been issued with regard to the inland sample and pattern post. Under the old system, the postage was 1d. for every 4oz. packet, whether a sample packet, goods sent for sale in execution of an order, or articles sent by one private individual to another. The privilege in the two latter cases is now withdrawn, and, under the guise of a boon in the shape of reduced postage, a great hardship has been inflicted upon all classes of society. These alterations have been justified, in the first place, by a fear of the great charge which would be levied by the railway companies for the carriage of an enlarged parcels post; and, secondly, from a fear of the system breaking down under the pressure of over-work.

The objection with regard to the railways was, if I recollect rightly, advanced some years ago, before a Committee of the House of Commons, by no less an authority than Sir Rowland Hill; yet, like many other objections of the same kind, advocated by authorities as great, experience shows that time is gradually removing its force. Railway directors have discovered that the almost prohibitory rates which they have levied on the carriage of small parcels have, as is generally the case in similar instances, led to evasion; and, as is well known, it is now the constant practice to dispatch one large case (which is carried at a comparatively low charge), the same being filled with small parcels, which, if separate, would have been charged very high rates, the distribution of the latter being left to the agents in the district to which they are consigned.

The second objection, as to the undue pressure of work which would be thrown upon the letter carriers by an increase in the weight they carry, appears equally groundless. How can it be gravely asserted that the department cannot undertake to carry more than 12oz. of sample or pattern in one packet, and yet can stand the strain of receiving 14lbs. if the parcel consists of books? It requires a strong infusion of red tape indeed to imagine that 12oz. of kid gloves would break down a postman, who is compelled to carry books 18 times as heavy. I have no doubt the time will come when light delivery carts will have to be used by the Post-office; and I must be distinctly understood to express my earnest hope that, even in these days of economy, extra duties will not be thrown upon Post-office servants of any grade without adequate extra remuneration. Perhaps the most remarkable feature of the recent change in this respect is that it would seem not to be in accordance with a statement made by my noble friend, the present Postmaster-General, when a deputation from this Society waited upon him, upon which occasion his Lordship stated that the Post-office was calculated and fitted, not for the carriage of large parcels, but for the rapid distribution of small ones.

The distinction between samples and other parcels leads to great inconvenience, and, as it is palpably unjust, leads to frequent evasion. The present regulation forbids the transmission of, for example, a pair of woollen socks; one sock may go, for that is a pattern, but a pair may not, lest they should be worn. The practical result of which is, that if a person wishes to send another a pair of socks, he sends each sock in a separate parcel, thus giving double work to the Post-office authorities. Parcels are forbidden, but books are carried, so that, whilst it is forbidden to send a comforter or a box of lozenges to a sick friend, you are at perfect liberty to provide him with a pocket edition of "Blair's Sermons." Another instance of the unsoundness of these regulations is afforded by an anecdote which appeared in a recent number of our *Journal*, where a gentleman having occasion to send by post a small parcel containing twelve white neckties, was obliged to send each one separately, so that the trouble of conveying what would in any case have been but a very light parcel, was needlessly multiplied twelve times. And here we may very fairly ask why our Post-office has not profited by the experience of foreign countries?

In North Germany every facility is afforded for the transmission of small parcels of every kind through the post. The details of these arrangements will be familiar to every reader of our *Journal*, through the answers to inquiries on this subject, which have recently appeared in its pages. In North Germany, during the present unhappy struggle, the Post-office has been of material service to the army, and especially to the sick and wounded. Large quantities of woollen goods, and every description of appliances for the mitigation of suffering, have been supplied by this means. A Member of Council has given me the information that a lady friend of his is in the habit of getting her fish from the Lake of Zurich, her pheasants from Bohemia, and her laces and ribbons from Vienna, all by post. Indeed, it would appear that there is hardly any restriction as to the kind of article which may be forwarded by the German parcels' post. Live animals are now excluded, with the exception of oysters, in consequence of a live bear having presented himself one day to be stamped and forwarded. I must not be supposed here to be asking our Post-office authorities to follow the example of the North German Post-office so far as to affix the Queen's head to a Strasbourg pie, a Boulogne sausage, or a salmon. I only mention these things as showing the vast difference there is between the facilities afforded by the same department in Germany and in England.

In France, the parcels' post admits of a very wide application; but it must be admitted the regulations are somewhat complicated, and in fairness I am bound to state that some complaints have been made there on account of the vast weight which their system of collection and delivery has thrown upon the Post-office *employés*.

Among the many complaints that are daily made with respect to the operation of the recently-introduced regulations, there are one or two which call for special notice on this occasion. I have received a letter from one of the most eminent firms in the City, stating the great inconvenience occasioned to them by the withdrawal of the impressed stamp on the newspapers, and the compulsory use of adhesive labels, which, in a case where many thousands are sent out, is both expensive and inconvenient. The same remark applies to the regulation which prohibits the use of the embossed stamp when transferred from a spoilt envelope to another. In extensive correspondence cases of misdirections must be frequent, and, under the new arrangements, would entail considerable loss. The same gentleman writes, that they daily send out nearly 800 invoices, letters, receipts, &c., which were formerly sent with an impressed stamp, but since the recent alterations they have had to adopt the adhesive label, which is, when the number of letters is so great, an unpleasant and tedious process.

In leaving this branch of my subject, I may remind my hearers that this Society has opened a subscription list, for the purpose of commencing a campaign for the removal of such of the recent regulations as are unsound in principle, and injurious to those whose interests we have at heart.

RAILWAY COMMUNICATIONS.

The interests of our commercial men are equally bound up in a sound administration of our railway communications. At first, England took the lead in this matter, but she has now to sustain the rivalry of other countries, where, in some cases it must be admitted, greater facilities are afforded to the industrial classes. The subject has consequently attracted much attention of late, particularly in the public journals, and many proposals have been brought forward; and there can hardly be a doubt that, by improved structural arrangements, or by new administrative combinations, the advantages now enjoyed through railway communication might be greatly extended. On these points many communications have been made to the Society of Arts for some years past, and the Council has thought right to name a special committee, which, by promoting discussion and carrying out investigations, shall be able to recommend some decided action during the ensuing Session.

TELEGRAPHS.

I mentioned last year that, in consequence of the Government having undertaken the administration of the telegraphs, a special committee of this Society had been appointed to watch its action in the matter. Telegraphy being as yet almost in its infancy, and having only attained its present stage by successive development, it was felt that there might be some danger lest Government interference should tend rather to stereotype the present condition than to foster the development of this science. As the Society have agitated for a cheaper postage, so do they intend to agitate for a cheaper system of telegraphy. In Switzerland, according to the returns of the Board of Trade, a reduction of the charge for telegrams from one franc to fifty centimes has increased the number of messages by 101 per cent. in the year 1867-8.

The following table shows the progress made from 1852 to 1869:—

	Home.	Foreign.	Total.
1852..........	2,876	..	2,876
1853..........	74,095	8,491	82,586
1854..........	109,599	19,568	129,167
1855..........	133,936	28,915	162,851
1856..........	169,376	57,696	227,072
1857..........	192.664	67,500	260,164
1858..........	180,489	66,613	247,102
1859..........	196,425	90,451	286,876
1860..........	208,311	95,619	303,930
1861..........	217,700	114,233	331,933
1862..........	241,814	140.638	382,452
1863..........	298,778	158,093	456,871
1864..........	325,165	189,787	514,952
1865..........	364,118	227,096	591,214
1866..........	383,159	285,758	668,917
1867..........	397,333	310,687	708,020
1868..........	798,186	354,906	1,153,092
1869..........	951,337	418,087	1,369,424

Such being the result of the change made in Switzerland, and the experiment progressing favourably, as it does in Belgium, surely we may take it as tolerably certain that, in our own more favoured land, the result of a similar change will be equally or even more satisfactory. However, as it is difficult in this country to bring about any reform of this kind at once, I shall, on the part of the Society, take an opportunity of urging on my noble friend, the Postmaster-General, the advisability of trying the effect of a reduction from 1s. to 6d. for telegraphic messages first in the Metropolitan district only, feeling assured that, if this experiment be fairly tried, it will shortly lead to the lesser sum being established as the uniform rate throughout the country.

CHANNEL STEAMERS AND SHIPS' LIFE BOATS.

It was announced by me last year that prizes would be offered for improved designs for channel steamers and for merchant ships' life-boats. In the first case 17 models, and in the latter 44 models and 6 drawings were sent in; but, inasmuch as in the latter case one competitor sent in 19 models, the number who actually competed was 31. I regret to state that neither in one case nor in the other did any design so far carry out the objects of the Society as to justify the committee in awarding a prize. For the present, at all events, the question of the Channel steamers has been dropped, but the committee are unanimously of opinion that the subject of lifeboats for coasting vessels is so important that a fresh effort should be made in this direction.

The wreck register and chart of 1869 shows that during that year there was a total of 2,114 wrecks and mishaps, showing an excess of 367 over the preceding year; the number of lives lost being 933. From an interesting analysis which appeared in the *Pall Mall Gazette* of the 15th inst., it seems that, of these fearful losses, a great proportion occurred in our coasting trade; and that of the 2,114, 177 happened in a perfect calm, or a gentle breeze, and 660 in moderately fresh and strong breezes. It is unquestionably true that much of this lamentable loss of life is due to the incompetence of the men who are in charge of the vessels, but it is equally true that a great deal must be set down to the want of a good class of light life-boats, suitable for coasting vessels. It appears, from the same source of information, that of the ships wrecked in the past year, 436 were between 20 and 30 years old; 229 between 30 and 40; 112 between 40 and 50; 53 between 50 and 60; 32 between 60 and 90; and 286 were of ages unknown; while a couple of veterans had actually been afloat more than 90 years, and were going on for their centenary anniversary.

As I have said, the importance of this subject is so great that the Council have agreed to the recommendation of the Committee—that they should renew the offer of the prize; and I hope the public attention I am now drawing to the matter will induce some of our shipbuilders to come forward, and, if only in the cause of humanity, give us the advantage of their scientific knowledge towards the production of a good ship's life-boat, by which this fearful death-rate may be considerably diminished.

Albert Medal.

It is impossible on this occasion not to allude to the successful completion of that marvellous work, the Suez Canal; and never was the Albert medal, to my mind, bestowed with more fitness than upon the talented and enterprising Ferdinand De Lesseps. I understand, from reliable authority, that the merchants of Liverpool are taking the necessary steps to make use of this new route, by building vessels suitable, from their draught of water, size, and shape, for the navigation of the canal; showing their confidence that the saving of time thus effected will more than repay the heavy dues which are at present necessarily levied.

India and the Colonies.

One of the most interesting of our committees is that which has been making extensive inquiries into the condition and resources of our Indian empire. Papers have been read, and discussions have been held during the last session, which have elicited the most interesting facts on subjects of the greatest importance both to England and her great dependency in the East. The press of India has given wide publicity to the proceedings of this Society with reference to tea culture, and this subject will again be brought before our Indian conferences. With the assistance of the experience gained during the practical discussions which have taken place on this subject, there now appears a reasonable prospect that this important branch of industry is about to emerge from its late depressed and unsatisfactory condition. The Council of the Society have agreed to the suggestion of their India Committee that a prize should be given for the best treatise on Tea Culture.

The hopes which I expressed last year, with reference to the question of silk culture, have been fully realised by the success which has attended the formation of the Silk Supply Association. That is now an established institution, while the *Silk Supply Journal* has already become the recognised organ of the trade. The support rendered to this association by the India, Colonial, and Foreign offices has enabled it to collect valuable information, and generally to stimulate silk cultivation throughout the world. We have lately received from Queensland a case of cocoons which were produced in that country, about 50 miles from the coast, the worms being fed on the Cape mulberry and the common mulberry, both of which trees, it is stated, can be grown to any extent in that district, the leaves being as large as those of a good sized cabbage. Eggs of the best kind are imported with ease into that colony from Japan. The cocoons which we have received have come over in good condition, and are pronounced by competent judges to be of excellent quality. Some of them have been sent by the Society to Macclesfield to be reeled. Looking at the disease which has so long been the scourge of the silkworm in Italy and in France, it is cheering to find that one of our own colonies is coming to the rescue, and giving such fair promise of adding to the diminished supply of one of our most important staples of industry.

The East India Association has adopted the views put forward by the Society of Arts for promoting the extension of hill settlements and sanitaria in India, with the object of extending the moral and social influence of our countrymen, while they receive more favourable consideration than formerly both at the hands of the Government and the press of India. The employment by the Commander-in-chief of English soldiers as working parties in the hill districts where sanitaria have been established, has been beneficial both to the health and discipline of that portion of the army, and this fact constitutes a further justification of the policy advocated in this respect by the Society of Arts.

Our trade with Central Asia continues to engage the attention of the Committee, and an interesting discussion took place last session respecting the proposed overland route between India, Eastern Thibet, Assam, and China.

A paper on the future management of Indian railways brought together many leading authorities. Both those discussions, which were adjourned, will, at no distant period I hope, be brought to a satisfactory conclusion.

Large audiences have attended the various meetings of the East India Association, some of which have attracted many of the leading statesmen engaged in the promotion of the welfare of India, and this Society has therefore willingly afforded the use of this hall for holding these conferences.

The large supplies of cotton obtained this year in the United States have been attended by a great reduction in price, and in this way have afforded considerable relief to the manufacturing interest of Great Britain; but at the same time it has caused great discouragement in India and the other cotton-growing countries, as well as in the flax trade of Ireland. The Council, therefore, desire that this Society and its Indian Committee should continue to co-operate with the Cotton Supply Association for Manchester in the promotion of cotton culture in India and elsewhere.

Members of the Society will recollect the admirable paper of Mr. Fergusson, read in this room, upon the subject of "Indian Architecture." The discussion on that occasion has borne good fruit. The government of India, soon after the discussion, were instigated by Sir Stafford Northcote, then Secretary of State for India, to devise a system for surveying and preserving the various monuments of India, and accordingly organisations for this purpose were created in Calcutta, Bombay, Madras, and the north-western provinces. Several volumes of surveys, with illustrative photographs, have been prepared, and two on the architectural remains of Kashmir and Muttra have been published. Moreover, casts have been made of portions of many buildings, and a complete reproduction of the eastern gateway of the Sanchi Tope, a very ornamental Buddhist work as early as the first century of Christianity, has been brought from the jungle, and is now in this country, to be shown, I have every reason to believe, in the International Exhibition of next year.

ANNUAL INTERNATIONAL EXHIBITIONS.

The next and last point to which I wish to advert is the first of the series of International Exhibitions, which it is proposed to open at South Kensington in May, 1871. These exhibitions will be held in galleries of a permanent character, which have been erected at the back of the arcades abutting on the Royal Horticultural Gardens. The object will be the same as in that of the earlier ones, which were established under the auspices of the Society of Arts, and under the presidency of H.R.H. the late Prince Consort. That object is well summed up in the words of the Royal Commissioners, who state their desire, "by stimulating the application of the artist talents, to give beauty and refinement to every description of article of utility."

Many persons have thought—and some have advised—that in view of the state of affairs on the Continent the opening of this exhibition should have been postponed; but I think her Majesty's Commissioners have exercised a sound discretion in determining to adhere to their programme. It appears to me to be a wise determination on their part to encourage the progress of Arts, Manufactures, and Commerce in spite of the drawback of war. It would have been, in my opinion, a great hardship if for such a cause we had deprived the industrial classes of our own and other neutral countries of such an opportunity of improving their taste and advancing their industrial interests. Judged by previous experience, the number of visitors will scarcely be affected by the war, even should it continue; and whatever falling off there may be in the number of foreign visitors, that will, it may be presumed, be more than counterbalanced by the additional influx of English visitors. It is curious to refer on this point to the returns of the Exhibition of 1851, where we find how very small was the foreign element in the total number of visitors. The increase in the number of foreigners who visited our shores in that year was only 43,000; and assuming that every one of these persons visited the Exhibition, the proportion would only show 1 foreign to every 130 British visitors. Nor shall we, even should the war continue, be deprived of the requisite specimens of French and Prussian art industry, many admirable specimens of which are to be found in great excellence both in England and in Belgium.

It is my pleasing duty also to announce that, even in this hour of national danger, the authorities for the time being in Paris have, by balloon post, signified their intention to recognise the appointments previously made by the Imperial Government, and have ordered that the permanent structure now in course of erection for an enlarged display of French goods, shall be proceeded with.

This series of exhibitions will be, to my mind, more instructive and complete than any that have yet taken place. On previous occasions the collections have been so vast as in great measure to baffle and bewilder those whose object it was to master the progress made by art and industry, in connection with the staple manufactures of the various countries represented. To remedy this state of things, the commissioners have decided to arrange each annual exhibition in four divisions, as follows:—

DIVISION I.—FINE ARTS.

Fine Arts applied or not applied to Works of Utility.

Class 1.—Painting of all kinds, in oil, water colours, distemper, wax, enamel, and on glass, porcelain, mosaics, etc.

Class 2.—Sculpture, modelling, carving, and chasing in marble, stone, wood, terra-cotta, metal, ivory, glass, precious stones, and any other materials.

Class 3.—Engravings, lithography, photography, etc.

Class 4.—Architectural designs, drawings, and models.

Class 5.—Tapestries, carpets, embroideries, shawls, lace, etc., shown not as manufactures, but for the fine art of their design in form or colour.

Class 6.—Designs of all kinds of decorative manufactures.

Class 7.—Copies of ancient or mediæval pictures, mosaics, enamels, reproductions in marble, fictile ivory, electrotypes of fine ancient works of art, etc.

DIVISION II.—MANUFACTURES.

Manufactures, Machinery, and Raw Materials.

Class 8.—Pottery of all kinds, viz., earthenware, stoneware, porcelain, parian, etc., including terra-cottas used in building; with any new raw materials, new machinery, and processes for the preparation of such manufactures.

Class 9.—Woollen and Worsted Fabrics, with any raw produce from new sources or prepared by any new process, and new machinery for woollen and worsted manufactures.

Class 10.—Educational Works and Appliances:—

- Section *a.*—School buildings, fittings, furniture, etc.
- Section *b.*—Books, maps, globes, instruments, etc.
- Section *c.*—Appliances for physical training, including toys and games.
- Section *d.*—Specimens and illustrations of modes of teaching fine art, natural history, and physical science.
- Section *e.*—Specimens of school work, serving as examples of the results of teaching.

DIVISION III.—SCIENTIFIC INVENTIONS AND NEW DISCOVERIES OF ALL KINDS.

Detailed rules and lists of the separate trades engaged in the production of objects of manufacture will be issued.

In divisions 2 and 3 producers will be permitted to send one specimen of each kind of object they manufacture, such object being distinguished by novelty or excellence.

DIVISION IV.—HORTICULTURE.

International exhibitions of new and rare plants, and of fruits, vegetables, flowers, and plants showing specialities of cultivation, will be held by the Royal Horticultural Society in conjunction with the above exhibitions.

Special rules for horticultural exhibitions will be issued by the Royal Horticultural Society.

Besides these four divisions, the music of all nations will form a great feature in this Exhibition. Its galleries will communicate with the Royal Albert Hall, which will also afford great facilities for carrying out this feature of the programme. I may also mention that spacious galleries in the hall will be set apart for the reception of Class 10, that is, Educational Works and Appliances. In this class the Society takes especial interest, and the Council have appointed several committees for the purpose of co-operating with Her Majesty's Commissioners. In leaving this topic, I cannot but express a confident hope that the study of the contents of this peaceful Exhibition will serve in some measure to cheer the minds of the public, now more than sated with the horrors and carnage of war.

Before I conclude, I think I may fairly congratulate our members upon the position which the Society of Arts now occupies in the public opinion of this country. There can be no doubt that each year our scope of action has been growing, and our great success in eliciting important information on various leading topics of the day has been generally admitted. Different departments of the Government have, at different times, requested us to obtain information, the collection of which they deemed desirable for the public service, fairly admitting, from past experience, that our organisation is eminently calculated for conducting such inquiries.

At the conclusion of his address, his Lordship said:—I may here, perhaps, announce, which I do with great satisfaction, that His Royal Highness the Prince of Wales, our President, on seeing by the newspapers that I was to preside here to-night, telegraphed to me his wish that I should take this opportunity of assuring the Society of Arts that, like his illustrious father, he takes the deepest interest in all its proceedings, and also his wish that we may bring to a successful conclusion all the matters we have now in hand. His Royal Highness also begs me to assure the Society that it may rely upon him in every way and on every occasion that he can, by his presence and co-operation, aid in promoting the successful issue of the great carnival of peace which is to be held next year, possibly in the midst of war.

His Lordship then distributed the following medals and prizes which had been awarded during last session, viz., the Society's Silver Medals for papers read before the Society at its evening meetings, as follows:—

To Mr. Thomas Dickins, for his paper "On Silk Supply."

To Mr. James Collins, for his paper "On India-rubber; its history, commerce, and supply."

To Mr. William Bridges Adams, for his paper "On Tramways for Streets and Roads, and their Sequences."

The Prince Consort's Prize of twenty-five guineas, to Edward Turner Sim, who, at the Society's Examinations, had obtained, during the last four years, the largest number of first-class certificates.

Mr. Henry Cole, C.B., proposed a cordial vote of thanks to Lord Henry Lennox for the admirable address which he had just delivered, saying it must be satisfactory to all the members to reflect that, through the circumstance of the Conservative party being out of office, they were able to obtain the services of his lordship to preside over their meetings. It would not be in order for him to enter upon a discussion of the various topics touched upon in the address, but there were one or two upon which he perhaps might be pardoned for giving his fellow-members a little additional information. In the first place, with regard to the efforts which had been made during the last four years to establish a musical training school for the people of this country, he was glad to see by the various addresses now being issued by candidates for the education boards, that many of these gentlemen acknowledged that something more was included in the term education than mere reading, writing, and arithmetic. The announcement that efforts were being made to include drill in the course of education appeared to meet with approbation, and he was also glad to find that there was now some prospect that in future the people of England would be as musical as their forefathers were before the era of the glorious Reformation. Notwithstanding the unhappy state of affairs on the Continent, he was glad to say that there was every probability of the forthcoming Exhibition fulfilling the intentions of those who were responsible for it, and that, even should the present war continue, French art and industry would not be altogether unrepresented. It was the intention of the Exhibition Commissioners, in a short time, to follow the same course which had been adopted on former occasions, and invite the members of the Society to see the preparations which had been made. They would then find the buildings, upon which there had been an expenditure of £300,000—not one penny of which had come out of the pockets of taxpayers—in a very forward state, and a hall which, if he mistook not, would create as great an interest as the Crystal Palace in Hyde Park in 1851.

Admiral E. Ommanney, C.B., F.R.S., having seconded the vote of thanks, it was put by **Mr. Seymour Teulon**, Vice-Chairman of Council, and carried unanimously.

Lord Henry Lennox, in responding, said he was deeply sensible of the compliment which had been paid him, and could assure the members that he was most anxious to do all in his power to promote the welfare and prosperity of the Society. Whether in office or out, his services might always be relied upon in any way in which they could be of use, or in which he could aid in furthering the objects which they had in view.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS,

Wednesday evenings at eight o'clock.

NOVEMBER 23.—"On South African Diamonds." By JAMES TENNANT, Esq., Professor of Mineralogy, King's College, London. His Excellency Sir HENRY BARKLY, K.C.B., will preside.

NOVEMBER 30.—"On Peat, and its Profitable Utilisation." By ROBERT M. ALLOWAY, Esq., M.A.

DECEMBER 7.—"On the American System of Associated Dairies, and its Bearing on Co-operative Farming." By H. M. JENKINS, Esq., Secretary of the Royal Agricultural Society of England. On this evening Lord VERNON will preside.

DECEMBER 14.—"On the Study of Economic Botany." By JAMES COLLINS, Esq., Curator of the Pharmaceutical Society, and Fellow of the Edinburgh Botanical Society.

DECEMBER 21.—"On a Method of Lighting Towns, Factories, or Private Houses by means of Vegetable or Mineral Oils." By ALBERT SILBER, Esq.

CANTOR LECTURES.

The first course of Cantor Lectures for the ensuing Session will be "On Artists' Colours and Pigments," by FREDERICK S. BARFF, Esq., M.A., F.C.S., and Fellow of the Cambridge Philosophical Society. It will consist of five lectures, to be delivered on Monday Evenings, the 21st and 28th November, and the 5th, 12th, and 19th December, at Eight o'clock. These lectures will treat of—The Nature of Colour; Chemistry and Manufacture of Colours and Pigments; Vehicles and Media used in Painting; Fresco and Silicious Painting; Destructive Influences on Colours, &c. Other courses of lectures are under arrangement for delivery during the Session. These Lectures are open to Members, each of whom has the privilege of introducing two friends on each lecture.

SHIPS' LIFE BOATS.

The Council have received and approved the following report of the Committee appointed to consider the models sent in competition for the prize offered for improved Ships' Life-boats, consisting of:—Lord Henry G. Lennox, M.P., Chairman of Council; Vice-Admiral Sir Edward Belcher; Right Hon. G. J. Goschen, M.P.,; Thomas Gray; Richard Lewis; Captain Nesbit; Admiral E. Ommanney, C.B.; E. J. Reed, C.B.; Admiral Ryder, C.B.; Seymour Teulon, Vice-Chairman of Council; Capt. Toynbee; Capt. Ward, R.N.; Lieut. C. P. Wilson, and Capt. H. Tyler.

The Committee find that forty-four models and six drawings have been submitted in competition for the medal, but inasmuch as one competitor sends in nineteen models, the number of competitors is reduced to that extent. The Committee, having inspected the same, came to the unanimous conclusion that the following classes must be excluded:—

1. The class which may be termed "boat rafts," as wholly unsuited for ships' boats.
2. All decked boats, for the same reason.
3. All boats depending on cork for their "extra buoyancy," inasmuch as cork is too heavy for use.
4. All boats with sliding keels, as too complicated to place in the hands of ordinary merchant seamen.

Excluding all coming within the foregoing classes, it appears that not more than four competitors are left.

After a careful consideration of the models of these four, the Committee are of opinion that none of them sufficiently fulfil the requirements laid down, or have sufficient merit, either of novelty or otherwise, to justify the award of the medal. The Committee desire to express their disappointment that the models and plans sent in do not sufficiently meet the object which the Society has in view, viz., to get a boat which will do the work at present required by a coaster or ordinary merchant-ship, having the additional advantages of a life-boat, with little or no increase of cost.

The Committee, however, are of opinion that the subject is too important to be dropped; and they suggest to the Council that this report, or a notice expressive of the opinions contained in it, be circulated among builders, asking them to compete again, and calling their attention to the requirements of the Merchant Shipping Act, 1854, by which ships under 100 tons are required to carry one boat, the dimensions of which are 14 feet × 5 feet × 2 feet 2 inches = 152 feet cubic capacity; ships of from 100 to 200 tons are required to carry two boats, viz., one 14 feet × 5 feet × 2 feet 2 inches = 152 feet cubic capacity; and one of 16 feet × 5 feet 6 inches × 2 feet 9 inches = 242 feet cubic capacity.

By order of the Committee,
P. LE NEVE FOSTER, *Secretary.*

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts' Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lt.-Col. Scott, R.E., secretary.

Educational Works and Appliances.—The following sectional committees have met:—

Section D.—Specimens and Illustrations of Modes of Teaching (Sub-section Natural History).—The Committee of this sub-section met November 2nd. Present—Professor Ramsay, F.R.S. (in the chair), W. H. Flower, F.R.S., Hyde Clarke, Captain Donnelly, R.E., and Wm. Matchwick.

Section C.—Appliances for Physical Training, including Toys and Games.—The Committee met November 10th. Present—Seymour Teulon, Vice-Chairman of the Council (in the chair), Sir Duncan Gibb, Bart., Rev. Muirhead Mitchell, Messrs. C. Franks, G. C. T. Bartley, Dr. A. Campell, A. K. Isbister, J. A. Franklin, and R. G. Wylde.

Section D.—Specimens and Illustrations of Modes of Teaching (Sub-section Physical Science).—The Committee of this sub-section met on Friday, November 11th. Present—Seymour Teulon, Vice-Chairman of the Council (in the chair), Professor Fuller, Rev. J. G. C. Fussell, Professor Guthrie, Professor Williamson, F.R.S., Rev. J. F. Twisden, Messrs. John Anderson, C. W. Merrifield, F.R.S., Thomas Sopwith, F.R.S. Amongst other business, a letter from her Majesty's Commissioners, asking the Committee to nominate suitable persons to serve on the Committee of Selection, was laid before each of these committees, and steps were ordered to be taken for carrying out this object.

Belgium.—The following extract is from the *Moniteur Belge*:—"The space appropriated to Belgium will barely allow of a third of the works of proposing exhibitors. The Belgian commissioners have therefore been obliged to make a careful selection. The examination of the objects proposed for exhibition in London will take place at Brussels on the 20th of January next. Works of sculpture, industrial art, &c., which cannot be moved without difficulty, will be inspected on the premises of the artists between the 15th and 20th of January next. Artists, mechanics, &c., provisionally entered as exhibitors in the fine art section, will receive the necessary instructions for the transmission of the objects destined to be submitted to the jury of inspection. We are informed of the presence in Brussels of Mr. Henry Cole, C.B., the director of the South Kensington Museum, and Colonel Scott, R.E., secretary of the English Commissioners. They were received by the King, and were present at a meeting of the Belgian Commission, when M. le Baron t'Kint expressed the opinion of the Commissioners that the forthcoming exhibition would be a complete success.

France.—The authorities for the time being in Paris have, by balloon post, signified their intention to recognise the appointments previously made by the Imperial Government, and have ordered that the permanent structure now in course of erection for an enlarged display of French goods, shall be proceeded with.

THE METROPOLITAN SCHOOL BOARD.

The coming election of this Board continues to excite increasing interest. The number of candidates now before the public is about one hundred and forty, and new names are daily put forward, so that the difficulty of selection will be considerable. About one-half of the candidates are tolerably well known, either in the political, religious, or scientific world, and there are quite enough good names in the list to make a most able, efficient, and trustworthy Board. Indeed, the people of London may be congratulated on the variety, and, at the same time, the general competency of the men who are coming forward to undertake these new and important duties.

The religious question is still, as might be expected, put prominently forward in many of the addresses that have been issued; but, as the *Daily News* observes, "a kind of tacit compromise seems to have been come to already on this question, and nearly all whose candidature is really serious advocate the retention of Bible reading, and the exclusion of theological drilling. . . . . What is needed is interest in education, willingness to attend and work, earnest resolution to wage a war *à outrance* against ignorance and crime. If the ratepayers will ask no other confession of faith from candidates than that which bears on their work—faith in education, faith in the Act of 1870, faith in the School Board, faith in the possibility of educating every child; and if they will reject every candidate who recommends himself, or opposes anybody else, for any political, theological, ecclesiastical, social, or parochial reason, they will elect a model School Board."

It may be interesting to give the names and occupations of the principal working-men candidates in the metropolitan boroughs:—Westminster (2), Messrs. George Potter (manager of the *Beehive* newspaper), and George Shipton (house decorator and painter); Marylebone (1), Mr. William Cremer (joiner); Chelsea (2), Messrs. William Harry (joiner) and John Osborne (plasterer); Hackney (1), Mr. Hales (elastic web weaver); Tower Hamlets (2), Mr. Frederic Cohn (cigar maker) and Mr. Matthias; Finsbury (1), Mr. Benjamin Lucraft (cabinet maker); Lambeth (2), Messrs. Robert Applegarth (secretary of Amalgamated Carpenters' and Joiners' Society) and Mr. Thomas Mottershead (silk weaver); Southwark (1), Mr. William Stafford (box maker); Greenwich (1), Mr. Thomas D. S. Floyd (baker).

There are now four Roman Catholic candidates before the metropolitan ratepayers—Lord Howard for Westminster, Mr. Arthur Langdale for the Tower Hamlets, Mr. James Wallace for Southwark, and Mr. Dale for Chelsea. In his address to the ratepayers of Westminster, Lord Howard says that, while he fully believes that "the only education worthy of the name is that which includes religious instruction from the earliest years," he is, at the same time, for "the fullest liberty of withdrawal from denominational instruction contrary to the belief of the parent or child."

There are also three ladies in the field, Miss Garrett, M.D., Miss Emily Davies, and Mrs. Wm. Grey, the widow of a nephew of Earl Grey.

At a recent meeting, Professor Huxley addressed the Marylebone electors, and, after making some remarks on the Education Act itself, he said that he took the liberty of drawing a distinction between religion and theology. While he would give religion, he would not add theology. This distinction was no new use of words, for it was as old as the hills. He declared he knew nothing more important than religion in the proper sense of the word. Any intelligent layman would know the parts of the Bible to read to pupils, and he saw no reason why this Book should be excluded.

At a meeting at Greenwich, Mr. J. S. Mill gave some advice to the electors as to what candidates to select and which to avoid. He reminds us of the essential distinction between education and instruction. Reading, writing and arithmetic are only the instruments of education, and we may teach them to our children, and still leave the children uneducated. What is needed is, to teach them to use their minds, to make them think, observe, reason, reflect. On the other hand, it is waste of time to occupy children's minds with points on which men are puzzled and divided; and it is a prostitution of educational machinery to give it either a social, political, or theological bias. Three classes of candidates are, therefore, to be avoided—those who merely go in for more schools, and do not care about better schools; those who mean to teach nothing but rudiments; and those whose first thought is to teach their religious views. On the other hand, Mr. Mill thinks two classes of candidates should be sought—working men and ladies. The School Board, in fact, cannot be too varied. It ought to be representative of the constituency; not of a majority merely, but of the whole.

The elections are fixed for the 29th instant.

VIVA-VOCE EXAMINATIONS.

Mr. Hyde Clarke has received from the Rev. Richard St. John Tyrwhitt, M.A., Christ Church, Oxford, a letter, from which the following extract is taken:—

"I was very glad to get the pamphlet with your paper in it. I think it excellent and most opportune. I wish it could be acted on here. I believe, by the way, that Bertram and Bué (German and French lecturers) do take considerable pains about *vivâ-voce* with their classes. I was taught French thirty years ago by a M. Alfonse Phillipe, who spoke English with a wonderful knowledge of the language, and very good accent, and he worked Ollendorf's system practically by shutting all books at lesson-time, giving us first the French of the lessson *vivâ-voce*, a few words to each boy round the class, and requiring the English from us with great exactness, and then next lesson *vice versa*, he taking the English of the same passage, we the French. This was two days a week. On Saturdays, we did an exercise in the grammar. Levizac's I think was used. I think in this way he made more out of three hours a week than any other man I ever knew. I never had any other French teaching, and have always had a practical speaking knowledge of that lingo."

CORRESPONDENCE.

A SHORT WAY TO POSTAL REFORM.

Sir,—One simple step towards postal reform is to stop the Post-office from becoming a further temptation to the Chancellor of the Exchequer, which causes its legitimate functions to be tampered with. The Post-office is for the service of the public, and not an engine to be employed for the fiscal requirements of the Finance Minister.

At present he has a surplus of £1,416,922, which, if called upon to give up, he will propose to compensate by additional income tax, or, perhaps, by poll-tax. Let therefore this surplus be settled as a permanent charge on the Post-office revenues of £1,500,000 per annum, but in any future increase of revenue let him not participate, but let it be applied strictly to the legitimate purposes of postal accommodation.—I am, &c.,

Hyde Clarke.

32, St. George's square, S.W., November, 1870.

PARCELS POSTAGE.

Sir,—In his opening address, Lord Henry Lennox not unnaturally devoted a good deal of attention to the anomalies and inconveniences of our postal system. May I venture to add one remark which, it seems to me, sums up the whole question with regard to a parcels post. The carriage of books, &c., at low rates by post involves either a loss or profit, or neither. In the former case the citizens at large are unjustly taxed for the benefit of those who use the book post; in the second, there can be no earthly reason why a profitable business should not be extended; and in the third, there is no reason why every one should not equally enjoy the benefit of the post-office organisation when it costs the country nothing, while there is every reason to suppose that an increased business would turn the scale in favour of the revenue.—I am, &c.,

W.

November 18th, 1870.

CASHMERE.

Sir,—I have not seen in the *Journal* any notice about Cashmere lately, and for the very good reason that you can take no interest in the movements of fashionable society in India, and cannot record picnics; and yet I think the Society of Arts has had something to do with sending pink and blue parasols into Cashmere, and may look forward with hope to more practical results.

One may be mistaken, but it is the Society of Arts which has given currency to the notion of allowing Englishmen to enter Cashmere. On the fall of the Sikh empire, this country was handed over to one of our supposed dependents, who would have been equally contented with a good jaghire anywhere else in India. From that time, Cashmere has groaned under the vile tyranny of the new sovereigns we created, and large portions of the hill country of the regions appendant on high Asia have been maltreated by them.

It will scarcely be believed here that, on the plea of sovereignty emanating from us, these new-baked emperors were allowed to exclude us from Cashmere itself, only limited permission of temporary access being allowed in the summer; a prohibitory tariff was imposed on our manufactures; we were impeded in the import of shawl goat-hair and other products; our traders were prevented from entering or passing through to high Asia, and this important route was closed to us.

In vain some of those men in India who display the zeal of statesmen, without being allowed to discharge the functions or exercise the prerogatives, remonstrated equally on behalf of the English and the oppressed natives. It was shown, too, that this was the most important of the hill countries, and the best suited for settlement by Englishmen, and it was proposed to give Gholab Singh a jaghire somewhere else in India, where he could also have been called an emperor, and lived in luxury, without having any subjects to oppress. It was allowed that it would be very unjust to expose any other people to his tyranny, but there was a dread of interfering with the rights of Gholab Singh.

At length some mitigation of the situation has been obtained. Some of our official and trading agents have been allowed to pass through, and risk the treachery of the Cashmere officials in the hills, but really the best thing is that this year hundreds of ladies and gentlemen have poured into Cashmere, to the desertion of Simla and the other hill towns. After the ladies have inaugurated the opening, there must be a fuller and freer occupation of the country. Cashmere will be opened to trade and enterprise, but so will the hill dependencies and the country beyond, and it is to be hoped the great gate to Central Asia will never again be allowed to be closed. That by Darjeeling and Thibet can hardly be said to be opened by the government.—I am, &c., C.

GENERAL NOTES.

The American Journal of Science and Arts, which has from its commencement been the vehicle for the original papers of the scientific men of America, will be continued, after the close of the present year, as a monthly journal.

Darjeeling.—The government of India has at length again taken in hand the consideration of the railway from Calcutta to the hills, and has directed Major Taylor to begin a survey.

Artists' Colours and Pigments.—In view of the course of Cantor Lectures on this subject, the first of which will be delivered on Monday next, it may be interesting to draw attention to the report of a commission appointed in 1865 to inquire into the method of heating, lighting, and ventilating, the South Kensington Museum, with especial reference to the alleged deterioration of certain paintings in the picture galleries. The commission have recorded their opinion that the method of warming, lighting and ventilating the Museum is on the whole satisfactory and efficient, and that every reasonable precaution is taken for the preservation of the pictures. They consider, however, that so little being known with certainty of the effects of light, air, and temperature on the various pigments and other substances used by painters, and of the action of these substances on one another, a series of careful experiments should be undertaken with reference to these points.

The Contamination of Water by Sewage.—Some important experiments on water contaminated with sewage have been made by Mr. Charles Heisch, the bearing of which is to simplify very much its qualitative analysis. A manufacturer of lemonade, finding suddenly that he could not keep his beverage more than a day or two, and unable to understand the reason of this, called in the aid of Mr. Heisch. The mischief was traced to the water, and it was afterwards discovered that an almost inappreciable quantity of drainage had reached the well which was being used. Following up this clue, Mr. Heisch believes he has discovered a method whereby sewage, almost in the smallest possible quantity, may be traced in water. Six drops of clear sewage were mixed with 10,000 grains (rather more than a pint) of West Middlesex and New River water. To six ounces of this mixture ten grains of pure sugar were added. The same quantity of sugar was also added to six ounces of water without any sewage. In from twenty-four to sixty hours the first mixture became turbid, and revealed in the microscope certain forms of cells, grouped in a manner which Mr. Heisch regards as characteristic. The water without sewage remained clear and sweet. One drop of fresh urine in 10,000 grains of water yields a mixture which will keep for several weeks, but the addition of sugar will induce the appearance of these cells in from twenty-four to forty-eight hours. Mr. Heisch states that filtering through the finest Swedish paper did not remove the germs, nor was boiling for half an hour any more effectual. Filtration through charcoal seems alone to have been found capable of removing the impurity.

The Purification of Paraffin.—The Mineral Oil Company (Mineralöl-Verein), of Halle, in Prussia, offer two prizes of 5,000 thalers for the solution of the two following technical questions. The one is, to find a chemical means of purifying crude pressed cake paraffin with the least possible loss, which must not exceed 5 per cent. The other is, to devise a method for cooling masses of paraffin to a temperature of at least 5° C. at any season of the year. Among the materials for the purification of the press cake, colourless oil of tar, benzole, and all like substances which exercise a solvent action on paraffin, are forbidden to be used. The loss of paraffin, when press cake free from dirt is operated on, must not exceed 5 per cent.; the process of purification must be rapid and easy of application, and must not be attended with any considerable cost. The refined paraffin is to have a blueish-white colour, and must be colourless. The process for cooling masses of paraffin must admit of 500 cwt. of material being cooled each day, in vessels containing 5 cwt. each, to a temperature of at least 5° C., the cooling to take place either in one place or several. It would be preferable for this to be brought about by cooling the room in which the paraffin candles are left to crystallise. The cooling of the material must be brought about gradually, and in such a manner that the formation of crystals, in respect to their constitution and magnitude, be in no wise interfered with. The answers must be sent in by the 1st January, 1871, and they will be considered by a commission appointed by the Mineral Oil Company, of Halle, and composed of Mr. Riebeck, of Halle; Bergrath Bischoff, of Weissenfels; Dr. Rolle, of Gerstewitz; and Dr. Hubner, of Zeitz. In the event of competition, the prize will be awarded to the proposer of the most advantageous solution to the question.

The Use of the Electric Light in War.—The Paris correspondent of the *Engineer*, in an interesting letter sent by balloon post, says:—"War certainly does something for science. The use of the electric light is common to both sides in the present struggle, but the French have used it largely. The apparatus, set up on Montmartre, is arranged by M. Bazin, and is electro-magnetic. The central cylinder supports four series of double coils, covered with copper wire, enveloped in silk; the cylinder is rotated by a small steam engine of 3-horse power, making 400 revolutions per minute. The lamp used is of the ordinary form, with the Foucault-Dubosc regulator. The reflector is parabolic in form, and the whole is surrounded by a shield to hide it from the enemy. This light, from its elevated position, commands the whole of Paris and the plains around. A spectator on Montmartre sees distinctly the details of the *façade* of a building which stands 2,600 metres off; at 2,900 metres a man may be seen standing at a window; at 3,000 metres a mass of cavalry or infantry is distinguishable; and at 4,000 metres the dome of the Invalides, with its bands of gold, is brilliant. A man cannot be seen on the dome at that distance, but on walking towards the building all soon becomes clear. On the ramparts, at 3,800 metres from Montmartre, the light is sufficient to read an ordinary newspaper. Thus, though the practical effect of the lamp only extends about 300 metres from its position, the field is illuminated to the extent of 700 metres, for the benefit of all placed between the light and the object. Thus a sentinel on the ramparts can see about 3,000 metres from the *enceinte*, and by this means strict watch is kept upon the plains around the city at night, as far, in one direction, as 1,000 metres beyond St. Denis. M. Bazin is now occupied in applying his apparatus to the purposes of night telegraphs, by the adoption of the system of flashes, and with the aid of coloured lenses. A corvette, the *Coligny*, already possesses such a signal apparatus, and the signals are distinctly visible at more more than eight miles distance."

MEETINGS FOR THE ENSUING WEEK.

Mon. ....**SOCIETY OF ARTS, 8.** Cantor Lectures. Mr. Frederick S. Barff "On Artists' Colours and Pigments." Lecture I. "The Nature of Colour."
London Institution, 4. Prof. Odling "On Chemical Action" (Educational Course).
Royal Institution of Naval Architects, 8.
Entomological, 7.
Social Science Association, 8. Mr. Frederick Hill, "On the Policy of this Country in regard to War."

Tues. ...Ethnological, 8. 1. Dr. Bleek "On the Concord and the Origin of Pronouns and Genders." 2. Dr. Bleek "On the Position of the Australian Languages."
Civil Engineers, 8. 1. Discussion upon Mr. Leslie's paper "On the Water Supply of Paisley." 2. M. Jules Gaudard "On the Theory and Details of Construction of Metal and Timber Arches."

Wed. ....**SOCIETY OF ARTS, 8.** Prof. Tennant "On South African Diamonds."
Royal Society of Literature, 8½. Mr. W. Birch "On the Three Great Seals of Edward the Confessor."
Geological, 8. 1. Mr. G. W. Stow "On some Points in South African Geology." 2. Mr. J. W. Hulke F.R S., "Note on some Reptilian Fossils from Gozzo." 3. Mr. F. R. Fairbank, M D., "On the Discovery of a 'Bone-bed' in the lowest of the 'Lynton Grey Beds,' North Devon."

Thurs...London Institution, 7½. Prof. Morris "On the Precious Metals and their Distribution."

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FRIDAY, NOVEMBER 25, 1870.

PROCEEDINGS OF THE SOCIETY.

MUSICAL COMMITTEE.

This Committee met on Monday, the 21st November. Present—Seymour Teulon, Esq., Vice-Chairman of the Council (in the chair), Lord Gerald Fitzgerald, the Hon. Seymour Egerton, Lieut.-Col. Scott, R.E., Messrs. Henry Cole, C.B., Alan S. Cole, and J. F. Puttick. The Committee had under consideration a reference from the Council with regard to the establishment of a National Training School for Music.

INDIA COMMITTEE.

This Committee met on Tuesday, the 22nd November. Present—Hyde Clarke, Esq., in the chair; Dr. Archibald Campbell, Dr. Boycott, Messrs. W. S. Fitzwilliam, Andrew Cassels, and Frederick Hendriks.

SECOND ORDINARY MEETING.

Wednesday, November 23rd, 1870; His Excellency Sir Henry Barkly, K.C.B., in the chair.

The following candidates were proposed for election as members of the Society:—

Bantock, J. William, Eyeworth-lodge, New Forest.
Barff, Frederick, M.A., 2, West Abbey-road, Kilburn, N.W.
Bing, L., North-end, Bishop's Stortford.
Campbell, Archibald, M.D., 104, Lansdowne-road, W.
Cole, Rev. Arthur Raggett, Hurstbourne-priors, Whitechurch, Hants.
Goode, W. James, 19, South Audley-street, W.
Gower, William Sutton, Dartmouth-point, Blackheath.
Kilner, Rev. J. M., the Castle, Chester.
Matheson, Sir James, Bart., F.R.S., Lewis-castle, Stornoway, N.B.
Noble, John, Park-place, Henley-on-Thames.
Pollen, John Hungerford, 11, Pembridge-crescent, Bayswater, W.
Rawlinson, Sir Christopher, Manydown-park, Basingstoke.
Robbins, J., 104, Portsdown-road, Maida-vale, W.
Sargeaunt, William Charles, 12, Spring-gardens, S.W.
Satchell, Walter A., 42, Argyll-road, Kensington, W.
Smith, George, Spring-cottage, Coalville, Leicester.

The Paper read was—

SOUTH AFRICAN DIAMONDS.

By James Tennant, Esq.,

Professor of Mineralogy, King's College, London.

The history of the discovery of diamonds at the Cape of Good Hope was this:—In March, 1867, Dr. Atherstone, of Graham's-town, received by post in an unsealed, unregistered letter, a rough diamond, which had been picked up on a farm in the Hope-town district, and forwarded by Mr. J. O'Reilly to Mr. Lorenzo Boyes, Clerk of the Peace for the district of Colesberg, who sent it to Dr. Atherstone, in order that he might give his opinion as to the probability of its being any value. He had not seen a rough diamond before, but, after taking the specific gravity, testing the hardness, and examining it by polarised light, he decided that it was a genuine diamond of considerable value; and, perceiving the great importance of such a discovery to the colony, he at once wrote to the Colonial Secretary, suggesting that it should be sent to the Paris Exhibition, and afterwards sold for the benefit of the finder. This fortunate person was a Dutch farmer, named Schalk van Niekerk, who, seeing the children of a neighbouring boor playing with some bright stones, was struck by the appearance of one, which he offered to buy of the mother. She laughed at the idea of selling the gem, and gave it to him at once. He showed it to Mr. O'Reilly, who was returning from a distant hunting expedition, and so it finally reached Dr. Atherstone. At the close of the Paris Exhibition, the stone was purchased by Sir Philip Wodehouse, then governor of the colony, for £500. Comparing the South African with other diamond-fields, it had hitherto been unusual to receive more than one large diamond—say of 40 carats—in the course of a single year, but the new fields had yielded no less than five stones exceeding this weight within that time. There was one of 56 carats, and another weighing 83 carats, which arrived last year, and proved to be an exceedingly beautiful stone. It is now in the possession of Messrs. Hunt and Roskell, who have kindly promised to allow any one who wished to see it. I anticipate that we shall have diamonds from this region exceeding the Koh-i-noor in size, and equalling it in beauty when cut and polished.

The diamond-bearing district of South Africa is, as yet known, confined to the Vaal Valley, some of its tributaries, and a part of the Orange River, below its junction with the Vaal. For the most part, the district of Colesberg, Albania, and Orange River Free State (which include most of the diamond-diggings) have the Karoo strata, or great Dicynodon formation, that underlies so large a part of the Cape Colony, for its basement, traversed in every direction by dykes of greenstone and other volcanic rocks. Along the Vaal River, however, the Karoo beds, if they ever extended quite so far, have been denuded off, leaving some schistose and shaley beds, traversed by basalt and other volcanic rocks; and these may be either remnants of the Karoo beds, or some of the palæozoic rocks beneath. Excepting occasional exposures, all these are covered with superficial deposits of tufa, pebbles, and sand. The pebbles consist of rock-crystal of various colours, agate, jaspers (black, red, and ribboned), quartzite, sandstone, iron-ore, basalt, granite, garnet, spinel, peridot, blue corundum, and diamonds. Where the quartz is angular instead of rounded, diamonds are said to be wanting. The superficial sand and soil, generally ferruginous, and even the tufa, have also been found to contain diamonds here and there. The diamond-bearing pebble-bed is formed, not only on the flats along the river, but also on the tops and sides of the hills ("kopjes"), sometimes 100 feet and more in height, within a few miles of the river. Most of the pebbles have been probably derived from the Quathlamba Mountains or Drackenberg range, which has certainly in its constitution all the materials for the common pebbles, and probably the rarer minerals also. The strata that have before now occupied the place of the Vaal Valley may have yielded some of the material, slowly let down from level to level, and pushed gradually forward, as the strata were worn away by water through great periods of time; certainly the presence of the pebbly accumulations on the kopjes indicates the existence of former levels of water-worn deposits, portions only of which now remain after the erosive action of the rivers. These kopjes seem to be harder masses of protruding basalt than the rest, and are said to have rich stores of diamonds remaining in the old alluvium coating their tops and sides, but often hidden by sand drifted from the flats. The association of agates points of course to volcanic rock, even if no basalt nor greenstone had been found; and the abundant evidence of igneous action, both in the Vaal Valley and in the water-shed whence the river comes, may probably have had to do with the origin of the diamond, in changing coal or some other carbonaceous compound into pure and simple crystals of carbon.

The many papers in the Colonial and other periodicals, by Atherstone, Rubidge, Gilfillan, Higson, Shaw, Muskett, Grey, and others, have been the chief sources of this information concerning the diamond-fields collated for me by my friend Professor Rupert Jones.

As in South Africa, so in Brazil and India, diamonds have been formed in superficial pebble-beds, whether loose or conglomerated, containing quartz and other hard rocks, derived probably from mountains many miles away, of palæozoic and highly altered rocks. It is, difficult, however, to make an exact comparison of the pebbly alluviums, so rich with diamonds, in these three countries. So also of South Australia the same may be said; and doubtless diamonds will be found under similar conditions in other parts of the world.

The following information relating to the diamond-bearing districts of the Brazils, by the Rev. C. G. Nicolay, will be interesting at the present time. He says:—

The information which we possess as to the geology of the province of Bahia is scanty, but, as far as it goes, satisfactory. The engineers Halfeldt, Vivian, and Cato have examined respectively the Rio di Sao Francisco, the route from the city of Bahia to Joazeiro on the same river, and to St. Isabel de Paraguassu in the Chapada Diamantina; my own observations, besides those in that locality, extend for about sixty miles round the city of Bahia, and on the new road to the Chapada by the Mato, or forest of Orobo.

The conclusions which may be arrived at from these and other sources are generally that—

I. There is a uniform strike and dip throughout the province within these limits, say, N.N.E. and S.S.W., with comparatively little variation.

II. The province must be geologically divided into zones.

1. Conglomerate and schists near the coast.
2. Sandstone in the Reconcavo from the city to the Lago of the river Paraguassu.
3. Of primitive rock extending to the pastoral district of the Serra da Mangabeira.
4. Of sandstone in that serra.
5. Of primitive rock with nearly level surface (Taboleiros). This is some twenty leagues in breadth, and is the district of cataracts on the rivers. It is traversed by enormous masses of quartzose rock.
6. Of forests under which probably sandstones predominate.
7. Of limestone.
8. Of conglomerates forming the Chapada, so called from the horizontal line which the tops of the hills present to the eye. All these cross the province from the Rio Paraguassu to the Rio di Sao Francisco.

The Chapada is 200 miles from the west side of the Bay of All Saints, commonly known as Bahia, *i. e.*, the bay which is again twenty-seven miles from the city of that name. It forms the eastern watershed of the Rio di Sao Francisco, and has within itself the sources of the rivers which fall into the sea within the circuit of the great river. Its height above the level of the sea may be approximately stated as 3,000 feet. The diamond workings are carried to the top. The conglomerates of the Chapada differ from those of the coast principally in that the former are, and the latter are not, highly metamorphic; they have also greater development in the Chapada, as schistose formations have on the coast; both contain diamonds, but those near the coast have been discovered but recently, and, for local reasons, the workings, though rich, have been abandoned.

The geological series at the Chapada is, descending—

1. Conglomerate.
2. Quartzite.
3. Sandstone.
4. Limestone.
5. Schist.
6. Primitive rock.

These are traversed by dykes and veins of trap and chert, and intervening between the harder rocks veins of dirt are not uncommon, as also of sand and clay-slate. These afford facilities for the entrance of water between the strata, by which their rapid disruption is effected; and caverns, named Grunais, are often formed by the disintegration of the softer rocks beneath the conglomerate.

While at the Chapada (December, 1865) the author ascertained that the quartzite is the matrix of those crystals of iron pyrites the presence of which marks the diamond cascalho or gravel, but saw no trace of diamonds in that rock; and since they abound in the Grunais, of which the conglomerate forms the roof, concluded that diamonds are found in the softer veins and strata which separate the harder rocks. When diamonds are found, cascalho (a water-worn gravel) is present. The most marked constituents of this are:—

1. Crystals of pyrites.
2. Specula of magnetic iron.
3. Fejoes (schorl).
4. Fabras, } *i.e.*, brown hydrophosphate of alumina.
5. Cabocles }
6. Pingua d'agoa (rolled hyaline quartz).
7. Pedra de ferro (oxide of iron).
7. Pedra de fogo (black silica).

The mineral equivalents are taken from M. Damon's analysis, from which it appears that the presence of Yttria characterises the cascalho of the Chapada.

Diamonds are found of all colours, but the colour is mostly superficial. Green predominates, but each locality has its characteristic colour, quality, and crystallization, which are well known.

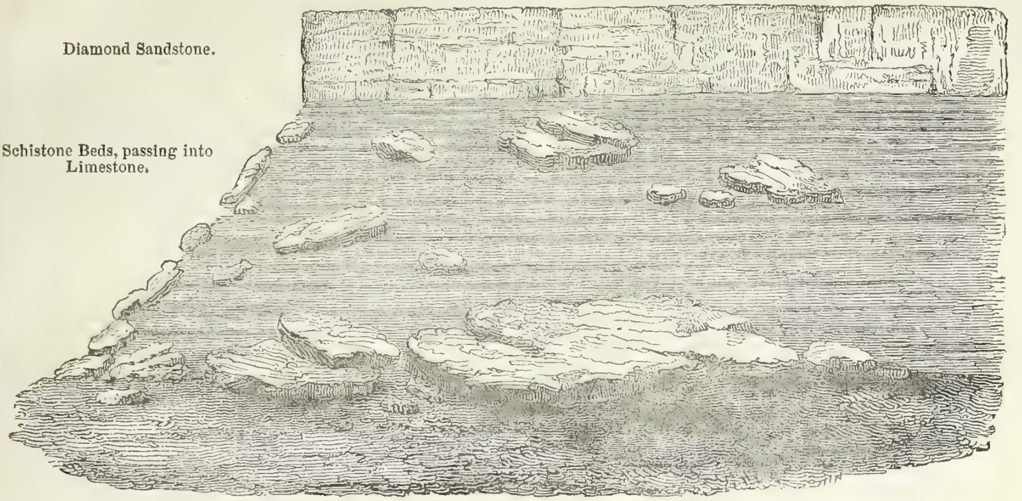
What may be called imperfect diamonds are also found; the most important of these is the "Carbonado," which is now commonly used in cutting diamonds.

The diamond-workings of the Chapada had, twenty years ago, the town of Santa Isabel as their centre; since then they have moved northward to Lencoes, now a city, and have extended more than thirty miles beyond it.

There seems no reason why the yield of diamonds should decrease so long as the present price is maintained; new localities, not only in the Chapada, but in other parts of the province, as at Pitanga, near Bahia, already noticed, will be found when required, and the province maintain its reputation of being the main source from which the market is supplied. The value of diamonds raised cannot be accurately determined, since only a small part comes to Europe through the regular channels, but it may probably exceed £500,000 in favourable seasons, *i.e.*, when water is abundant.

In a paper "On the Fossils of the Eastern Portion of the Great Basaltic District of India," by the late J. G. Malcolmson, Esq., printed in the "Transactions" of the Geological Society of London, second series, vol. v., p. 537 (1840), will be found a description of the geological "Age of the Diamond Sandstone and Argillaceous Limestone" of India. We have subjoined the woodcut from that paper, illustrating the formation:—

Diamond Mines in the Table-land of Bangnapilly.



We give, from Greenough's Physiological and Geological Map of India, the names of the diamond districts of that country, as follows:—

Diamond Mines in India.

Bamulacotta, Garoopilly, near the Mundi Cunnamo Pass, near Garoopilly.
Bangnapilly, Gonipartata, or Parkal.
Bannoor, Partial.
Dayranoor, Alkur.
Devanur, Burthyenpadur.
Heera (Punnah), Pertala.
Kannamadokola, Warapilly.
Goodipad, Codasetty Kalu.
Moorcondah, Kattakindepally, near Bombartipadu.
Priapully, 24 miles north of Trepetty.
Tantrapaud, 46 miles north of Ongola.
Candapetta Cuddapa, 20 miles north of Nellore.
Lamdoor, Mysore and Salem,
Masulipatam, Viralimodos, } Valley of Cauvery.
Ovalumpully, Sholasigamany,
Piapully, Golashully,
Punchatgopadoo, Kulkiry, } Mysore.
Antior, Mundurim, near Seringapatam.
Barthemi, Tippaty.
Pandoa, Beygoor.
Malawali on Kistna, Bannercota.
Sampulpur, on Mahanuddy.
Badrachelum, on Godavery, east of Papconda.
Bundelcund.
Wyragur.

Minerals Found in Ceylon.

Diamond, ruby, rock crystal, amethyst, rose quartz, cat's-eye, prase, iron flint, chalcedony, hyalite, topaz, schorl, garnet, pyrope, cinnamon stone, zircon, hyacinth, spinnelle, sapphire, corundum, chrysoberyl, adularia, cornelian, labrador stone, common felspar, hornblende, pitchstone, gypsum, graphite and sulphur, ceylanite, quartz (red).

DISCUSSION.

Mr. John Fordred said that, having several friends in South Africa, his attention had been drawn to the question of the diamond discoveries for the last two years. He thought it would be a good thing if some instructions were given to those who were going out searching for diamonds, as there seemed to be a great want of knowledge on this subject, not only amongst those who were comparatively ignorant of mineralogy, but even amongst those who were acquainted with that science. Indeed, when the information first came to this country that diamonds were found in South Africa, the statement met with a most extraordinary amount of incredulity amongst the trade, and Mr. Harry Emanuel sent out a gentleman, Mr. J. R. Gregory, to examine the whole of the region, and give his opinion as to the possibility of diamonds being found there. After visiting the district, Mr. Gregory came back, and made his report to Mr. Emanuel, who wrote to the *Journal* of this Society (vol. xvi., p. 849), denying the possibility of the existence of diamonds in that country, and stated that Mr. Gregory had found that the whole geological and mineralogical formation of the district was not all similar to that where diamonds had ever previously been found. When this letter reached the Cape, it caused much astonishment; Dr. Atherstone and the other mineralogists there had a good laugh at the statement, and said what was the use of denying the diamond discoveries on such grounds when the stones were actually found. Time went on, and at last Mr. Emanuel was obliged to retract what he had said, and, in the Society's *Journal* of May 21, 1869, p. 517, he admitted that the fact could no longer be denied, but even then he said it was something surprising that diamonds should be found there under such novel conditions. However, in one of the last letters from the Cape, which appeared in the *Times*, it was stated, on the authority of a well-known mineralogist, that itacolumite had now been found amongst the minerals accompanying the diamonds. This rock is found universally in connection with diamonds, in fact it is believed by many to be the principal matrix of the diamond. Nearly all the Brazilian diamonds were found in this substance, or mixed with it in a disintegrated state. All this showed that the first investigators had overlooked such an important mineral, and was another proof of the great need there was of proper instructions being given to those searching for diamonds. He found by the colonial newspapers that a new word had been coined to represent the region where the diamonds had been found, viz., diamentiferous, and though some people laughed at this as a hybrid kind of word, it was certainly as good as some we got from America, and at any rate it was becoming universal throughout the country. In conclusion Mr. Fordred thought it very desirable that the Society of Arts should cause to be drawn up by some competent person a few plain and simple instructions for the use of those proceeding to the diamond fields, and publish them in the *Journal.* It was well known that many other valuable minerals accompany the diamond, and if the instructions comprised also a description of these it would add to their utility, as in all probability stones as valuable as diamonds were being overlooked and thrown away by the present diamond searchers. A few such instructions were published in the *Mechanics' Magazine* of Oct. 14, 1870, at page 271.

Mr. Rabrone said he had had the good fortune to spend some eighteen years within a hundred miles of the district at the Cape where the diamonds were now being found, and, having been engaged there in connection with the press, he had had the best opportunities of knowing what was going on. Even in South Africa itself the diamond discoveries were at first but little known, and created but little interest. People did not believe that children could be found playing with diamonds, and rolling them about on the floor; but since it became his duty, about two years ago, to make these facts public, he had watched with much interest the progress of the discoveries. The gold-fields of South Africa at first excited a good deal of attention; but they were soon given up as being too far off, being 2,000 miles from any port; but the diamond fields were within a few days' waggon journey. He looked forward very anxiously to the development of this source of wealth. Professor Tennant had alluded to the first diamond being purchased at a high price by the colonial government, but the fact was that, although not of very large size, that stone was of remarkably fine quality. Since then the discovery of diamonds of a large size had been a most remarkable feature, and he believed the proportion of large stones was without precedent. According to the best authorities, he believed the common average in the Brazilian mines was about one diamond of 18 carats in 10,000, and the labour of 500 men washing for twelvemonths, could be carried in the palm of one's hand. He had lately read, however, of a gentleman in one of the colonial towns having a tumbler full of diamonds. One firm within the last fortnight had sent home £23,000 worth, and the last mail steamer brought £18,000 worth, consigned and insured. He was informed only lately of a working blacksmith, who left his trade and went to the diamond-fields; he soon picked up one of 54 carats weight, for which he refused £8,000 on the spot, and he was now, or shortly would be, in England with it for sale. Mr. Tennant had referred to the large diamond called the "Star of South Africa," the finding of which had caused immense excitement; but within the last fortnight he had seen an announcement that a diamond of 87 carats was in the market; and he knew that many of these stories were authentic, because in many cases the finders were known to him personally. A short time ago this tract of country was a kind of "No-man's-land," claimed by no one, and only roamed over by a few savages, living in moveable huts, and having no property of any description. Now, however, it had risen into great importance. Claimants were rising up on all sides, and it was a serious question who were the *bonâ-fide* possessors. The native chiefs, who would have been pleased a short time ago to have taken £100 for the whole of it, would now like to make a handsome profit out of it, and the representatives of each state who had made bargains, but had never taken the trouble to ratify them, were also on the alert. In consequence of the defective nature of the governments, there were no certificates of purchases and no means of identifying the property, and he feared great difficulties would arise in consequence. The moment these discoveries were made, the rival claimants came into the field, and every effort was made to substantiate their claims both by the Transvaal Republic and by the Orange River Free State. The latter state, it might be remembered, was absolved from allegiance to the English Crown within the last 10 or 15 years, which he believed was anything but a wise act on the part of the government, as they cut off a number of loyal subjects and a tract of country which had now proved of great value and importance. There was now a population of 10,000 men, and they were increasing every day. The association of gold and diamonds was well known to the scientific world, and he held in his hand a brief memorandum of the recent diamond discoveries in Australia. From this it appeared that, during 1869, 984 diamonds were sent over from the colony of Victoria, while Sydney had exported 2,000; but he believed the latter number included the whole findings from the date of the first discovery. The details, however, which gave one stone at six carats, and another at 2½, seemed rather to show that the average size was small. The comparatively small number of small diamonds found in Africa, in proportion to the number of large stones, was probably owing to a want of knowledge and skill on the part of the workers, who found the large ones but missed the others, and this was proved by the fact that those who were skilled in the matter frequently found small stones in the heaps of refuse which had been discarded. He thought it would be conferring an immense benefit if the Society would reprint, and issue in a cheap form, a few general instructions to those who might be about engaging in this enterprise, for nothing could tend more to develop the resources of the country. Every kind of mineral wealth was to be found there, not even excepting coal, which, when the country was further developed, would be of immense value, although the great cost of land carriage and freight did not allow of the lead, iron, and coal mines being worked for exportation. All these were to be found in the close vicinity of the diamond fields, but the district had not yet been properly surveyed. The whole district in which the diamonds were found included at least 1,000 square miles. The whole of South Africa, including the district in question, had been subject to volcanic eruptions; and at the junction where the intense heat mixed the mineral and sedimentary deposits, considerable changes of structure appeared to have been formed, and in these conglomerate masses the diamonds were chiefly found, and agates, chalcedony, sapphires, and corundum were all common features of the country. He had heard of a merchant who had a large sack filled with agates and other stones brought to his warehouse, but he did not care about having them, and they lay there until the sack burst. He did not suppose that it would pay any one to export the common agates, as there was a large supply always to be obtained from the Black Forest, cut and finished for the market, but it was quite possible that a careful search by men of science would show that there were minerals which it would pay men of capital to seek for and collect.

The Secretary said the largest diamond from South Africa, which had been referred to by Mr. Raborne, was now in the hands of Messrs. Hunt and Roskell, of New Bond-street. Mr. Hunt had kindly furnished him with a model of it, which would be handed round, and he had also offered to show it to anyone who would call at their place of business.

Mr. Henry Rawlinson, C.B., said, with the chairman's permission, he would say a few words as to the practical uses of the diamond other than as an ornament. They were now being very largely used, and would be still more so, in the place of steel. Diamonds were used for drilling rocks, drilling steel, for facing millstones for grinding flour, and other purposes of the kind. An acquaintance of his had sent him a box full of the matrix of slate rock, of granite, pyrites, and other substances which had been bored by the aid of the diamond in one of the slate quarries in Wales. They wanted a trial hole put down very quickly, and by the aid of a diamond borer they got down to the depth of 84 feet in 36 hours, bringing up the matrix in the shape of a long rod. There was no doubt that the use of diamonds could be very largely extended in that way. He might be wrong, but he believed some mineralogists considered the diamond to be of vegetable origin—that it was simply a crystallized gum. Professor Tennant would correct him if he were wrong, but he believed there was no known matrix for the diamond—that it had never been found in a true matrix, but always in alluvium. If it were found imbedded in any way, it was in a conglomerate, a secondary formation. Chemists had decided by experiment that it was the nearest possible approach to pure carbon; some saying it was absolutely pure, and others stating the carbon to be 98½ or 99 per cent. It would certainly be very extraordinary if it should turn out to be a crystallised vegetable. Diamonds were found occasionally with cavities and different flaws in them, and were also found of all colours. The reason they were so precious was not on account of their scarcity, but because perfect diamonds were very scarce. A diamond perfect in colour, in form, and that would bear cutting into a perfect gem, was very rare indeed. And it was the same with other precious stones. For instance, sapphires and rubies were by no means scarce, for he himself had a sapphire as large as the end of his thumb, and he had seen sapphires and rubies of considerable size; but these stones also were liable to be flawed, and to show what was termed an "off-colour," and therefore to have no value for ornamental specimens. A ruby or sapphire of one, two, or three carats in weight, and absolutely as perfect as a diamond of the same size, would be worth as much as a diamond two or three times the weight, because they were much more rare. He quite agreed with Professor Tennant that the panic which had recently arisen amongst the holders and dealers in diamonds at the first news of the diamond discoveries in South Africa was quite uncalled for, for an enormous quantity would have to be found before it would bring down the price to any appreciable extent, because it must be remembered, in calculating diamonds, that if a thousand were found in the rough state, probably not more than ten per cent. would cut into perfect gems. All the rest would have to be used for other purposes, and many of them were not fit to be cut at all. They would come into use for those mechanical appliances to which he had referred.

Mr. Cornelius Varley said he had been a witness of some of the earliest experiments made by scientific men with diamonds and other precious stones, some of which were very interesting.

Mr. Rawlinson said the mischief in the colony might arise in this way—that parties heard that diamonds were worth so much per carat, and thought that applied to the rough stones, whereas they generally lost about one-half the weight in the process of cutting.

The Secretary remarked that Mr. Hunt had told him that the process of cutting generally reduced the weight of a stone about one-half.

Professor Tennant said Mr. Rawlinson was quite correct in saying that probably not more than ten per cent. of the diamonds discovered would be of the first quality. Many of the stones sent from South Africa were very defective, being full of cavities and cracks. The very fine diamond which he saw on the previous day, weighing 66 carats, had three flaws in it, one a very large one, which would considerably diminish the value. £5,000 was offered for it immediately it was found, and he could only say if it had belonged to him he should have been very well satisfied. A gentleman present had given him very valuable information with reference to carbonado, a substance which he had not alluded to. Twenty years since this substance was sold at 7d. per carat, 10 years ago it was sold at 10s., and now it could only be got at 20s. Several specimens were on the table, and, although it was devoid of any lustre, it was very valuable for its properties. It was useful for cutting mill-stones, and for a hundred other purposes, and probably three-fourths of the diamonds were now cut by its aid. It was impure carbon, somewhat porous, occasionally semi-transparent, and sometimes, but very rarely, showing a crystalline surface. Many of the stones received from Africa were small, but he had merely alluded to a few of the larger specimens received within the last few months. The majority of those received were small, but still he believed thousands were overlooked, as they were not easy of detection to an unpractised eye. He himself had lost one in his own room, and though he knew it was there, he could not find it after three hours' search, so that it was no wonder if persons unacquainted with them missed the smaller specimens.

The Chairman, in proposing a vote of thanks to Mr. Tennant, said that gentleman had been consistent through good and evil report, in his evidence as to the genuineness of the South-African diamonds. It was perfectly natural that the wonderful stories told of the diamond discoveries should at first have been received with a certain amount of incredulity, and that, even after the fact of diamonds being found was proved, the value of the discovery should be disparaged. However, facts were stubborn things, and no one could now dispute the fact that diamonds had been found over a very large extent of country, and that some had been gems of the greatest purity, brilliance, and value.

The vote of thanks was passed unanimously.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ORDINARY MEETINGS,

Wednesday evenings at eight o'clock.

NOVEMBER 30.—"On Peat, and its Profitable Utilisation." By ROBERT M. ALLOWAY, Esq., M.A.

DECEMBER 7.—"On the American System of Associated Dairies, and its Bearing on Co-operative Farming." By H. M. JENKINS, Esq., Secretary of the Royal Agricultural Society of England. On this evening Lord VERNON will preside.

*DECEMBER 14.—"On a new Method of Producing Durable Mural Paintings by Fictile Vitrification." By ALAN S. COLE, Esq. On this evening the Right Hon. A. S. AYRTON, M.P., will preside.

DECEMBER 21.—"On a Method of Lighting Towns, Factories, or Private Houses by means of Vegetable or Mineral Oils." By ALBERT SILBER, Esq.

CANTOR LECTURES.

The first course of Cantor Lectures for the present Session, "On Artists' Colours and Pigments," by FREDERICK S. BARFF, Esq., M.A., F.C.S., and Fellow of the Cambridge Philosophical Society, commenced on Monday evening the 21st inst. The remaining lectures will be delivered on Monday Evenings, the 28th

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* The paper originally announced for this evening is unavoidably postponed through the illness of the author.

November, and the 5th, 12th, and 19th December, at Eight o'clock. The first lecture was on "The Nature of Colour." The remaining lectures will treat of the Chemistry and Manufacture of Colours and Pigments; Vehicles and Media used in Painting; Fresco and Silicious Painting; Destructive Influences on Colours, &c. These Lectures are open to Members, each of whom has the privilege of introducing two friends on each lecture.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

Circulars or Papers fastened by Stamps.—The *Bookseller* says:—"Newspapers and such documents as are allowed to pass at the book rate of postage must, in order to secure that privilege, be sent either entirely open, or in wrappers open at the ends, so as to admit of the contents being readily removed for inspection. If wrappers be used, it is not enough that they be partly open at the ends; they must be entirely open at the ends; and the privilege of transmission at the low rate of postage, applicable to printed matter, is forfeited by any packet the contents of which are in any way fastened into the cover, or the cover of which cannot, from any cause, be withdrawn without difficulty. The privilege is similarly forfeited by circulars, &c., sent without covers, if they are fastened at some point by means of gum, wafers, seals, or even postage labels. Can the Secretary of the Post-office have read this order, which bears his name? We think not, or he would never have given permission to post the broad sheet of the 'largest paper in the world' entirely open, and have interdicted circulars, weighing an eighth of an ounce, from passing because one end is fastened down with a postage-stamp. Some of our own proofs this month have been charged a penny upon delivery, in consequence of the stamp being partly attached to them. This is even more absurd than the objection to the bit of thread at the back of the *Bookseller*."

A letter in the *Times*, signed "Thomas Scott," complains that—"A printed paper, well under two ounces in weight, in a wrapper open at both ends, and duly bearing a halfpenny postage stamp, was presented with the demand for 3d. extra, the reason for which was that the halfpenny stamp was so affixed that half of it was on the wrapper and half on the printed paper—a mode of affixing stamps often adopted to secure the wrapper from slipping off."

Messrs. Ashton and Green, of London, make the same complaint:—"A large number of trade circulars and invoices recently sent to Liverpool and Manchester, as we supposed, in conformity with the requirements of the postal authorities, have been charged at the full rate as letters, with what effect upon their recipients may be easily imagined.

Sale of Needlework.—An "Officers' Widow" says in the *Times*:—"I have for the last year been able to add a little to a very limited income by the sale of needlework, which I have sent to the various purchasers by the pattern-post. Now that privilege is withdrawn, and my work is also at an end, as the small profits are completely absorbed in the charges of the railway companies."

Small Parcels.—A writer in the *Globe* says:—"In reference to the sample and pattern post, it is of vital importance to many to obtain small articles of the best quality from good makers, for the completion of our daily work. Silk, for needlework, fine thread, and lace braiding, cannot be got in country places. The railways do not encourage the transmission of very small parcels by rail, while their delivery through the post is not much extra trouble; while to many women it makes the difference between a respectable living and destitution."

"A Country Cousin Deprived of her Rights," writes to the *Globe* to state her own grievances and those of her sex, in their being unable to get now by post their ribbons, gloves, and dainty trimmings, and asks the Post-office authorities to reconsider their late decision on the matter.

"Bradfordian," in the *Bradford Observer*, says:—"The restriction will be greatly felt by large numbers of persons who have been in the habit of sending small parcels of goods which do not properly come under the name of samples, or who may wish to make exchanges of small articles of little intrinsic value, but still of comfort to the recipients. Now, under the altered *régime*, the carriage may cost as much as the article is worth. If you send the article by train, the cost of delivery is excessive for a small article. This looks like giving the post cards with one hand, and taking away an equal privilege with the other, and, to my mind, is going backwards with a vengeance. Instead of affording more facilities for communication, the Post-office authorities are throwing obstacles in the way. I think if requisitions were laid at different places in town for signature, and then sent to the Postmaster-General, praying that the stringent rules of the pattern post might be laid aside, perhaps it might do some good.

Sir,—"The new regulations for the carriage of printed matter are as complicated, unintelligible, and unsound, as they could well be." So said Lord Henry G. Lennox, in his opening address, printed in the last number of the *Journal*, when speaking of the postage of printed matter and samples; and his opinion appears to be fully justified by the rules which have recently been issued.

Why printers and publishers of books and newspapers, and dealers in such articles, should be more favoured in the use of the Post-office than the public, and retail dealers in manufactured articles, it is difficult to understand, and still more difficult to see the equity of.

Why newspapers, which in bundles may weigh (but must not exceed in weight) 14lbs., and may measure 2 ft. in length and 1 ft. in depth, or width, provided they are printed upon sheets of paper which are unstitched, and that they are issued at periods not exceeding seven days, should be sent through the Post-office for one halfpenny, for every two ounces and yet an ordinary article of manufacture, if sold, and of the weight of the *Times* newspaper as frequently issued, viz. 7 oz., cannot be sent except at letter rate, it is hard to understand. The Post-office was not established by the government for the exclusive benefit of booksellers and newspaper proprietors, but for the purpose of affording greatly increased facility and security to the public in the despatch of letters and small parcels, over that afforded by the stage-coach and wagon in days gone by.

Since the Post-office undertook the duty of carrying letters and newspapers for the public, mail-coaches have been superseded by railways, and sailing-vessels by steamers, and the facilities for the carriage of the mail-bags, whatever they may now contain, are quite as much in advance of mail-coach conveyance, and vastly more so, than are the demands made upon the Post-office by the extended commerce of the United Kingdom and its foreign possessions. What possible difference can it make to the Post-office officials whether they stamp a wrapper placed round a parcel of books, or round a piece of calico, a roll of silk, or a parcel of any other manufactured goods, which are neither dangerous nor calculated from their nature to cause injury of any kind to the persons handling them, or to articles with which they come in contact? Why, moreover, the Post-office authorities should permit printed papers, published once in seven days, and called by the Post-office authorities newspapers, to be carried and transmitted abroad at one rate, and declare that similar publications issued once in fourteen days are not newspapers, and shall only be carried by inland post, or, if sent abroad, must go at a higher rate as printed matter, is unintelligible, and the more so as they do not refuse to carry the latter for the same amount of payment as the former inland. Unless a publication is accepted by the Post-office authorities, and registered as a newspaper, the proprietors of such paper are deprived of the privileges, which in some cases they have enjoyed for more than twenty years, of their being forwarded to foreign countries as such.

For carrying two ounces of sealed matter, the Post-office charges 4d., while two ounces of un-sealed or printed matter is allowed to pass through the same offices and to be carried by the same agents, the same distance, for one halfpenny. Fourpence for two ounces is a freight-rate of £597 6s. 8d. per ton for letters. One halfpenny for two ounces is equal to £74 13s. 4d. per ton for printed matter, prices which, after payment of railway and post-cart conveyance, leave a large margin for central administration and for the remuneration of letter-carriers. It has not been found impracticable on the part of the Post-office to take over the business of the telegraph companies with their staffs, or to supply additional carriers where necessary, by the appointment of boys who distribute the messages sent; and inasmuch as the book-post regulations restrict the measure and weight of a parcel of newspapers to 14 lbs., though a newspaper proprietor is not restricted as to the number of parcels he can send, and as the majority of trade samples and parcels would not amount to as many ounces, any increased service, where necessary, could readily be obtained at but little additional cost by the appointment of youths to assist the present post-carriers.

Surely the Post-office authorities cannot have withdrawn the privilege hitherto granted to quiet the grumbling propensities of railway directors. In England, railway companies stand exceptionally well in the matter of postal carriage. In Switzerland, Germany, and elsewhere. where concessions have been granted for the construction of railways, it is compulsory on the railway companies to carry all post letters and parcels without charge, while in England a high rate of freight is paid by the Post-office for the work done; and any increase of work demanded of them by the Post-office, in order to a free use of the postal system in the carriage of parcels in this country, could not fairly be objected to, and would, no doubt, add greatly to the one million and half of profits annually realised by the Post-office.

I am, &c.,

H. G. H.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lt.-Col. Scott, R.E., secretary.

Bavaria has intimated that the whole of the space allotted to her for next year will be taken up by a display of fine art.

Refreshments.—A meeting of this committee was held on Tuesday, the 22nd inst. Present—Mr. Thring, Capt. Donnelly, Mr. Owen, Capt. Festing, Mr. Thompson, Mr. H. Cole, C.B., Lieut.-Col. Scott, R.E., secretary.

Mechanical Inventions.—A meeting of this committee was held on Wednesday, the 23rd inst. Present—Sir Wm. Fairbairn, Bart., Mr. J. Anderson, C.E., Mr. C. F. Beyer, Mr. W. Menelaus, Mr. J. Platt, M.P., Mr. H. Cole, C.B., Mr. H. P. Marshall, Lieut.-Col. Scott, R.E., secretary.

Hydraulic Lifts will be employed for the purpose of conveying visitors to the upper galleries of the Albert Hall. It is in these galleries that the exhibition of educational works and appliances will take place, and visitors to the Exhibition be afforded an opportunity of hearing the organ and other musical performances without extra charge.

Glass Show Cases.—Inquiries having been made as to whether exhibitors will be allowed to have their own glass cases for the display of their articles, the Commissioners are desirous of making known that they provide all the cases, and that only cases of the nature of a picture frame will be permitted exhibitors for such articles as require protection. Though articles may, by this arrangement, possibly be separated, every exhibit will bear the name, &c., of the exhibitor.

Albert Hall.—The scaffolding which has been used in its construction is gradually disappearing from the interior, and the proportions of the hall and its capabilities in the matter of sound are gradually being developed. The farthest point from the orchestra at which listeners will be placed is in the gallery, and at some musical experiments which took place on Wednesday morning, the 23rd inst., the most delicate sounds that could be produced on a single violin were clearly and distinctly heard, and without that excessive blending that sometimes takes place in an empty building. The effect of the presence of a large audience has of course yet to be tested; but as above the highest line at which an audience will be placed, there is an immense unoccupied space, and as the roof, from its shape and construction, will act as a gigantic sounding-board, the effect of a concourse of spectators will be very much less than may probably be supposed.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

TRADE OF THE UPPER YANGTSZE RIVER.

Amongst the papers furnished by Sir Rutherford Alcock upon China, one of unusual interest contains an account of the proceedings of the delegates of the Shanghai Chamber of Commerce, whilst engaged upon an exploration, in company with Mr. Consul Swinhoe' made in order to ascertain the capabilities of a portion of the River Yangtsze. The printed matter in the report gives very fully the joint observations upon the prospects that await extended operations into the centre of the rich and populous province of Szechuen, through which this portion of the river flows. Hankow was the point of departure, and here Admiral Keppel placed two vessels at the disposal of the party, besides rendering them every possible assistance which enabled them to proceed. Just above Yochow, where occurs the confluence with the waters of the Tung-ting Lake, the river loses one-half of its breadth, and is thence properly called "Upper" Yangtsze. The navigation was somewhat intricate until the expedition arrived at Shasi, which, beyond doubt, is the largest mart after Hankow. The river front was lined with junks, closely packed, along a length of a mile and a half. At this point chiefly, the vessels from Szechuen meet those from Hankow, Fanching, and the ports in Hoonan, and it is here that the principal transhipment takes place. The junks vary from 300 peculs' capacity to 2,000, and even more; upon the upward voyage there were counted about 800 of these, and taking 50 tons as an average size, there must have been no less than 40,000 tons of shipping lying at Shasi. The city has never been destroyed by the rebels, and consequently its banking arrangements, trading guilds, and business establishments generally have been left undisturbed in the midst of the ruin of so many centres of trade. The produce of Szechuen and Yunnan almost all passes this place on its way to the coast provinces, and a very large distribution takes place at this point.

From thence the course was easy to Ichang, 363 miles distant to Hankow, which became a resting place to arrange the plans for continuing the cruise. The city is built on high, level ground, the country around is fertile, and the mountain ranges, which break off, afford some magnificent scenery. According to the opinion of the surveying officers attached to the expedition, the navigation for many years to come, so far as foreign steamers are concerned, must cease at this point. The shipping business is about one-fourth, or one-third, that of Shasi; oil and opium are produced in the vicinity, and there is also a good market for teas. Not far above this place it was necessary for the party to re-embark in a junk, and slow progress was made to Wankien, Fungtoo, Foochow, Changhow, until they arrived at Chungking. Here the mandarins, who had previous notice of the intended arrival of the delegates, had prepared a good reception, and the people did not molest them in their movements about the town. The party remained a week, during which time they spared no pains to collect information from every quarter. With this object, constant communication was kept up with the merchants. It was, however, difficult to obtain any precise accounts of the trade; but what could be elicited, after a due amount of sifting, has been presented for the purposes of the chamber at Shanghai. The agricultural population were in good circumstances, the farms large, and the heads of families as well dressed as the merchants in the towns. The women, as a rule, appeared to be richly attired, and the appearance of the people was that of a perpetual holiday. The labourers sing at their work, and their manners are more cheerful than is usual with the Chinese.

The distance from Chungking to Hankow is 832 English miles. Although not one of the largest cities in China, the shops and houses are large and substantial, the people fully employed, apparently well fed, well clothed, and well housed. Everything about the place was suggestive of prosperity, and this owing to the fertility of the country and immunity from the ravages of the rebels. The appearance of the city inside, hongs, shops, and guilds, was that of a place of large trade, and no doubt the position assigned by popular report to Chungking is the true one, that it is incomparably the largest mart in Szechuen. There are many other places in this large province of secondary importance, and which are the recognised centres of special branches of trade, and a good many products find their way to distant markets, independently of Chungking, either by a different route, or by merely passing in transit. But still this city, from its commanding geographical position, is more essentially the emporium of Szechuen than London is that of England, and, from all that could be learned, its trade represents fairly, not only that of Szechuen, but of the whole Upper Yangtsze. The people expressed great readiness to trade, and foreign merchants will undoubtedly be well received, whenever they may choose or be permitted to go there.

We learn, too, from the report, that Hankow, to which point the expedition returned, is the natural focus of foreign trade, both in imports and exports, with the central and western provinces of China. The depression of trade at that time was a universal complaint amongst residents; the keen competition of the natives had reduced the profits to a minimum. Of the import business passing through Hankow to the interior, the natives had possessed themselves of about one-half, in some branches even two-thirds, which they have been enabled to do by their economical habits, the facilities for transport the steamers afford them, and the monetary facilities they enjoy from the excellence of their own banking business. Of the foreign goods that pass through, by far the largest proportion is sent to the great markets of Hoonan. Next in importance stands Szechuen, which takes off a much smaller quantity of plain cottons, but an equal quantity of woollen fabrics. A large proportion of the Szechuen business is done direct with Shanghai, the merchants coming down in the steamers and making their own purchases, which are re-packed and transhipped to boats at Hankow. The country produces within itself some of the most valuable articles known to commerce, and that with a small expenditure of labour and capital. Of silk, they provide enough for their home consumption, which is very large, and also for the requirements of the province. Of the coarser productions, the rice, wheat, and other grain crops, it supplies all the food required by the population, so that they need to import nothing under that head, whilst in such articles as oil, tobacco, sugar, salt, and hemp there is a superabundance. Thus the province is self-supporting as regards food, and the sale of the surplus supply of the common articles is sufficient to handsomely renumerate the industry of the people, and, above all, the wealth of the province is increased to an extraordinary degree by its fortuitous production of certain articles of high commercial value, almost peculiar to itself. It, in fact, is endowed with a large fund of ready-made wealth by the mere bounty of nature.

The result of this prosperous condition is a large amount of unemployed labour, for the members of families which live in such a fruitful soil are able to remain at home, and enjoy comfort in comparative idleness, their subsistence not depending on their own work. It is the existence of this superflous labouring power that causes the Szechuen people to buy so much raw cotton in place of cotton manufactures. As the people count nothing for their time or labour, anything which the cotton cloth realises over the cost of the raw material is reckoned profit. This is, doubtless, a considerable obstacle to the more extensive introduction of foreign cotton goods, for the manufacturer competes at a disadvantage with the amateur weavers of Szechuen, who are able to put their goods in the market on terms somewhat analogous to those in which the elegant productions of gratuitous labour are sold at ladies' bazaars. But still, for all that, foreign makers do compete to a fair extent with the hand-looms of the Szechuen cottages, and with moderate prices for cotton in Europe, and a careful study of the wants of the people, it may reasonably be expected that foreign goods will work their way more and more into general use.

ENGLISH BEETROOT SUGAR.

The following letter, from Mr. James Caird, has appeared in the *Times*:—

Sir,—I send you a sample of the sugar made by Mr. Duncan this season at Lavenham, in Suffolk, from beet grown by the farmers in that neighbourhood. It brought the highest price in the market for sugar in crystals. Mr. Duncan is at present converting into sugar about 400 tons of roots a week.

This is now the third year of the Lavenham factory, and of the growth and manufacture of English beetroot sugar on a considerable scale—a scale equal in extent to that of continental sugar factories. The analysis of the roots in both previous years had shown the quality to be satisfactory, but chemical and mechanical means for fully extracting it proved defective. There have been many other difficulties inseparable from a new undertaking, inexperienced hands not being the least, but perseverance and the exercise of great intelligence have triumphed, and the successful introduction of a new and most profitable agricultural industry into England has been accomplished. Mr. Duncan has now satisfied himself that the growth and manufacture of beet sugar can be carried on in Suffolk with quite as much success as in the north of France.

I have before me the figures of last week's working. The total value of the syrup produced is £960. The expenditure, including cost of roots, government duty, and working expenses, does not exceed £660. So there is a handsome balance for interest of capital and profit, besides the value of the refuse pulp sold, and thus returned to the land for cattle food. The roots are, no doubt, richer in sugar this year than usual, but on the other hand, sugar is very cheap.

Broadly stated, the conversion of the roots into sugar has more than doubled their value, though bought from the farmer at a price more remunerative to him than any other article he produces. The land is not impoverished, as nearly the whole of the feeding properties of the beet is returned to it to fatten cattle. The whole available surplus labour of an agricultural parish receives indoor employment, in the sugar factory, during three or four months of the slackest time of the year, and at good wages. Capital is profitably employed, and trade of all kinds in the neighbourhood benefited, while the general supply of sugar is augmented.

This opens a large question. If, in the southern and eastern counties, we can grow beet sugar as profitably as in the north of France, we can compete—as France has successfully competed—with cane sugar from any quarter. To what extent would it be prudent, with our limited experience, to anticipate the successful application of this new industry in England?

Mr. Campbell, of Buscot-park, in Berkshire, is conducting on a great scale a similar experiment, so far as the growth of the sugar beet is concerned, but with the ultimate intention of being able to convert the root either into sugar or spirit, as may at the time be most profitable. The weight and quality of the sugar beet grown on his estate this season cannot be surpassed. Thus, in Berkshire as in Suffolk, the soil and climate have proved equally suitable. There is no appreciable difference in the climate of the counties adjoining these, and we may therefore reasonably assume that, on all soils on which mangold is now advantageously grown in the counties from the Wash to the English Channel, sugar beet may be gradually introduced. Now it so happens that two-thirds of the entire acreage of mangold in the United Kingdom are grown in these southern and eastern counties. There is as yet no means of judging how much further the limit may be extended. I think it very likely that the south-eastern counties of Ireland may be found suitable.

And here a very important consideration should not be overlooked. The farmer will run very little risk by trying the experiment as a grower of beet, for Dr. Voelcker has clearly shown by analysis that one ton of English sugar beet is equivalent in nutritive qualities, as cattle food, to one and a-half ton of common mangold. Therefore, if the farmer cannot deal with the sugar factor, he can use the beet with the same advantage for cattle food, as, though the crop is less bulky, his twenty ton crop of beet will be as nutritive as the thirty ton crop of mangold.

About 200,000 acres of mangold are grown annually within the area I have indicated. One-fourth of this, if applied to sugar beet, should yield 60,000 tons of sugar, or about one-tenth of the present consumption of the kingdom. This would seem a not very remote result of more extensive trials, and, when attained, the further progress would be rapid. But, while I feel great confidence in the further profitable extension of this industry, I will venture to offer a word of warning. It did not pay Mr. Duncan either the first or the second year, and he is no ordinary man. He combines in a remarkable manner business capacity with chemical and engineering knowledge. These, with further experience, carefully sought on the Continent, and that within his own factory at Lavenham, have led him to an entirely successful issue in the third year. But the business is quite new in this country, and men are not yet educated to it. Enough, however, has been done to show that success may be anticipated by those who can bring to it a like command of capital, skill, and perseverance.

MILITARY EDUCATION IN PRUSSIA.

The basis of the military organisation of Prussia, as is well known, has long been universal liability to service, which has been extended likewise to all the States comprising the North German Confederation. The military force consists of three distinct bodies, viz., the standing army, which is divided into the active and the reserve, the landwehr, and the landsturm. Upon the completion of his twentieth year, every citizen becomes liable to serve for seven years in the first, after which he is transferred to the landwehr, where the service extends for a further period of five years. The landsturm, or last reserve, consists of the whole able-bodied male population, between the ages of 17 and 42, who do not already belong to the other branches.

The mode in which the army is officered is uniform in nearly all the states; and three requisites are exacted before a commission is given:—Firstly, a good general education; secondly, actual military service; and thirdly, professional knowledge gained by something like a year of military study. Though almost everyone must serve in the ranks before becoming an officer, such service is with a distinct recognition of his being a candidate for a commission, and this cannot be obtained without the nomination of a commanding officer. Since young men of good social position can alone obtain this nomination, and, only with the consent of the officers of the regiment, there is probably no army in the world where the class spirit is so developed as in that of Prussia.

While in France the system of education has been little altered during the last thirteen years, in Prussia, during this interval, it has undergone constant extension and improvement, the chief alterations consisting in the enlargement of all the educational establishments, the requirements for a commission remain in principle the same as they were, the double examination for the rank of officer, and the exaction from the candidate of proof of both general and professional knowledge, being still the peculiar features. The most useful changes have been in the war schools, where the greatest pains are bestowed upon a thorough practical instruction in military subjects. Both in France and Prussia, no attempt has been made to give a special military education at an early age, and up to 17 or 18 the future officer receives the same kind of education as the civilian, and in the great majority of cases, at the ordinary schools of the country. The idea is, that a young man can derive no advantage from studying the theory of the profession until he has learned the practice of it, hence all professional instruction is deferred until regimental duty has been performed for nearly a year. The examinations are not only based on the course of instruction at civil schools, but they have also been used as a means of raising the character of the education given at these schools.

The most marked contrast in the French and Prussian systems consists in the thorough competitive character of the former. In Prussia, the principle of competition, though recognised, is seldom carried into practice; in fact, the term "competitive examination" scarcely seems to be understood. The object appears to be, not to attempt to establish an accurate comparison of the educational attainments of a number of individuals, but to form a general estimate of the abilities, character, and military capacity of each. In a country where military service is compulsory, there exists always the great inducement to exertion afforded by the desire to escape duty as a private soldier. The great aim of the tutors is not merely to impart a certain amount of positive knowledge, but to develope the faculties, and to cultivate the powers of thought and reasoning; and this is thought to be best obtained by small classes, and care bestowed upon the higher objects of education. There is an entire absence of minute details as to numbers, dates, and facts, and attention is directed to broad principles, which are intended to lay the foundation for further individual study in after-life.

In no part of the service are mathematics made an important element, and even to officers of artillery and engineers the general principle is, that the higher branches can only be studied with advantage by a few who have real mathematical talent, and that it is waste of time to force the study upon those who have not a taste for such. Great importance is attached to the subject of *reconnaissance* and field sketching, rapid sketching on horseback being frequently practised. Thorough instruction in military law and regulations, in regimental internal economy, in official correspondence; the preparing returns and keeping accounts, is made a very important element of the education of candidates for commissions. A knowledge of at least one foreign language is necessary. Advantage is taken of visits to military establishments, manufacturing departments, and fortresses, to illustrate the subjects taught in the lecture room. Proficiency in drill, riding, fencing, gymnastics, &c., is allowed to compensate for a partial failure in theoretical attainments. Except for the officers at the higher schools, every examination includes *viva-voce* questioning, to which the same importance is attached as to the paper work.

For the staff, a separate organisation is provided at Berlin, where a large building is appropriated to the various offices and departments, presided over by General Von Moltke. There is no regulation on the admission of officers, nor is there any direct preliminary examination; but the officers are, for the most part, selected from three classes, viz., those who have completed the prescribed course at the Military Academy, those who notify their desire to enter the staff, and those who are recommended by their superiors for that special purpose. The instruction, besides certain duties, consists in drawing up reports upon strategetical and tactical questions, the preparation of private comments upon foreign armies, the contribution of articles upon military subjects to the *Militair Wocken Blatt*, or military paper, the attendance upon the annual manœuvres, or the active campaigns of other nations. As a practical and scientific body, the Prussian staff ranks very high, and its character for efficiency in the field has been fully shown by recent events.

MR. FORSTER ON THE EDUCATION ACT.

The Right Hon. W. E. Forster, at the annual distribution of prizes and certificates at the Birkbeck Literary and Scientific Institution, asked permission to say a few words as to the way in which the Education Act was being generally received, because, although it was not precisely the direct question before the meeting, it was a matter of vital importance to the entire kingdom. The first resolution to be submitted, he perceived, was one of pleasure that a national measure of education had been passed, and of hope that it would be responded to throughout the nation, so as to provide a comprehensive and efficient system of national education. That hope was already fulfilled, and fulfilled far beyond his most sanguine expectations. In passing the Act, the government believed they were offering a measure that would secure an elementary education for every child in England and Wales, but they knew much inquiry would be necessary to find out the exact amount of deficiencies in different places before those places could be forced to supply those deficiencies. They thought, however, that there might be some districts that would anticipate the process, and would not want to be forced, because they were mournfully conscious of the educational destitution which it was necessary for them to relieve. Consequently, the government were most glad to admit an amendment to the Bill providing the means for such advantage. He himself was led to hope that some few places would embrace the opportunity, but he must confess he had no idea it would have been done to the extent to which it had been done. He had a list of twenty-six boroughs which, through the town councils, had applied to be brought into connection with the Act at once. They were the most important boroughs of the kingdom, and with the exception of Bristol, which he dared say had a good reason, although he had not heard of it, there was no important town in the kingdom which had not taken this gratifying step. These towns represented a total population of two millions and three-quarters. In these boroughs elections were in progress, or were over. Liverpool, to its honour, had not only anticipated the necessity of a Board, but the trouble of a contest, by producing fifteen of its citizens so respected by their fellow-townsmen that they had been elected without a contest. And this had been done by no skilful arrangements or compromise between different parties, but because the inhabitants generally agreed to sink minor differences for the sake of seeing a sound education brought home to every child, and it was a most hopeful sign that the second largest town in the empire should show their anxiety in so remarkable a manner. He was also personally proud to give the same account of Bradford, which he had the honour to represent. Precisely the same course had been adopted there, and but an hour or two ago he had a telegram to say that although there were originally forty candidates for Bradford, they had all retired but the requisite fifteen, who met with the entire confidence of their fellow townsmen, and were returned to do their work in connection with the educational requirements of the town. The fact that the first districts stepped forward to join in the working of the Act was a most favourable omen. By this expression he did not necessarily mean the first men in property and station, but the first in the estimation of their fellow townsmen. Some of them, as he was glad to see, were artisans, but whatever they were they were representative men. He did not say the same result would not follow in other towns, his belief being that the operation of the Act would develop an amount of municipal faculty such as we had never seen before. In the country districts, it was true, boards had not yet been asked for, partly because it was exceedingly difficult for the Department to define the regulations under which they were to be elected; but there was an amount of activity with regard to education which never existed before. There was scarcely a rural village, however secluded, that had not counted the cost, in order to ascertain their true educational position. This was shown first in the philanthropic and Christian desire on the part of the wealthy to provide education for their poorer neighbours; and, secondly, in that inherent dislike to rating which was operating so strongly that the Education Department was being deluged with proposals to supply the recognized educational deficiencies. One misapprehension with regard to these proposals was, that for every pound subscribed by individuals the Education Department would supply another pound. Seeing, however, that the Department only gave one-fifth of the proportion, the efforts that were being made in the country districts were more to the credit of the lovers of education than was supposed. Putting London and these boroughs together, about six millions of the population of England and Wales would be under the operation of the Act before the end of the year. In London he saw the greatest possible ground for hope; in fact, compared with the fear which he, in common with others, had when the question first came into his hands, he could not describe the thankfulness he felt. The work to be done in London was probably greater than in any other part of the kingdom, for while the educational destitution was immense, the difficulty of meeting it was equally great. It was, however, impossible not to treat London as one large town, and if they attempted to say that each part of London had to be burdened with the relief of its own misery, destitution, and ignorance, a feeling of unfairness unquestionably arose. Then came the difficulty of administering taxation, if one area was chosen. While he did not believe the vestries deserved the blame which had been cast upon them, the work clearly could not be given to them, because it was not in accordance with human nature that the representatives of a part of London should have the control of the funds of the whole. After facing this difficulty week after week, and having several plans before him, he decided upon the plan which was now to be tried. In his difficulties, however, he was most ably assisted by the metropolitan members. The metropolis was nobly responding to the call that had been made upon it, and he was delighted to see the excitement which prevailed. It was felt that the suffrage should be made as wide as possible, and he hoped the Government would not be blamed for not insisting that proof should be given that the voter had paid his rates. The election would be conducted upon household suffrage in the widest meaning of the term, and he wished it had been possible to have included the occupiers of lodgings. Without discussing the question of the ballot, he would point out that it would be a real ballot, but it had been arranged that if anything were written upon the voting paper, except the number of votes to be given, it would not be received. Any voter, therefore, signing his name would nullify his vote. He advised the electors to compare, as far as possible, the elections in the City, where there was no ballot, with the places where the ballot would operate. He was hopeful as to the result of the cumulative vote, and was thankful it had driven the wire-pullers to their wits' end. At any rate, it would have this effect—if a majority showed itself too greedy, it would be to its own cost and defeat. He was delighted to see some women appearing as candidates, being sure that unless their assistance was procured it would be impossible to have the necessary knowledge as to the education of girls. The ladies and gentlemen on the Metropolitan Board would have very heavy duties to perform—they would have to furnish the government with the entire educational returns; to discover the educational destitution, involving what had never been attempted before, an organised inquiry into the misery, pauperism, and crime which had produced it; to inform the Educational Department where new schools were required; to find a good deal of money for the schools and to furnish them, and provide them with teachers whom they would have to keep up to their duty. Amongst the things which they might in addition do, if they chose, were the settlement of questions as to the payment of fees, the establishment of free schools for special districts, and the regulations as to attendance. So far as could be gathered from the addresses of the candidates, their real desire was to have fair play only on the religious question. He was sanguine as to this difficulty when the Bill was before Parliament, and he was sanguine now that it would meet with a proper solution. Those who were anxious to be on the Board seemed to think that the Bible ought to be read, like other books, with necessary explanations only, and he had the fullest confidence that what the schoolmasters would teach would be the great moral and spiritual truths of life and conduct, without any attempt to cram into the poor little brains of the scholars theological dogmas which their age prevented them from understanding. In conclusion, the right hon. gentleman said he was sure the Board would not rest until it had succeeded in making London as conspicuous for its means, as it had hitherto been for its want, of education.

The **Lord Mayor** having expressed his conviction that the educational measure of last session, which Mr. Forster took so active a part in promoting, would tend in an eminent degree towards securing the happiness and prosperity of the country, moved a resolution to the effect that the meeting viewed with great satisfaction the legislation on education of the past session, and trusted that the measure initiated by the Government would be responded to by the country in such a manner as to provide a comprehensive and efficient national system.

The **Earl of Lichfield** seconded the resolution, which was supported by **Professor Tyndall**, who alluded to the fact that the forthcoming elections for school boards were exciting the liveliest interest throughout the length and breadth of England, and dwelt upon the importance of appointing really good and efficient masters for the district schools.

Sir J. C. Lawrence, M.P., proposed a vote of thanks to the Society of Arts for the earnest and successful manner in which it had encouraged Arts, Manufactures, and Commerce throughout its long existence, and especially for the valuable aid which it had given, by means of its excellent system of examinations.

Mr. Serjeant Simon, M.P., seconded the motion. He believed that the education measure, when it came properly into operation, would render such institutions as valuable to the working classes as colleges and universities were the middle and upper classes.

Mr. Douglas Straight, M.P., spoke to the resolution, bearing his testimony to the extent of misery and educational destitution among the criminal classes. The want of education led to the perpetration of vice and profligacy, and he hoped that one of the first steps taken by the London School Board would be to look after the education of what might be called the gutter children of the metropolis, so that they might become, as they grew up, well-conducted members of society. He hailed with delight the prospect of women being selected to seats on the School Board, because he believed their presence would be productive of great advantage, especially in looking after the educational culture of the female youth of the metropolis.

Lord Henry Lennox, M.P., as chairman of the Society of Arts, returned thanks for the compliment. Much still remained to be done in the cause of education, and whatever improvement it was desirable to suggest, the watchfulness and services of the Society of Arts might be relied upon.

SCHOOL BOARD ELECTIONS.

The list of candidates for the London School Board now stands as follows:—

City.—Mr. Samuel Morley, M.P., the Rev. Prebendary Mackenzie, M.A. (rector of Allhallows, Lombard-street), Mr. H. E. Knight, Mr. Alderman Cotton, Mr. J. B. Austin, Mr. John Chubb, the Rev. Prebendary Rogers, M.A. (rector of Bishopsgate), Mr. G. W. Hastings, and Mr. W. S. Gover. Four members.

Westminster.—Mr. W. H. Smith, M.P., Sir Charles Trevelyan, the Rev. Dr. A. Barry (principal of King's-college), Viscount Sandon, M.P., the Rev. Dr. J. H. Rigg (principal of the Wesleyan Training College, Westminster), Mr. George Potter, Lord Edmond Fitzmaurice, M.P., the Rev. J. H. Barber, M.A. (head master of Pimlico Grammar School), Mr. George Shipton, Lord Howard of Glossop, Mr. G. W. Martin, and Mr. C. E. Mudie. Five members.

Marylebone.—The Rev. Prebendary Thorold, M.A. (vicar of St. Pancras), Alderman Sir Sydney Waterlow, Miss Elizabeth Garrett, M.D., Dr. James Edmunds, the Rev. Dr. Joseph Angus (president of Regent's-park College), Dr. George Wyld, Mr. M. A. Garvey (barrister), Mr. G. Verey, Mr. W. T. Whelpton, Mr. F. S. Powell, Professor Huxley, M.D., Mr. J. Marshall, Mr. Arthur Mills, Mr. James Watson, Mr. W. Beare, Mr. T. G. Brewer, Mr. W. R. Cremer, Mr. Hepworth Dixon, Mr. J. T. Holt Dunn, Mr. J. Guedalla, Mr. E. J. Hutchins, and Mr. J. F. Stanford. Seven members.

Finsbury.—Mr. Torrens, M.P., Sir F. Lycett, Dr. F. Tomkins, Mr. W. Rivington, Rev. J. Rodgers (vicar of St. Thomas's, Charterhouse), Mr. Hugh Owen, Mr. T. C. Clarke, Mr. F. J. Hartley, Mr. C. H. Hopwood, Mr. J. R. Morrison, Mr. E. Mirams (barrister), Mr. E. J. Tabrum, Mr. B. Lucraft, Mr. John Sands, and Mr. C. H. Lovell. Six members.

Greenwich.—The Rev. Dr. Miller (vicar of Greenwich), the Rev. B. Waugh (Dissenting minister), Mr. W. G. Lemon, the Rev. J. M. Glenie (Roman Catholic), Miss Emily Davies, Mr. John Macgregor, M.A., Mr. F. Johnson, Mr. George Offor, Mr. W. W. Stanyer, Mr. W. D. Barnett, Mr. G. White, and Mr. T. S. D. Floyd. Four members.

Chelsea.—The Rev. Canon Cromwell (president of St. Mark's Training College), Lord Lawrence, Dr. J. H. Gladstone, Mr. E. S. Dale (barrister), Mr. J. Osborne, Mr. T. G. Snell, Mr. W. A. Davy, Mr. R. Freeman, Mr. W. Harry, Mr. G. N. Kiell, and Mrs. Grey. Four members.

Tower Hamlets.—Dr. Bowkett, Mr. E. H. Currie, Mr. H. Clements, Mr. H. D. Jeffries, Mr. A. Langdale (Roman Catholic), Mr. F. Young, Mr. T. Scrutton, Mr. Matthias, Mr. W. Pearce, and Mr. E. N. Buxton. Four members.

Southwark.—The Rev. J. Mee, M.A. (vicar of St. Jude's, and formerly Dean of Grahamstown), Mr. E. H. Bayley, Mr. W. Rendle, Mr. B. Ingle, Mr. C. Herring, Mr. T. Turner, Mr. J. Sinclair, Mr. F. J. Clements, Mr. Crescens Robinson, Mr. A. Lafone, Mr. J. Wallace, Mr. A. Side, and Mr. W. E. Baxter. Four members.

Lambeth.—Sir Thomas Tilson, the Rev. F. Tugwell, M.A. (vicar of St. Andrews), Mr. C. Few, Mr. Edward Gudgeon, Mr. R. Applegarth, Mr. G. M. Murphy, Mr. W. R. Selway, Mr. J. E. Tresidder, Mr. C. White, Mr. John Gibbons, Mr. J. Stiff, Mr. S. Shaen, Mr. M. D. Kavanagh, Mr. A. M'Arthur, and Mr. T. Mottershead. Five members.

Hackney.—Sir Thomas Fowell Buxton, Bart., E. F. Coke, M.A., J. H. Crossman, R. G. Clements, W. Green, J. Hales, Septimus Hansard, M.A., W. Lockhart, B.A., John Oakley, M.A., G. F. Pardon, James Allanson Picton, M.A., Charles Reed, M.P., J. Runtz, Adolf Sonnenschein, T. Bywater Smithies, and C. R. Wood. Four members.

It will be remembered that the election is fixed for Tuesday next, the 29th inst., and that each elector is entitled to the same number of votes as there are members to be elected, and may give them all to one candidate, or divide them as he pleases. The members are not to be paid, but the Board may pay the chairman such salary as they may from time to time, with the sanction of the Education Department, fix.

The Rev. C. H. Spurgeon, in a letter to some of the daily papers, gives particularly sensible advice to the electors. "Assuming," he says, "for the moment that all the candidates are equal in character and position, a supposition which each elector will readily be able to substantiate or reject, one very important requisite is not, however, found in all, viz., acquaintance with the subject in hand. If we had to elect a national astronomer, we should rightly consider a man's character and standing as collateral matters, but the main thing would be his knowledge of astronomy; so in the present case, one very important element is the candidate's acquaintance with education, educators, educational processes, and literature. Some members of the Board should very fitly represent the financial element, and keep the expenditure in check; others should represent the working classes, who are on the receiving side of the question, and see that the economy does not degenerate into meanness. It is but just that some of the working men's candidates should be returned." We shall soon know how far this excellent counsel will be followed.

A similar amount of interest appears to be felt in the School Board elections in many of the principal industrial centres.

At Leeds, since the failure of an attempt made last week by influential parties to avoid a contest, there have been meetings daily of one religious party or another, as also of the Leeds Liberal Registration Society and the Reform League, for the purpose of nominating candidates. The political parties agreed upon eight gentlemen, the Church Education Association upon five, the Wesleyan Methodists three, the Roman Catholics two, and other smaller bodies of religionists also agreed upon candidates. Moreover, a working men's meeting has been held, at which it was agreed to put two persons in nomination. Consequently, there will probably be a contest on a large scale on the 28th inst., which is appointed to be the day of election.

At Liverpool, there was, till recently, every prospect of a contest, which will now be avoided. The denominational bodies, though anxious for an amicable arrangement, found a difficulty in reconciling their several claims to representation on the Board. The Church of England party held that, by their numbers and position, they were entitled to at least seven out of the fifteen members to be elected. The Nonconformists and Roman Catholics respectively considered that they ought to have the opportunity of selecting five members each. At length, however, the Catholics signified their willingness to accept one less than that number, and the Nonconformists made a corresponding concession, on condition that the seventh candidate, yet to be selected by the Church of England party, and who will be a working man, is acceptable to the Nonconformist party. A large number of "independent" candidates had, however, to be considered, and between these and the denominational representatives negotiations were busily carried on, and, almost at the last moment, they were induced to withdraw. There are now, therefore, only as many candidates as seats on the Board, and the denominational proportion will be seven Churchmen, four Protestant Nonconformists, and four Roman Catholics.

A crowded and excited meeting has been held at Bolton, to receive a list of thirteen names to form the School Board for that town. The list includes four Churchmen, two Wesleyans, two Independents, one member of the Society of Friends, one Roman Catholic clergyman, and two working men (a Unitarian and a Churchman), the Mayor, also a Churchman, being the thirteenth, but he declined to serve. Strong opposition was manifested to the Catholic priest as a candidate, and he ultimately agreed to retire on the condition that, as the Roman Catholics of Bolton formed one-sixth of the population, they should form one-sixth of the representation on the School Board. This was agreed to, and two lay Roman Catholics were named, and a list of names approved. The probability is that there will be a severe contest.

There were 67 nominations for the Manchester School Board, and of these 44 candidates now remain, and appeal to the suffrages of the ratepayers, 23 gentlemen, including the Bishop of Manchester, having withdrawn from the contest. Miss Lydia Ernestine Becker is among the present candidates.

The election of a School Board for Coventry is fixed for the 30th inst., and during the past ten days considerable interest has been excited on the subject. The Liberals have held meetings in the various wards in the city, and adopted lists of candidates. At an aggregate meeting of this party, a resolution was passed in favour of supporting only those candidates who were known to be in favour of strictly undenominational teaching in rate-supported schools. The number to be elected on the School Board is 11, and a resolution was passed approving the names of seven gentlemen, who were pledged to the principle of undenominational instruction. At a meeting of the Conservatives, resolutions were passed declaring that it was essential that, in all rate-supported schools, Scriptural teaching should form part of the education, and nominating seven candidates to represent the principle embodied in that declaration. Political parties being nearly equally divided in Coventry, it is expected that the contest will be very close.

At a public meeting at Nottingham a Board was adopted, consisting of one representative of the Birmingham League, one of the Manchester Union, three Churchmen, one Congregationalist, one Baptist, one Methodist, one Roman Catholic, one Unitarian, one of the Town Council, and two working men.

At a meeting of Protestant Nonconformists, held at Salford, to consider the propriety of nominating candidates for the School Board, it was stated that the friends of the Established Church intended to nominate eight members and the Wesleyans three, and the Nonconformists were anxious to nominate five.

At Sheffield, the number of persons nominated is about 90. As the Board is to consist of 15 members, there will in all probability be a contest, though the number of candidates will be very much reduced before the day of election.

The list of 46 candidates at Bradford has been reduced to 15, the number required for the Board. Consequently there will be no contest.

The election of a Board for Bridgewater is set down for the 29th inst., and there will, it is expected, be no contest.

The Nonconformist ministers and superintendents of the Nonconformist Sunday Schools of Bromsgrove have applied to the Education Department for an order for the election of a School Board.

CORRESPONDENCE.

PATENT LAWS.

Sir,—A clever letter upon this subject appeared in your last issue, but, unfortunately, it is the production of one of a numerous body of professional gentlemen whose income would, in a great measure, cease and determine on the abrogation of these laws. M. de Fontainemoreau acknowledges that even the present amended code is a mass of imperfection; but the remedies proposed by himself and others are utterly impracticable. The intended test of originality could only be obtained by the labour of a body of men going through a search of centuries of documents in each case, and that imperfectly. That would involve an expense almost equivalent to the cost of a Chancery suit, previous to the applicant's obtaining his patent right. Again, it is absolutely impossible to obtain a test of the usefulness of an invention or process from any other source than the approbation of the public, as proved by its general adoption.

Undoubtedly, these laws are a mere excuse for an authorised lottery, as shown by the statistical fact that ninety-nine out of a hundred applicants never realise a penny of profit from their royalty, and that of those few who do, a full statement of their finances would show that they would have been quite as well off if they had never meddled with patent privileges. The Messrs. Boulton and Watt, notwithstanding their exorbitant charges, were so impoverished by the cost of repeated rider patents to secure the former piracies, costs of Chancery suits, that they applied for, and obtained, a prolongation of their exclusive privilege for 21 years.

Patents often remain locked up for years, from the want of necessary or useful improvements, as was notoriously the case with the sewing-machine, which remained almost a dead letter for 15 years, that is, until the expiry of the first patent, for which the original inventor only obtained £50, after having expended hundreds upon the invention.

The origin of patent right dates from the rather dark ages of civilised life, during the reigns from the eighth Henry to that of Charles II., when royal privileges were granted to favourites for exclusive trading, and other purposes, in defiance of the general benefit of the world at large. In fact, if every production of the human mind were made the subject of patent right, as would seem to be the drift of its advocates, where would be the benefit to the general public, for it would be in precisely the same position as without any patent right at all ?

M. de Fontainemoreau is most decidedly in error when he asserts that the number of abolitionists is becoming small, when so many great names have been added to the list of late, many of whom have been patentees themselves. The argument that the patent laws are the cause of invention, cannot be sustained for a moment in the face of the great fact that the myriads upon myriads of the appliances of civilised life were all fundamentally invented before the advent of those laws, and, we are bound to believe, even before the era of the Deluge.

Indeed, there never was a truer saying than that very old one, that "necessity is the mother of invention," for if a want become manifest, some one will be sure to turn up to supply the deficiency. This is a very small and crude sample of all the arguments that might be brought against the ultimate continuance of the patent laws.—I am, &c., Henry W Reveley.

Reading.

GENERAL NOTES.

Indian Architecture.—General Cunningham, of the Bombay Engineers, perhaps the most learned man on the archæology of India, is about to proceed to India at once as surveyor-general of the Archæological Survey. The Society may congratulate itself on this result, as fairly attributable to the discussion in the Society's room, which was originated by the admirable paper read by Mr. Fergusson, 19th December, 1866.

China Grass Machine.—In the beginning of the year, the India Council published the conditions of competition for a prize of £5,000, for the best machine or machines for preparing rheea or China grass. It is required that the machinery should produce a ton of fibre, of a value of not less than £50 per ton in the English market, at a working expense of not more than £15 per ton. Rewards of lesser amounts are offered for inventions of merit, even if unsuccessful, and specimens of the bark and fibre are placed at the disposal of the applicants to the home India-office. The time at first allotted, which would have expired on the 10th of next February, has been prolonged for another year. There are already not less than 100 competitors. At the India Museum there are now to be seen some specimens of fabrics woven from the fibre of China grass, manufactured by Messrs.

Wade and Sons, of Bradford. These stuffs, says the *Engineer*, "have the appearance of very fine alpaca, with, however, a more silky gloss. They are, apparently, not so elastic as either silk or alpaca, as they more easily take and more permanently keep a crease. This objection is being overcome by working up a little wool into the fabric. Taking the possibility of making such beautiful fabrics, together with the authoritatively-stated fact that 'there is a practically unlimited extent of country in India where the plant could be grown,' it must be seen that the subject is one of vast importance, and that the material offers a wide field for work to our machinists."

Prizes for Hardware Designs.—The proprietors of the *Ironmonger* having awarded prizes for designs for cruet frames, purpose to offer prizes for designs for garden seats, door letter-boxes, and metal flower holders for the table.

Supply of Gas in Paris Besieged.—The gas company, in order to economise its fuel, have commenced injecting petroleum into its retorts, and also to make use of gas tar in its furnaces.

Salmon in Japan.—Mr. Troup, acting-consul at Niagata, in a report this year to Sir H. Parkes, states that great quantities of salmon are caught in all the rivers of that province. Besides in the Shinano-gawa it is found in the Aga-no-kawa, the Arakawa, and the Miomote-gawa, or Murakami rivers to the north-east. Might it not be possible to introduce the spawn into Tasmania and New Zealand from Japan more successfully than has yet been done from England?

International Copyright.—It does not appear (says the *Bookseller*) to be generally known amongst publishers that books printed in the English language and copyright here are copyright also in France, Germany, and other countries with which we have treaties. It is therefore totally unnecessary to enter them, or make any arrangements for continental editions, as they cannot be reprinted there except with the author's or proprietor's sanction. A very small sum is usually paid for the right to reprint; the cheap foreign editions are largely purchased by English visitors and brought home, and they are also shipped off in large quantities to America, and to our own colonies, to the detriment of English editions.

Effect of the War on the Silk Trade.—Curious industrial changes are likely to result from the Franco-Prussian war. The silk trade of the South of France is almost entirely suspended, and the advices from Japan are to the effect that orders for silkworms and eggs for Europe have entirely stopped. It is stated that the silk manufacturers of England and Italy have more orders than they can execute. Scarcity in production necessarily enhances prices, and the men of enterprise in the United States have had their attention attracted to the silk manufacture. The diminished manufacture has not, as yet, very materially affected the market, but it must do so ere long. The European peoples have at present but little to spare for the most costly products of the loom, but it may be expected that the convulsion and derangement over a large demand for various descriptions of goods will set in. Our American friends think that their western seaboard gives them great facilities for the cultivation of the mulberry leaf, and they propose to enter into competition with Europe in the silk trade. They propose do so honourably and openly, and not after the manner of introducing "an ugly-looking gray worm" surreptitiously "by wandering monks." It would appear that the silk manufacture has been cultivated with great success in California, where extensive experiments are being prosecuted. If the attempts in the United States to supersede China and Japan as the great staple producing marts of silk should prove successful, it is impossible to foretell the vast amount of trade which will result from American enterprise.

Dry Goods Imported into New York.—The importations of foreign manufactured goods is on a scale much larger than that of the same period of the past two years. Since the commencement of 1870, the total value of foreign "dry goods" landed at New York has been £17,700,000, against £16,400,000 to the same date of 1869, and 13,900,000 to the same date of 1868.

The Petroleum Trade.—The export from Philadelphia for the current season amounts, according to the official statement recently given in the columns of the *North American*, of that city, to 35,938,779 gallons, to compare with 21,980,768 gallons in the same period of last year. This increase, amounting to 13,949,031 gallons, has been effected notwithstanding the interruptions and drawbacks entailed upon the trade with Germany, and, indeed, with the whole north of Europe, by the present war. 9,250,000 dollars is the amount to be added, under the petroleum head alone, to the total of Philadelphia commerce. The trade presents some curious features. For instance, while the export to England has fallen from 1,818,270 to 888,433 gallons, the quota of Ireland has gone up from 1,843,000 to 4,128,269, and of the British West Indies, from 77,191 to 97,251. Spain shows a heavy increase, from 429,260 [to 897,870; and Cuba, from 27,755 to 49,737. Italy ranges far above all the rest, with 1,649,871 this year, to set off against 417,130, in 1869. This is nearly a fourfold increase, and with it we may class the rise of the figures at Gibraltar, from 1,294,771 to 2,297,151, since much of the quantity received at the port in question is decidedly intended for Italian consumption. The growth for North Germany runs from 4,666,146 to 6,887,016. Holland receives about 320,000 gallons. In actual figures, Belgium stands at the summit of the list, although her proportionate gain is not equal to that of many other foreign states. Her figures are 5,214,678 last, to contrast with 8,632,855 for the present year. As the exporting season draws to a close, the returns from abroad indicate continual extension of shipments for the coming year, and some Philadelphia experts put the probable money value of the quantities to be sent out from that port at more than 12,000,000 dollars. This estimate, taken together with the quantities consumed at home, conveys a very impressive idea of the importance to be attached to this peculiar article, so utterly unknown at the beginning of the present generation.

MEETINGS FOR THE ENSUING WEEK.

Mon. ....**SOCIETY OF ARTS, 8.** Cantor Lectures. Mr. F. S. Barff "On Artists' Colours and Pigments." Lecture II. "Chemistry and Manufacture of Colours and Pigments."
Institute of Surveyors, 8. Mr. E. Ryde "Parochial Assessments (Railways)."
Social Science Association, 8. Mr. Ernest Hart, "Medical Organisation in Time of War."
Actuaries, 7. Mr. T. B. Sprague "On Legislation in reference to Life Insurance and Life Insurance Companies."
Medical, 8.
London Institution, 4. Prof. Odling "On Chemical Action" (Educational Course).

Tues. ...Royal Geographical, 8½. Capt. Sherard Osborn, "Geography of the Sea-bed."
Civil Engineers, 8. M. Jules Gaudard, "On the Theory and Details of Construction of Metal and Timber Arches."

Wed. ....**SOCIETY OF ARTS, 8.** Mr. R. M. Alloway "On Peat and its Profitable Utilisation."
Royal, 4. Annual Meeting.

Thurs...Antiquaries, 8½.
Linnæan, 8.
Chemical, 8. Mr. W. H. Perkin "On some Anthracene Derivatives."
London Institution, 7½. Prof. Morris "On Gems and Precious Stones."

Fri.......Geologists Association, 8.
Philological, 8¼.
Archæological Inst., 4.
Architectural Association, 7½. 1. Prize Essay. 2. Mr. Rhodes "On the 19th Century.'

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FRIDAY, DECEMBER 2, 1870.

PROCEEDINGS OF THE SOCIETY.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The following report from the Musical Committee was laid before the Council at its last meeting, when the same was adopted:—

1. In order to carry on the work already begun by the Society of Arts, with the view of establishing a National Training School for Music, the Committee recommend the Council to make music—as one of the Fine Arts—an object of the Society's attention.

2. For promoting this purpose, the Committee recommend that a musical section of the Society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall.

3. These concerts to consist of performances of vocal and instrumental music of the highest character.

4. After paying the expenses of the concerts, the profits to be applied to the establishment of a National Training School for Music.

5. Members of the Society, for every subscription of one guinea paid to the musical fund, to have the privilege of obtaining a transferable ticket for six evening concerts in the arena and balcony without further payment, provided that no member as such shall have the privilege of receiving more than five tickets on these terms.

6. Persons not members of the Society shall have the liberty to purchase tickets on such terms as the Council may from time to time determine.

7. That the Musical Committee of this Society, consisting of:—

The Lord Henry G. Lennox, M.P., or the Chairman of the Council for the time being
The Vice-Chairman of Council for the time being
Lord Gerald FitzGerald *
The Right Hon. Sir J. Pakington, Bart., M.P.*
Sir John E. Harington, Bart.*
Sir. Francis Sandford *
E. A. Bowring, Esq., C.B., M.P.*
Henry Cole, C.B.
A. S. Cole, Esq.
Capt. Donnelly, R.E.*
The Honourable Seymour Egerton
W. Hawes, Esq.*
C. Wren Hoskyns, Esq.
Frank Morrison, Esq.
J. Puttick, Esq.*
S. Redgrave, Esq.*
Lieutenant-Colonel Scott, R.E.*
E. C. Tufnell

be authorised to carry out the arrangements for the six concerts, as soon as a guarantee fund for not less than two thousand pounds has been obtained, and one thousand subscriptions of one guinea.

That Sir Michael Costa be asked to meet the Committee, to discuss the necessary details.

A guarantee fund for assuring the Society against loss has been commenced, and the following gentlemen have guaranteed the amount set opposite their names respectively:—

F. A. Abel	£10
Sir W. H. Bodkin	10
C. Minton Campbell	100
A. Cassels	10
E. Chadwick, C.B.	10
Hyde Clarke	10
Alan S. Cole	10
Henry Cole, C.B.	50
Sir Charles W. Dilke, Bart., M.P.	20
Capt. Donnelly, R.E.	20
Hon. Seymour Egerton	10
Lieut.-Gen. C. Eardley-Wilmot, R.A.	10
Lord Gerald Fitzgerald	10
J. A. Franklin	10
Capt. Galton, C.B.	20
Dr. Hogg	20
Professor Huxley	10
Messrs. Lucas Bros.	250
Admiral E. Ommanney, F.R.S.	10
J. F. Puttick	10
Samuel Redgrave	10
Sir Francis Sandford	10
Lieut.-Colonel Scott	50
G. Spottiswoode	10
Seymour Teulon	10
Henry Thring	20
Henry Vaughan	10

The Council earnestly hope that the members of the Society will support, and co-operate with them in, this important public undertaking, and by joining in the proposed guarantee, and by availing themselves of the privilege of subscribing for tickets at the reduced rate, aid in securing the establishment of a National Training School for Music.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

THIRD ORDINARY MEETING.

Wednesday, November 30th, 1870; ROBERT RAWLINSON, Esq, C.B., in the chair.

The following candidates were proposed for election as members of the Society:—

Anderson, John MacVicar, 6, Stratton-street, W.
Berghtheil, Z., 48, Clifton-gardens, Maida-hill, W.
Cooke, John, Darlington.
Couch, Thomas Ross, 172, High-street, Wapping, E.
Green, Robert, E., Church, near Accrington.
Hughes, Henry, 25, Green-street, Grosvenor-square, W.
Hulme, F. W., 8, St. Alban's-road, Kensington, W.
Jayne, James Barton, 17, Park-street, Croydon.
Moser, L., 18, Belvue-place, Southampton.
Noble, James, 71, Warwick-gardens, Kensington, W.
Pearse, Robert William, Frank-cottage, Lewisham-road, Greenwich, S.E.
Phillips, William C., 73, New Bond-street, W.
Pratt, Major, 17, Grove-end-road, St. John's-wood, N.W.
Robinson, Randolph, 4, Cranley-place, Onslow-square, S.W.
Rogers, Edward, 33, Inverness-terrace, W., and 56, Friday-street, E.C.
Rola, Vincent, 22, Leinster-square, Bayswater, W.
Sansom, C. T., Queen's Bench-offices, Temple, E.C.
Waltham, Edward, Watcombe-house, Stockwell-green, S.W.
Winsor, George, 58, Russell-street, Bermondsey-street, S.E.

The following candidates were ballotted for and duly elected members of the Society:—

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* These signed the Report on Musical Education, 1866.

Armstrong, Robert Williams, Rose-isle, Belleek, Fermanagh.
Bacon, Charles, 155, North-street, Brighton.
Barton, William, Boston, Lincolnshire.
Bartram, R. W., Belvedere-road, Lambeth, S.E.
Beattie, W. G., Engineer's-office, Nine Elms' Works, S.W.
Bindon, the Hon. Samuel Henry, Melbourne, Australia.
Bodkin, William Peter, Merton-lane, Highgate, N.
Bradbury, George Francis, Wellington Works, Oldham.
Bretnall, Henry, 24, Huntley-street, W.C.
Campkin, James, 4, Kingsland-road, E.
Child, Henry, Torr's Animal Charcoal Works, Deptford, S.E.
Dresser, Christopher, Tower Cressy, Notting-hill, W.
Evans, Philip James, Port-house, Brimscombe, Gloucestershire.
Finch, Mark, Vitriol Works, Victoria-docks, E.
Fletcher, Edward, Engineer's-office, North-Eastern Railway, Gateshead.
Gordon, Frederick, Ellerslie, Buckhurst-hill, Essex.
Gould, Frederick, the Elms, Kingston-on-Thames.
Greig, David, Steam Plough Works, Leeds.
Grover, Lieut. George Edward, R.E., 1, Champion-terrace, Shooter's-hill, S.E.
Hamel, Leopold, 25, St. Mary-gate, Nottingham.
Hancock, C. L., Himbey-road, Dudley.
Heller, T. E., Hercules-buildings Parochial Schools, Lambeth, S.E.
Herring, W. Anthony, Iron Foundry, Chertsey.
Higgin, Thomas, Tower-buildings, Liverpool, and Lansdown-house, Huyton.
Hodgson, George, Beehive and Laycock's Mills, Thornton-road, Bradford, Yorks.
Hoefnagel, Alexander, 21, John-street, Crutchedfriars, E.C.
Hoskold, H. D., Mining-offices, Cinderford, Newnham.
Jacob, Arthur, 1, Palace-grove, Bromley, Kent.
Jones, William, 13, Wharf-road, City-road, E.C.
Knight, Robert S., Ph.D., Grove-cottage, Atherstone, Warwickshire.
Lister, S. C., Manningham Mills, near Bradford.
Martin, John C., High-street, Barnes, S.W.
McCarter, John W., City Saw Mills, Foyle-street, Londonderry.
Minns, Charles, 9, Victoria-chambers, Victoria-street, S.W.
Mockford, William George Sharp, Normandy-wharf, Deptford, S.E.
Muir, Andrew, Victoria-bridge Works, Salford, Manchester.
Newlands, B. E. R., F.C.S., Vitriol Works, Victoria docks, E.
Nicholson, E. Chambers, Herne-hill, S.E.
Oakden, Rev. Joseph, St. Stephen's Vicarage, Congleton, Cheshire.
Paget, Arthur, Loughborough.
Powell, Alfred John, M.D., 122, Newington-causeway, S.E.
Richards, Westley, Carlton-club, Pall-mall, S.W.
Richardson, Charles, 6, South-wharf, Paddington, W.
Richardson, William, 6, South-wharf, Paddington, W.
Robertson, S. B., 6, Crown-office-row, Inner Temple, E.C.
Robins, Edward C., 16, Southampton-street, Strand, W.C.
Robins, Sydney, 108, Adelaide-road, South Hampstead, N.W.
Robinson, James, 17, Leamington-road-villas, W.
Roebuck, John Arthur, Q.C., 19, Ashley-place, S.W.
Ruck, George T., 19, St. Dunstan's-hill, E.C.
Russ, William, 9, Victoria-chambers, Victoria-street, S.W.
Scally, J. Dillon, Burton-on-Trent.
Seeley, Charles, M.P., 26, Princes-gate, W.
Smith, Willoughby, 18, Wharf-road, City-road, N.
Soares, Gustavo de Mevielles, 33, Sussex-street, Pimlico, S.W.
Starley, J., Coventry.
Strange, Lieut.-Col. A., F.R.S., 22, Jermyn-street, S.W.
Trendell, A. J. R., South Kensington Museum, W.
Vansittart, Mrs. Henrietta, Maid of Honour-row, Richmond, Surrey.
Walker, Robert Bruce, Gaboon, West Africa.
Welch, Edward J. Cowling, C.E., Eden Works, Eden-street, Hampstead-road, N.W.
Woodfield, W., Easemore Works, Redditch.

AND AS HONORARY CORRESPONDING MEMBERS.

De Geraci, Count Ventimille, Prince of Castel Buono Palermo, Sicily.
Müller, William, University of Gottingen, Hanover.

The Paper read was—

ON PEAT, AND ITS PROFITABLE UTILISATION.

By Robert M. Alloway, M.A.

The subject of the paper which I am permitted to offer to your notice this evening—the profitable utilisation of peat—is one which, about twenty years ago, attracted considerable interest, and became at that time a matter of speculation and inquiry in many places. If it had then had the good fortune to have fallen into more practical hands, it might not have remained up to this period so neglected as it is.

Perhaps some gentlemen present may recollect that, about the year 1850, two members of the House of Commons brought forward there certain striking but rather extravagant statements of the supposed value that lay hid in peat; so great, indeed, that even 500 per cent. of profit was alleged to be not too much to be expected from its manufacture. Clever, but rather superficial letters were about the same time published in the late Mr. Dickens's *Household Words*, and in *Chambers' Journal*, entitled "The Irish California," "The Devonshire Dorado," "The True Tom Tiddler's Land," "Peatal Aggression," &c., which, being filled with flowery descriptions and too facile assertions of unascertained and unproved value, became soon suspected of being largely overdrawn, and caused peat and its utilisation to be looked on with indifference, if not with ridicule. When this was followed up by the establishment of two or three companies and the erection of large factories, which, being worked on false principles, were very soon abandoned, their failure was at once attributed to the impracticability of the peat itself, and not to the errors and mistakes of the projectors. This, of course, was unjust, and has placed much difficulty in my way, or that of anyone who may endeavour to treat it properly and profitably, as it is an arduous task to overcome a popular prejudice.

Almost everyone is aware that large tracts of land in England and Scotland, besides immense portions of Ireland, are covered over with this despised but really singular and valuable substance. Peat has been admitted by geologists to be of a nature akin to coal, in fact, coal in its primary condition. Coal having once existed on the surface of the earth, and being then spongy and full of moisture, like peat (as the ferns, horsetails, &c., found imbedded in it prove) became buried hundreds of fathoms deep by the upheavings and subsidings of that period, and thus being subjected to great pressure, the soft material was consolidated by the superincumbent weight, as well as by the increased heat from the internal fires of the globe. Reflecting on this theory of the formation of the coal beds, it was not illogical for the first experimenters in peat to come to the too hasty conclusion that compression, joined with artificial drying (as if in imitation of nature) was the true method for treating it, in order to make it into an improved form, and which might be called peat-coal.

One of the first to turn his talents and ample pecuniary resources to this matter was the father of the late Lord Willoughby d'Eresby. He invented a very powerful compressing machine, which he imagined would press all the water out of the peat, and leave it in a dry condition. His machine, however, was found in practice to press more of the moisture into the peat than out of it, and finally his plans were found to be quite erroneous, and his machinery useless. Notwithstanding his failure, several others followed him with more or less modifications of his ideas, but all still working on the erroneous notion that compression was the only true method, nature herself (as was argued) pointing it out in the formation of the coal-beds. Nature, no doubt, is a grand guide in most matters, but need not be too slavishly followed, and above all must not be misunderstood. If nature is to be fully followed in this case, all the conditions of time and place which accompanied their formation should be present also, which, of course, is not the case, nor ever can be. Compression, therefore, by machinery upon the plans invented by Lord Willoughby d'Eresby, and carried on by all other experimenters in peat who followed him, up to the present day, having failed to produce anything really profitable or useful, a practical man will naturally turn his attention to something else, which I have endeavoured to do, and consider that I have fully succeeded in effecting it.

For the last twenty years I have taken an increasing interest in peat, being fully persuaded of its great importance, and the wealth, commercially and agriculturally, that lies hidden in it. I do not put an extravagant value on it, but may promise a fair and reasonable return for outlay, such as is generally looked for in similar undertakings. I had good facilities for experiment on a deep peat bog of my own in the Queen's County, and, having become acquainted with several of the gentlemen who were successively trying their own plans, on visiting their factories, I could not but become conscious of the cause of their failures, which I frequently suggested to them; but each and all were too strongly biassed by their own pre-conceived notions, and wedded to them, to alter their workings in any way to my views. My prophecies, however, were eventually proved true in all cases by the successive failures of all, and I thence came to the conclusion that, if a peat coal could not be made without expensive machinery and without artificial drying (thereby wasting other fuel), it could not be done to any profit or practical result. Something then drew my attention to the effects of air-drying, by simple atmospheric evaporation, making the sun and the wind act for me more effectually, rapidly, and economically in consolidating and drying the wet peat than ever had been done, or I am certain ever can be done, by any kind of machinery to compress with, and by hot flues, kilns, or blasts to dry with. I was aware that much might be effected by atmospheric evaporation, but was agreeably surprised to find it exceed my expectations. I then shortly brought my first ideas to a successful practical issue, the simplicity and rapidity, as well as the economy of the process being very apparent, but yet only to be clearly understood on being seen at work.

In consequence of the experiments and convictions above alluded to, I discarded, as impracticable and unprofitable, Lord Willoughby d'Eresby's hydraulic press, Cobbold's cylindrical churn, Glynn's steam rams, &c., with all kinds of hot-air blasts, heated tables, hot flues, kilns, &c., and simplified, step by step, an economical, common-sense, working plan, on plain scientific principles, by which a dense, portable, wood-like (rather than coal-like) substance can be made at once from the soft, wet peat, consolidated without pressure, and dried in a few days (generally three or four) by atmospheric evaporation alone. In arriving at this desirable result, I always kept in mind the laws of capillary attraction and atmospheric evaporation, which govern so many matters of daily occurrence, small and great.

My process consists of two plain principles, which I trust will not be despised for their simplicity, nor for their appearance of being only improvements on the old, barbarous method of air-drying peat, which generally takes from three to four months. There is, in reality, almost nothing absolutely "new under the sun;" not even electricity, animal magnetism, or photography; but, in all and each of those arts, such improvements have been made in the first rude ideas or discoveries respecting them, that their present marvellous perfection has been accomplished by gradual improvements, and are acknowledged to be the same now as if they were absolutely new.

It may be remarked that my process appears to be little more than the old hand-turf method improved, which, of course, I cannot altogether gainsay; but then, if so, the improvement is as great and as important, and carries as much difference as there exists between the amount of one to forty, or between three days, in point of drying, and three months. My manufacture of peat differs from the old method of making common, hand turf, inasmuch as that the former is completed and dried in three days, the latter taking three months. One crop only of common turf can be raised from the same plot of ground in the season, whereas from thirty to forty crops of mine can be taken in the same period. By this I mean, that from, say, one acre of bog-land but one single crop of common turf covering it all over, can be raised and dried in the same year. Common "turf" or peat, in large sods, requires about three months to dry, and, consequently, there almost never occurs so fine a season as to allow of a second crop being properly saved. In my process, the drying season lasts from five to six months, and as, on an average, two crops per week may be counted on, and there being more than twenty available weeks, between thirty and forty crops will be the return (which, in fact, has always been done at my model manufactory) from the same space of drying-ground as could produce but one only of common turf.

My peat-coal is as portable as pit-coal, whereas common turf is almost unportable, at least to any distance. In place of compressing machinery, with hot plates or flues, &c., for drying, I have enlisted the services of three grand, natural, wonder-workers, who do what I want without cost or payment, viz., in summer the sun and the wind, and in winter the rain. The rain lends great help to the mashing or pulping, which is my first process, and the sun and the wind dry my products in much less time than any artificial heat or wind-machine ever did, and at a twentieth part of the cost.

Thus, my first simple process is the mashing or breaking up the raw material. Peat, being sponge-like, requires to be disintegrated in order to destroy its cellular conformation. This, if not done, would leave it in its sponge-like condition, and prevent its proper consolidation. Those, therefore, who attempted to compress raw peat without first having mashed it, could not but fail, as it would continue always liable to reimbibe moisture, even if the compressing machinery had succeeded, which none ever did.

As to the actual method of mashing that I employ, it is very simple, but very effective and economical. I constructed several machines myself for this purpose, all of which failed; I also attempted, ineffectually, to make use of existing machines, such as are employed for mortar, and for working up brick-clay, &c. The peat, from its peculiar nature, will not break up or mix readily in any of these. It is of a greasy and india-rubber like tenacity. Thus having failed to invent a mashing machine myself, or adapt any other known one, I struck out a simple mode of mashing by hand, the rapidity and effectiveness of which in pulping the raw peat must be seen to be fully appreciated.

The peat-bank being opened in the way usual in common turf cuttings, I place one man to dig it in large sods, which he throws over to six others who are opposite to him in line, each armed with a wooden mallet, having a long handle. Each man strikes the sod thrown to him, and by a few blows completely mashes it up. The peat thus broken up is shovelled at once into an adjoining water-hole, from whence a similar bank of peat had been previously taken, and had become in consequence partly filled with water. There it remains melting into a thick pulp, until required for moulding. This mashed up peat absorbs all the water, and when the moulding commences in April, it is generally of about the proper consistency. It is then shovelled up on the adjoining bank, by a man who stands on the pulp by the aid of large foot boards, like snow-shoes. The man on the bank wheels it off in light, but peculiarly-constructed barrows, to the drying tables, where he quickly discharges the wet peat on light boards, like mortar boards, from whence the moulders (women, girls, or boys), each take up as much of it as possible in their hands, give the portion so taken up two or three rapid slaps of the upper hand, and quickly place the "pat" on the table, each fresh "pat" just touching its neighbour. As the "pats" dry, which they do very rapidly, they shrink asunder, whereby the air passes more freely between them. This slap of the hand (particularly the soft hands of women and children), is the only method I ever found effectual in driving the peat together, and putting it into a proper condition for having its moisture evaporated by the atmosphere, and its mashed up particles condensed by contraction. No machine has ever been produced to do this, nor in my opinion likely to be. Peat balls or bricks thrown from any kind of machine come out full of cracks, and tumble to pieces as they dry.

My drying tables are constructed of a frame work of wood, each 36 feet long by 4 feet wide, and of a convenient height for the moulders to stand at, generally about 2 feet 6 inches. These tables are completely in the open air, and uncovered by any sheds, which would only impede the drying. This framework is covered crosswise by common deal 4-feet plastering laths. I found that the dry, wooden lath absorbed the moisture and aided the drying better than wire netting or any other material that I tried. These laths are nailed down to the framework at about half an inch asunder, so that the air can pass freely upwards or downwards. When the "pats" are dry, on the third or fourth day, one man or boy pushes them off the tables very rapidly into a long wheel or hand-barrow on the other side, by which they are conveyed into open lattice-work wooden sheds, which are built conveniently adjoining for storage, and very soon after are fit for sale and use.

The moulding is carried on from about April to November. It is easy and healthful work. The peat is dried and the tables cleared generally on the fourth day after being moulded, and the peat-coal raked off and put in the store-houses, when the tables are immediately refilled with a fresh batch of wet "pats," and so on through the entire season, until the frosts and long nights come on at the end of October, when the moulding ceases, and the pulping for the next year's work commences.

This healthful and profitable employment of young boys and girls, from ten to fifteen years of age, may be a matter pleasing and interesting to some; and if my peat process should be carried out on a large scale, it would prove to be an admirable industrial school, and afford excellent, healthy employment for children of that age, who generally are unequal to and unfit for the hard drudgery of common farm-work or factory-work, and for whom there is so little profitable, and at the same time wholesome work, to do anywhere. The poor-houses, particularly in Ireland, are filled with sturdy but idle boys and girls, and I could suggest a plan by which the rates could be relieved from the cost of maintaining these poor little jail-birds, and which would change them into different creatures in a short time.

As to pit-coal, of course I do not mean to interfere in any way with its position in public estimation, nor to detract from its wonderful value and importance to England and the whole world, but I may say that the peat-coal which I offer to your notice might be preferred by many (if to be had in large quantities in the general market) as a domestic fuel, being much cleaner than pit coal, and untainted by noxious gases, which are deleterious to health, and notoriously injurious to furniture, pictures, &c. The preliminary expenses required for establishing a full sized working manufactory would not be a fiftieth (I may safely say) of those necessary for opening a coal-pit, and also without future risks or chances to calculate or allow for. All here is open and visible work on the earth's surface. In fact, the first outlay on the tables, store-houses, &c., would be less than that required to stock a common farm, not to speak of mining or other expensive kinds of manufacture. This peat coal has also been pronounced by competent authorities to be a first-class fuel for generating steam. If it should ever become the general fuel of the large cities of England, then London, Edinburgh, and Dublin, &c., would, I am convinced, enjoy as pure atmospheres as Paris or Brussels. A great deal has been written and spoken about encouraging the industrial resources of Ireland. Here is one of the foremost and most peculiar of them, calling aloud to be utilised. Why may it not be? If my process be not what I state, let it go. But if, on strict investigation (which may be made and proven on the spot, where it can be seen at work), it shall be found not to be exaggerated in its value, I cannot understand why it should not be carried out, when millions are every day spent on matters that are comparatively unremunerative, and accompanied with risks and chances which frequently make losses the rule and profits the exception.

My peat farming can also compare favourably with common tillage farming, or stock farming. The peat is not liable to be damaged by the thousand ills that land produce is heir to. It cannot be injured by blights, birds, vermin, or insects, like corn or green crops. It is proof against diseases and fluctuations in value, or accidents, like cattle, &c. Even the worst kind of wet summer weather will merely delay the drying for a day or two.

The following outline of statistics may be at present sufficient to give a general idea of the process. I may premise that it is by the number of drying tables that my calculations are made as to the size of a manufactory. A full-sized one should consist of 10,000 tables, each 36 feet long by 4 feet wide, constructed simply of substantial wood frame-work. These 10,000 tables would turn off in the season (say from March or April to November) about 50,000 tons of peat coal (about 5 tons per annum on average being made from each table). This, if sold at only 10s. per ton (a very low rate) would give a profit of 20 per cent.

This full-sized manufactory would cost in outlay on plant as near as possible £10,000, a comparative moderate sum, and would require about 100 acres of deep peat bog, which would contain sufficient raw material for forty to fifty years' work. A brisk wind and unimpeded sunshine are nowhere to be found in greater perfection than on a large, open bog, where almost every day in the year there is more or less breeze and motion of the air, which in my process is better than dull sunshine. Both sunshine and breeze together are of course perfection, and perform wonders in the way of drying the "pats."

To sum up, the peculiar advantages of my process are —That the peat-coal can be made so inexpensively as to afford a certain and remunerative profit in three or four days, and is capable of being sent anywhere over the world in bags like coal; that it is cleaner and freer from smuts and sulphurous smoke than coal; that 30 to 40 crops of it can be taken where only one crop of common turf can be produced in the same season; that it is cheaper, more portable, and better every way than common turf, and can compete with pit-coal anywhere but at the pits' mouth, or in places in close proximity to coal districts. In addition to the above, it will afford opportunity for that long-sought object, the profitable utilisation of the vast peat wastes of these countries, particularly in Ireland, where there are three millions of acres covered by peat, while it would afford remunerative and yet healthful employment for men, women, and above all, children, with handsome profits to the employer and capitalist.

The moulders get so dexterous in a few days that they can earn much better wages, with less toil, difficulty, or hard work than they could at any other kind of farming employment. I may fairly call this a species of farm-work, to which it is much more similar than to any kind of factory work, as the term is generally understood. The feasibility of rapid hand-moulding was first suggested to my observation on seeing the boys at Woolwich Arsenal making copper caps for the army. A few years ago, they were made there in large quantities altogether by handwork, and it was surprising and interesting to remark the quickness and facility with which such small articles passed through the manipulation of those smart little boys. My peat "pats," being much larger, and not requiring such dexterity of finger, are consequently much easier to be formed into the proper shape and size. Most people would be well pleased at seeing the young girls and boys whom I have trained, healthfully and lightly employed at the moulding. The whole process being done by task or piece-work, the cost of labour can be ascertained to a fraction almost, while the expenses in any method hitherto attempted by machinery have been quite undefined, and a certain mystery attached to them, besides requiring more hands to attend to them than I require without machinery, in making an equal quantity of fuel.

The first and only expenditure necessary is for putting up the drying apparatus, viz., the tables and the lattice work wooden store sheds. The cost of erecting those may be calculated by the number of tables, at, as nearly as possible, 20s. for every table, which includes the cost of erecting the required number of sheds for storing the peat-coal in, according as it becomes dry on the tables, every three or four days. Thus, £10 000 would be ample capital for the establishment of a full-sized manufactory, consisting of 10,000 tables, with all necessary adjuncts of sheds, implements, short roads, &c. These 10,000 tables would produce about 50,000 tons of peat-coal in each season. The money at first expended in labour would be available again in most places in a month or two, and could thus be turned over three or four times in the year, carrying, of course, each time a profit of at least 20 per cent. In localities where pit-coal is scarce and dear, the selling price at the works might be fairly increased to 12s. or 14s. per ton, which would add very considerably to the profit. The tables, and store-sheds, and store-houses, when once substantially erected, would last for many years (perhaps thirty to forty, or longer) with a mere trifle for occasional repairs to the laths and woodwork, on which there would be but little "wear and tear."

The peat-coal is so condensed, and thereby so reduced in bulk, that one cart or dray can carry as much value of fuel in it as ten similar conveyances could of common turf. The same proportion holds in carriage by railway, canal, or long sea, as well as in storage. It will also not occupy more space than coal in transit; a railway truck that conveys five tons of coal will also carry five tons of the peat-coal. Railway companies generally decline to carry common "turf," or at least put a prohibitory freight upon it. I found the freight on peat to be 12s. per ton between Portarlington Station (Queen's County) and Dublin, only about 40 statute miles. On remonstrating with the board of directors of the Irish Great Southern and Western Railway on this point, and sending them a few bags of my peat-coal, as a sample, to their board-room, they were so pleased with its appearance, portability, and cleanliness, that they voluntarily agreed to carry it to Dublin for 8d. per ton, less than pit-coal. If it were largely manufactured, I have no doubt but that all other railway companies would do the same, or make the freight even less, and give liberal encouragement to a product of such universal consumption.

I have in my possession a considerable number of testimonials as to its value. I will, with your permission, read two or three of the shortest of these, and hope I am not abusing your patience; but I wish to allude to this matter in every possible point, and explain its difficulties and the way to overcome them.

The first and shortest is from a gentleman of high position, the Chief Superintendent of the Government Valuation-office in Ireland. He writes:—"I consider Mr. Alloway's peat excellent, and better than any other I have yet tried."

Another is from one of our Irish judges, formerly well known in Parliament, which runs thus:—"Thanks for the peat, which I have received and tried. It burns clearly, steadily, and slowly, without waste, and, as far as I can judge, leaves no unpleasant deposit of ashes or otherwise. I hope it will turn out a profitable speculation, not only on your account, but in the interests of the country."

The third and last that I shall trouble you with is from Mr. David M'Dowall, the proprietor of large saw mills and corn mills, worked by powerful steam engines, in Dublin. He first gives his opinion of it as a domestic fuel, and then as a steam generator, viz.—

"Patent Saw and Corn Mills,
Montgomery-street, Dublin.

"Your peat fuel is first-class for house purposes. I divided what you sent me amongst a few friends, and all are loud in their praise of it. I cannot give an opinion about it for steam yet, but I would like to get five tons of it for that purpose. If you succeed, and which I have no doubt you will, it will be a great boon for Ireland.

"David M'Dowall."

I then sent him a larger lot, and received the following:—

"I have used a good deal of your peat fuel in my house, and we prefer it before the best house coal. I have also tried it for steam purposes recently, and, although my boilers are not so suitable for it, being made purposely for burning sawdust, I am persuaded that where tubular boilers are used, either on land or sea, it would be much preferable to either coke or coal, and would be found a first-class fuel for generating steam. I cannot but wish you every success with your invention (decidedly a good one), and I will most heartily join in a company to carry it out.

"I am, dear Sir, faithfully yours,
"David M'Dowall.

"P.S.—All engineers know very well that tubular boilers require less flame than cylindrical ones, but the more extreme heat the better. Hence the use of coke; it is the very thing your peat is adapted for.

"D. M'D."

As to the *minutiæ* of the cost of manufacture, in case any gentleman present might wish to know it, I will add the following particular items of the manipulation as close as I can here:—

Cost of Handwork.

	Per ton.	
Mashing	0	9
Moulding (at the rate of 10 tables to make a ton, at 3d. per table)	2	6
Turning the "pats" on the tables	0	6
Raking-off and carrying to store-sheds	0	3
Filling up bags, carting from store-sheds to the main store-houses adjoining the bog	1	0
Total, 5s. per ton for manipulation	5	0
Leaving 3s. per ton to answer for incidental expenses of agency, superintendence, &c., as well as interest on money expended on plant, which will be found more than sufficient	3	0
Total cost per ton	8	0

It has been remarked to me, that if my process be the good and profitable one that I state it to be, why has it not been taken up as largely as is required in Ireland? I am sorry to say I cannot answer that question further than that Ireland has been the locality where two remarkable peat establishments were erected not long since, which, being attempted on wrong principles and extravagant outlay, failed, and whose failure has disgusted the public so much that it is both blind and deaf to any further experiments in peat. But this blindness and deafness to a simple and economic process like mine, cannot, I suppose, last for ever. Another friend of mine has told me that my process is quite unknown, and that I have not advertised it enough. That is quite true, for I wished to wait until I had properly satisfied myself that I could satisfy others. Having done this, and having now brought it before the notice of the Society of Arts, it cannot, at least, any longer remain unknown.

I exhibit a bag full of the "pats," taken from one of the storehouses, where I have about fifty tons kept for sample. They are, as may be seen, more like hard wood than coal, and suffer no waste whatever in carriage.

DISCUSSION.

Mr. Lewis Olrick said there could be no doubt of the immense importance of the subject, or that peat might afford a mine of wealth to this country; it was astonishing, therefore, that it had been allowed to rest so many years without being developed. Mr. Alloway, in bringing the matter forward, had only mentioned a fraction of the wealth that could be derived from peat, having omitted entirely the most important branch of the subject, viz., peat charcoal. There were about six millions of acres of peat in the kingdom, and each acre was capable of developing nearly £1,000 of peat charcoal. He quite agreed with the remarks made by the author of the paper, that machines for condensing peat—for depriving it of the water—were useless, but he could not assent to the fact stated by Mr. Alloway, that they pressed more water into it than was in it before. The proportion of water in peat was 80 or 90 per cent., and even when prepared like the specimens before them, it contained 25 per cent., even after exposing it to a temperature of boiling water there was still 8 to 10 per cent. of moisture. Mr. Alloway admitted his was only an old plan improved; which was true, but he fell into a great error in stating that machinery was not to be compared with hand-labour for its production. The author had no doubt referred to the American machines, which had this great defect, that they cost £2 000, and required so many men to work them that they turned out no more than could be produced by hand-labour. The machinery to which he wished to call attention was that invented by Mr. Danchell, and which was in use at the Red Moss works, in Lancashire. The amount of peat which could be raised by one man digging was about five tons per day; if the hand-dredging system was employed one man could penetrate ten feet deep, and raise ten tons a day. By the use of the dredging machine, which was two-thirds of a three-horse power engine, they were able to raise 210 tons per day. There were thus three systems. By hand-digging you could raise five tons ten feet high, or 50 tons one foot high. By hand-dredging you could raise ten tons ten feet, or 100 tons one foot high, whilst by steam-dredging, with one stoker and one labourer, and the refuse of the fuel, which was only worth say another man's wages, you could raise 210 tons 20 feet high, which, being divided by three, was equal to 1,400 tons one foot high. So much for machinery. Mr. Alloway stated that, having the tables covered over by any kind of roof, would only interfere with the dredging; but further on in his paper he stated that wet weather merely interfered with drying for a day or two. It appeared to him that if the weather were wet for a month at a time, it would prevent the drying for as long as it lasted. With regard to the employment of young children, boys and girls, a great number of whom were described as being idling about doing nothing, in his opinion they would be much better employed going to school than in earning their living at that early age. Mr. Alloway said that peat fuel was much cleaner than coal, and so it might be before it was used, but it certainly left much more ash than coal. He also stated that it was very valuable for generating steam, but he (Mr. Olrick) had had considerable experience with boilers of every kind, and he could only say that there were many boilers which would not burn peat at all. The price was stated to be 10s. a ton, whereas his friend Mr. Dunchell gave it at 5s. Referring to the question of peat charcoal, he might remark that charcoal was much used for domestic purposes in France. One firm there employed 300 workmen who were engaged five months in the year making peat charcoal, which was sold at a price of £5 10s. or £6 a ton, at which rate it was very profitable. Another firm in Rheims produced 14,000 tons of peat per annum, a great portion of which was converted into charcoal. The principal portion of the operation of transforming peat into charcoal consisted in the expulsion of all gaseous elements; and Mr. Danchell, by great pains and attention, had been able to produce this effect in the most perfect and economical manner, the result being a very superior description of charcoal, and a greater per-centage than was made on the old-fashioned plan. Under the old system an oven which made five or six tons of charcoal took five or six weeks to cool, but the machinery in use at the Red Moss Works went on without interruption, the charcoal being withdrawn at one end whilst the peat was put in at the other, by which means about 2½ tons were produced every 24 hours, which was more than eight times the quantity produced under the old system. All this was owing to machinery, and showed the immense importance of this part of the subject. He was convinced that peat charcoal would not only be cheaper than that made from wood, but invaluable for some purposes. For instance, the purification of sewage was a topic of great public importance at the present time, when many towns were in great difficulties to know how to prevent the pollution of their rivers; and while all engineers agreed that filtration through charcoal was the best means of purifying it, the difficulty remained as to where the supply of charcoal could be obtained.

Mr. Page thought it was very desirable that all discussions should be confined, as strictly as possible, to the subject brought forward in the paper which they followed. He though Mr. Olrick had hardly followed this plan, but he evidently possessed a great deal of information which he should like to hear communicated in a separate paper.

The Chairman said he thought the attention of the meeting should be confined, as much as possible, to the question of the production of peat fuel in Ireland, with especial reference to the employment of that large quantity of unskilled labour which at present, unfortunately, seemed to find no market there. With regard to the educational aspect of the question, he might remark, incidentally, that children employed in this kind of industry might, without any difficulty, spend half their time at school; and thus not only earn a living, but receive education at the same time.

Mr. W. Austin, C.E., said it was of great importance to be able to get a clean and wholesome fuel. He had devoted 18 years of anxious care and attention to this matter, and had sometimes wondered why peat, which had been written and spoken about for the last 150 years, had never come into general use. He believed the subject had never been thoroughly understood. There was a great deal of prejudice against it, and on the other hand a great deal too much had been said in its favour, by people who thought they were going to make mountains of gold out of it. He had gone into the matter in a practical spirit, determined to ascertain what was the best way of working it, and he had found the great difficulty to be the expensiveness of the machinery. Messrs. Gwynne had devoted a deal of attention to this subject, and had produced a machine which, unfortunately for them and for the development of peat consumption, was of a very costly character. He tried his best to lessen the expense of this machine, but Messrs. Gwynne could not produce it below a certain figure, the result of which was that it did not answer, for even gold might be bought too dear. He suggested to Messrs. Gwynne that the peat should be made, not in blocks or bricks, but in round balls, and they took out a patent for the purpose; but the same difficulty was still in the way, and, after some years, the patent lapsed. He then devoted his attention to the subject, determined, if possible, to succeed. The great point was to drive out the wind and water, the latter element forming about 75 per cent. of English peat, while in America, Canada particularly, it formed as much as 90 per cent. Mr. Hodges, the engineer of the Montreal-bridge, after a good deal of labour, brought out a machine, a drawing of which he had with him, for cutting a kind of canal through the peat, and throwing it up on each side to dry. This machine would turn out 760 tons per day, which was left on the bank to be dried by the action of the sun and wind, and this product would burn about as long as the same weight of coal. He (Mr. Austin), however, had perfected a system by which, first mashing the peat, and then submitting it to the action of a centrifugal engine of immense power, such as had lately come into use for making sugar, he had produced a far superior article. There were shown at the Dublin Exhibition some specimens of peat reduced to the shape of discs, much more solid than Mr. Alloway's product, which gained great praise, but on putting them on the fire they were found not to burn well, as they fitted flat on to another, like muffins, which they sometimes resembled in shape. Upon this hint he formed his peat into the shape of a ball, which he thought could never be surpassed. He had a specimen in his hand which weighed fifty per cent. heavier than coal, and would burn three times as long as the best coal, weight for weight. It had been tried on the Thames from London-bridge to the Nore and back, and the result was that 12 cwt. beat 28 cwt. of the very best coal that could be got in the Thames. It had also this advantage, that there was no smoke or smut, and not a particle of sulphur. He had introduced it to the managers of the Underground Railway, who would use it as soon as he was in a condition to supply a sufficient quantity. He had also submitted it to the Peninsular and Oriental Company, who burnt 1,000 tons of coal a day in their fleet of 78 ships, and they were ready to take all he could make. He could manufacture this at a cost of 8s. per ton. He had done so, and he would not state that which was not true. He was only holding back for want of machinery, the class of machine he used never having been applied before to such a purpose. In fact, three different kinds of machine were combined in his process, the result being one ball per second such as he held in his hand—about the size of a cricket-ball.

The Chairman said if only a fraction of Mr. Austin's statements were reliable, he could say, from a life-long experience in connection with the utilisation of raw material, Mr. Austin need not trouble the Society of Arts or any other society with his views, for, without doubt, the largest fortune ever made in this country was open to him. However, he must say he had no faith in the production of a fuel three times the value of coal to be sold at 8s. per ton.

Mr. Austin said he did not profess to sell his fuel at that price, but that was the cost of production.

Mr. Pickstone wished to correct Mr. Alloway in one or two particulars. Evidently that gentleman knew little about coal-mining, or the cost of machinery for that purpose, or he would not have stated that it would require fifty times as great an outlay to produce 50,000 tons of coal per annum as would be necessary for preparing the same quantity of peat fuel. No colliery proprietor would think of spending more than £20,000 for producing such a result. No doubt in Ireland, where coal was almost unknown, and peat abundant, it would be a great boon to the country if could be utilised in the manner suggested, but it would never pay for transport. If Mr. Austin could prepare an article three times the value of coal at a cost of 8s. per ton, all the coal mines had better be closed, at any rate until the peat was exhausted, for it was certain that coal could not be produced for much less than 5s., which, multiplied by three, would make 15s. as against 8s.

Mr. F. Hahn Danchell said he had wished to make a few observations on the subject, but unfortunately he knew nothing about peat in Ireland, to which the discussion had been limited. He had long ago come to the conclusion that, in this department of industry, as in every other, hand labour could not compete with machinery. The number of persons required to produce a certain quantity, as stated by Mr. Alloway, would do very well in a small way, but when it came to large quantities, such as, for instance, he had seen in Bavaria, where it was used for locomotives, and where he had seen 2,000 men at work at one establishment, under a regularly ordered administration, it would require all the population of England to turn out by hand-labour such a quantity as would be required if it came into general use. There was another consideration which seemed to have been lost sight of, namely, that the depth of peat bogs varied considerably, some being as deep as 25 or even 30 feet, and he knew of one which was 32 feet deep. By hand-labour a man could dig very well to a depth of five feet, but below that it required an additional man for every five feet, besides having the water to get rid of. Some, indeed, only worked the peat to a depth of 5 feet and abandoned the rest, but this was a very superficial way. Then, again, there were different layers in a peat bog, which were of a very different density, and, as would be seen by several specimens which he would hand to the chairman, unless these were all mixed up together, the product would be very inferior and variable in its character. As for making peat by hand in the way described, he was afraid that though it seemed very easy, the amount of labour required would be something enormous to produce any large quantity. In order to obtain one ton of dry peat, you had to deal with about seven or eight tons of material; and when that was carried backwards and forwards in the way proposed, it must entail an enormous amount of labour; in fact, there was nothing but machinery which could do it. He should be happy at another time to read a paper explaining his method, and the machinery which he had adopted.

Mr. Symes said perhaps when Mr. Alloway replied he would state what was the particular object he had in view, because if it was merely to render peat available for domestic purposes on the spot, he thought that, as ordinarily used in the shape of turf, it answered every desired purpose.

Mr. Page, C.E., said he should be glad to bring the discussion back to the paper which had originated it. Mr. Alloway had not gone into a comparison between hand-labour and machinery generally, but had simply stated that two or three manufactories established for producing peat by machinery had signally failed, and he had pointed out a mode of dealing with peat by which the poor could be employed. When he said that from the beginning of this century to the present time there had been more than 350 millions of money spent in poor rates, they might easily understand how important it was that some system should be introduced into the country which would employ those who were now kept alive by the poor rates. No Government was fit for its position unless it could afford to give the people under it some means of employment. When there were some six million acres of peat in the United Kingdom, and when there were so many acres of land unproductive, surely it was of the greatest importance, in the interest of the country, to employ the poor in a way which would give them a practical education, and an education in books at the same time, and thus effect an enormous saving in the taxation. He thought Mr. Alloway had rendered an essential service to the country when he pointed out a simple mode of employing those who had no knowledge of skilled labour, and if they could establish such manufactories all over the country it would materially reduce the burden of taxation.

Captain Selwyn, R.N., said that although he admired the good heart and kindness of feeling which prompted the natives of the Sister Isle to come forward with many proposals which were supposed to be panaceas for those ills under which Ireland had suffered, he could not permit himself to think that it would be true kindness to forget that there was an inexorable logic of facts which said unmistakably that whatever you might employ a man to do, if it did not pay had much better be left alone. Mr. Alloway had taken as a basis of calculation the expenditure on machinery and plant alone (and even this he thought was under-estimated), and had utterly ignored any payment to the workmen.

Mr. Alloway said Captain Selwyn was under a misapprehension.

Captain Selwyn said there was no statement of daily or weekly wages included in the calculation.

Mr. Alloway said the prices given included the cost of manipulation, which came in all to 5s. per ton.

Captain Selwyn said that even if that were so, the next point was of almost equal importance. From the figures given it would appear that in one factory for turning out 50,000 tons a year, there would be required 62 miles of tables 4 feet wide, or equal to acres of ground covered. This was a most remarkable fact, and one which it was no kindness to pass over, since it showed the illusory nature of the whole scheme. Secondly, the price of 5s. per ton must be supposed to be increased by the usual 30 per cent. for plant, and then it appeared there would be a cost of 11s. 4d. per ton for transit 40 miles, so that at the end of the journey it would come out at about 20s. per ton, and the result then would not possess greater specific gravity than wood. It was perfectly obvious that such a product could not compete with coal, produced at the pit's mouth at a cost of 4s. to 5s., and which only reached the price of 20s. after a voyage of some hundreds of miles. He had, as was well known to many persons present, gone very deeply into the question of the condensation of fuel, and had shown that it was a most excellent and even necessary thing, but he could not allow persons to run away with the idea that peat could ever, from the hydrocarbons it possessed, be made to equal coal, except by such means of compression as Mr. Austin advocated, and that involved a great deal of extra expense for machinery. If they could compete with nature in the condensation of hydrocarbons, they would be able to convert peat and wood, which consisted of diffused hydrocarbons, into condensed hydrocarbons, such as coal, or into a still more condensed form, as in the case of oil. These things only took place as the result of condensation; and if you got the substance from nature in an uncondensed form, you must put money and labour into it in order to condense it. These were hard facts, which must be thoroughly got hold of and digested, and then there would be no more idea of employing people out of philanthropic motives upon labour which did not and could not pay. He believed there was nowhere more talent and genius than in Ireland, which he hoped would some day be devoted to producing profitable results instead of unfruitful speculations, and therefore it was that he wished all persons who came before the Society with sentimental or philanthropic plans of this character to understand that economical money results must be clearly shown, and then they would receive every possible support and encouragement, but otherwise it was no use to bring the matter forward at all. He was the worst friend, nay, the worst enemy, to Ireland, who should adopt a tender or sentimental tone in discussing such a subject. Turning to the question of how peat could best be utilised, he should say it would be by the employment of the most inexpensive machinery possible, which would produce a fuel of sufficient density. He fully admitted its excellence in many respects; in the absence of that deposit of unconsumed carbon which was the great difficulty in steam boilers of all kinds; of the waste carbons which resulted in sending soot into the air, poisoning the population and vegetation; in the waste of surplus ammonia in some places, and the taking it away where wanted from others. He fully recognised all this, but there still remained the question, how much did it cost at the place of production, and how much could it be sold for where it was to be consumed. He had no interest in the matter, either as connected with machinery, engineering, or any patent process, but science should not, in his opinion, be mixed up with sentimentalism, or be sacrificed to courtesy. It was impossible to lay down a factory, consisting of sixty-two miles of table four feet wide, for anything like the cost indicated, especially when you included the cost of carriage of the timber and its protection from decay in the open air; and all this apparatus only produced fuel of about the same specific gravity as wood. If people would only consider the simple question of the specific gravity of fuel, and state how many tons would do the work of a certain number of tons of coal, giving the price and its evaporative power at 212 degrees, or any higher temperature they could name, men of science could tell at once whether they were labouring at a fallacy or a great truth. He did not intend to discourage anything which might be said by Irishmen; he loved their country, and had a great respect for it, and believed the natives only wanted a little more logic in their composition to make them the finest race on earth. If they would only condescend to join heart and hand with Englishmen, and borrow a little of the Anglo-Saxon logic, which Englishmen were credited with possessing, it would, with their genius and enthusiasm, make a most excellent compound. A little reasoning would show where they had gone wrong, and why they should employ machinery, because, by its aid, a vastly increased amount of product could be turned out at the same price. Peat, for certain purposes, and if condensed into charcoal form, would form a most valuable fuel; and condensation meant hard peat charcoal, not sending away stuff with a lot of water in it, which could not be burned. For many purposes charcoal had a particular value where the sulphur in coal rendered it useless, and plenty of persons would willingly use it if supplied at a reasonable rate. But the producers must clearly state what price they could supply it at; must listen to reason and common sense, and not broadly say, "Accept my sentiments for the sake of my country."

Mr. Page asked if Captain Selwyn disputed Mr. Alloway's calculations.

Captain Selwyn said he did entirely.

Mr. Fordred said Mr. Alloway did not seem to have included in his calculation the cost of raising the turf; if this were added it would swallow up the whole of the 20 per cent. Ten tons of wet turf would only produce about one ton of dry. He said that one man could raise five tons five feet, and therefore it would take two men to raise one ton of dry peat per day, and certainly they ought to earn 2s. a day each. This would make the wages for raising the peat 4s. per ton.

The Chairman said he had the less scruple in closing the discussion, inasmuch as a paper had been promised by Mr. Danchell upon the subject of utilising peat by mechanical processes, when there would be an opportunity for further debate. From the attention he had given to this subject, and also from certain knowledge which he possessed with regard to means of condensation of substances containing a great deal of water, he thought there could be no difficulty in dealing with this material very simply and cheaply before it was dried, and in giving it a form much more condensed than that of the specimens on the table. However, he would not detain the meeting longer at present, but would propose a cordial vote of thanks to Mr. Alloway for his interesting paper.

Mr. Alloway, in reply, said that the utilisation of his peat-coal in the shape of charcoal was one of its most important items. When charred it would be found to retain its present form and consistency, by which it would be available for iron and steel work, be quite equal to wood charcoal and much cheaper. As to the number of hands required, they would be found to be very moderate, compared with the requirements of any other kind of manufacture. Messrs. Malcolmson employed upwards of two thousand people at their cotton factory near Waterford, all living in the village of Portland and its neighbourhood. The proprietor of the late peat factory at Derrylea, County Kildare, where powerful machinery was used, found work for nearly three hundred hands, in addition to, and in attendance on, his machinery, yet these together could not make as much peat fuel in a year as he could with the same number of hands in a month, and that without machinery or the waste of other fuel for drying. As to intending any sentimental or *ad captandum* argument or appeal in his incidental allusion to the employment of boys and girls, he disclaimed it, but as there were plenty of philanthropists who objected to young people being engaged at all in common factory work, he wished to meet their praisworthy views by showing that his process was the very reverse, and was not only not injurious to the health of growing children, but, on the contrary, highly conducive to it. As to their being better employed in being altogether at school during their earlier years, he doubted this in respect to those useful members of the community who have hereafter to earn their livelihood by the work of their hands, as instruction in that line, coupled with schooling in the rudiments of common education, would be the most suitable to their health and future condition; and he had a suggestion to make to that effect by which the young girls and boys might be at school during the winter and spring, when their easy healthful work at the peat-moulding would not be required. The real point that he submitted was, that machinery had failed to work peat to advantage. Some gentlemen who had spoken to-night evidently did not agree to this. But, if so, why did they not produce their machinery and let the public see it at work? If he had a machine to propose he would do this. One gentleman (Mr. Austin) fairly acknowledged that his machine was too costly to pay. That, of course, put it out of the market, and confirmed what he said. He feared he had the engineering interest against him, as he employed no machinery, which he would, however, be happy to do if it could be used cheaply; but as all experience proved it could not, it appeared only folly to further pursue the matter in that direction. Those who were interested in pit-coal need not be in the least jealous, or take alarm at any possible progress that the manufacture of peat-coal could make. It would be many a long year before enough of it could be made to affect the coal market to any sensible effect, if it ever did so. The demand for English pit-coal for railways, steam engines, steam ships, factories, &c., all over the world was so enormous, that what peat-coal could be made would not be missed out of it, but yet might be a useful and popular adjunct to it. According to Mr. Gladstone's statement in the House of Commons a year or two ago, the consumption of British pit-coal was increasing forty per cent. every year; and some who had studied the subject considered that this vast absorption of coal must end before long in a diminution of the supply, notwithstanding its great extent under the soil of England. He thanked the chairman and the meeting for their kind attention to his remarks, and hoped that some good might result from the ventilation of so really important a matter.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS,

Wednesday evenings at eight o'clock.

DECEMBER 7.—"On the American System of Associated Dairies, and its Bearing on Co-operative Farming." By H. M. JENKINS, Esq., Secretary of the Royal Agricultural Society of England. On this evening Lord VERNON will preside.

*DECEMBER 14.—"On a new Method of Producing Durable Mural Paintings by Fictile Vitrification." By ALAN S. COLE, Esq. On this evening the Right Hon. A. S. AYRTON, M.P., will preside.

DECEMBER 21.—"On a Method of Lighting Towns, Factories, or Private Houses by means of Vegetable or Mineral Oils." By ALBERT SILBER, Esq.

CANTOR LECTURES.

The second lecture of the course "On Artists' Colours and Pigments," by FREDERICK S. BARFF, Esq., M.A., F.C.S., and Fellow of the Cambridge Philosophical Society, was delivered on Monday evening, the 2[illegible]th ult. The subject of of the lecture was, the "Chemistry and Manufacture of Colours and Pigments," which will be continued on Monday evening next, the 5th inst. The remaining lectures will be delivered on Monday evenings, the 12th, and 19th inst., and will treat on Vehicles and Media used in Painting; Fresco and Silicious Painting; Destructive Influences on Colours, &c. These Lectures commence at eight o'clock, and are open to Members, each of whom has the privilege of introducing two friends on each lecture.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

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* The paper originally announced for this evening is unavoidably postponed through the illness of the author.

"That a special subscription for this purpose be opened, to which contributions are invited."

Small Parcels Post.—Mr. W. Hooper, of 7, Pall-mall East, S.W., has addressed the Postmaster-General as follows:—"The extreme utility to business houses and private individuals of the late regulation which allowed the transmission of small articles by sample post, induces me to express to you my regret at the recent order annulling the privilege. It is perhaps hardly conceivable the great inconvenience it will occasion, especially as the former regulation was sufficiently long in existence to develop its usefulness, as no other means of conveyance offers anything like the safe and easy, as well as punctual means of transmitting small articles to those of Her Majesty's subjects who reside in the remoter parts of the kingdom. In expressing to you these sentiments, I feel that they are only such are universally held, and begging you will be so good as to reconsider the order, with a view, if possible, of restoring the former arrangement."

"A Manchester Man," writing to the *Times*, says:—"Few anticipated that such a boon as the halfpenny post was to be counterbalanced by the withdrawal of one equally valuable to most persons. From its commencement the Post-office authorities allowed the sample post to be used for any small parcel not strictly a sample. For the transmission of actual samples it was comparatively rarely used. For my own part, I can safely say that, while I have sent or received hundreds of small parcels not being samples, I have never had occasion to send one sample or receive half a dozen. In this respect I dare say my case is that of 19 out of 20 ordinary persons. After allowing this privilege to the public for several years, one that has been so highly appreciated and extensively used, it is deplorable thus suddenly to withdraw it. After more than a fortnight's experience of the working of the new postal arrangements, I, for one, should be highly pleased by a restoration of the arrangements as they existed on the 30th of September last, for I feel that I have gained a loss."

A correspondent of the *Field* says "the inconvenience occasioned by the new regulations will be felt most severely by ladies and gentlemen wishing to procure small articles, such as gloves, fishing tackle, ribbons, &c., at short notice, the Pattern Post being in many instances the only mode of transmission to out-of-the-way places. Perishable goods might with advantage be prohibited, as well as those which could injure the contents of the mail bags, and, if advisable, the charge might be increased, or even doubled; but let not our good friends of the Post-office take away the great boon of which they have just given us a sufficient taste to make us now feel what very great inconvenience will be caused by its withdrawal. I have also heard that several tradesmen will be seriously injured by the new regulation. I am quite certain I express the feelings of those country gentlemen and ladies with whom I have conversed on the subject."

Sections of the Post-office Act of 1870, bearing upon Newspapers and Parcels.

Sir,—Having already forwarded to the *Journal* a comparative statement of the postal systems of France, Belgium, Switzerland, North Germany, and England and having pointed attention to some of the anomalies resulting under the new postal regulations of this country, as well as to the inconveniences accruing to the public and commerce generally, I have thought that it might be well to place on record in the *Journal* so much of the Post-office Act of 1870 as bears directly upon the various points under discussion.

By section 8 of the Post-office Act, 1870, it is declared that—

"From and after the thirtieth day of September, one thousand eight hundred and seventy, registered newspapers, book packets, patterns or sample packets, and post cards, may be sent by post between places in the United Kingdom, at the following rates of postage:—

"On a registered newspaper, with or without a supplement or supplements	One halfpenny.
"On each registered newspaper in a packet of two or more, with or without a supplement or supplements	One halfpenny.
"On a book packet, or pattern, or sample packet, if not exceeding two ounces in weight	One halfpenny.
"If exceeding two ounces in weight, for the first two ounces, and for every additional two ounces, or fractional part of two ounces	One halfpenny.

"Provided that a packet of two or more registered newspapers, with or without a supplement or supplements, shall not be liable under this section to a higher rate of postage than the rate chargeable on a book packet of the same weight."

Section 9 declares that—

"The Postmaster-General may, from time to time, with the approval of the Treasury, make in relation respectively to registered newspapers, book packets, pattern or sample packets, and post cards, sent by post, such regulations as he thinks fit for all or any of the following purposes:—

"For prescribing and regulating the times and mode of posting and delivery.

"For prescribing prepayment and regulating the mode thereof.

"For regulating and the affixing of postage stamps.

"For prescribing and regulating the payment again of postage in case of redirection.

"For regulating dimensions and maximum weight of packets.

"For regulating the nature and form of covers.

"For prohibiting or restricting the printing or writing of marks, or communications, or words.

"For prohibiting inclosures.

"And such other regulations as from time to time seem expedient for the better execution of this Act."

And by section 6 it is declared that:—

"Any publication coming within the following description shall, for the purposes of this Act, be deemed a newspaper (that is to say) any publication consisting wholly or in great part of political or other news, or of articles relating thereto, or to other current topics, with or without advertisements, subject to these conditions:—

"That it be published in the United Kingdom.

"That it be published in numbers at intervals of not more than seven days.

"That it be printed on a sheet or sheets unstitched.

"That it have the full title and date of publication printed at the top of the first page, and the whole or part of the title and the date of publication printed at the top of every subsequent page."

And then follows the definition of a supplement to a newspaper, for the purposes of the Act.

Thus it will be seen that it is not within the discretion of the Postmaster-General to decide what is or what is not a newspaper, nor to prescribe what it shall weigh, provided it is published once in seven days, and complies with certain other conditions set forth in the Act, unless section 14, given below, be held to give him that power.

Neither is there any limit of weight prescribed by the Act which a newspaper may not exceed, but the authority to regulate the weight and dimensions of *packets* of newspapers (not single newspaper) rests with the Postmaster-General, and that has been fixed at 14 lbs. weight, 2 ft. in length, and 1 ft. in depth and width.

In like manner, the Post-office Act of 1870 does not define what constitutes a pattern or sample admissible to be sent through the post; but by Section 13 it is declared that—

"The Treasury, from time to time, by Treasury warrants, may regulate the sending of book packets and pattern or sample packets by post between the United Kingdom and places out of the United Kingdom, or between places out of the United Kingdom, whether through the United Kingdom or not, and in relation thereto may prescribe rates of postage, weight, and other matters."

"Any Treasury warrant and Post-office regulations made in that behalf before the passing of this Act are hereby confirmed, and the same shall continue in force unless and until altered by Treasury warrant or Post-office regulations (as the case may be)."

And Section 14 declares that:—

"If a question arises whether any publication, not being a newspaper, is a newspaper or a supplement, or whether any packet is a book packet or pattern or sample packet, within this Act, or any Treasury warrant or Post-office regulations, the decision thereon of the Postmaster-General shall be final, save that the Treasury may, if they think fit, on the application of any person interested, reverse and modify the decision and order accordingly."

What, therefore, is necessary, in order to obtain a withdrawal of the restricted interpretation recently adopted by the Postmaster-General in reference to the pattern and sample post, is a new regulation by the Postmaster-General, or a new Treasury warrant for the guidance of those employed in carrying out the Post-office operations.

It would appear to come strictly within the province of the Society of Arts to organise such a representation to the Treasury, on behalf of commerce and the public in general, as may lead to a reversion to the free use of the Post-office in the transmission of parcels, which had been permitted for some years past, and which, since its withdrawal, has proved so injurious to many who have based their business transactions upon the facilities afforded for the exchange of small articles of little value upon a low rate of postal delivery.—I am, &c., H. G. H.

What is a Newspaper?

SIR.—I beg leave to lay before you a correspondence respecting the *Journal of Gas Lighting, Water Supply, and Sanitary Improvement*, which happens to be one of several publications unfortunately deprived, by the interpretation which the authorities put upon the Act, of an advantage which I conceive the legislature intended we should possess, viz., the right of transmission through the post for one halfpenny.

I am aware that the *Journal* is not a newspaper under the 6th section, because it is published at longer intervals than seven days, but it having been registered as a newspaper, and treated as such in every respect long before the passing of the Act of 1855, referred to in the schedule, I submit it comes within the terms of the 7th section.

As the largest portion of the issue of this *Journal* is circulated through the post, it is a matter of very considerable importance to me as well on the question of limitation of weight as of expense, as frequently I should publish a supplement if I had the privilege of sending above four ounces for one postage.

The anomalies of the present arrangement in this direction are numerous. I may mention, among others, that if it is required to send three *Journals* to a purchaser the postage is 3d., whereas the same weight of *Illustrated News* (*i. e.*, 12 oz.) would be delivered for 1d. The post-office has just double the amount of labour in the case of the weekly as in that of the fortnightly publications for the same remuneration. And lastly, the *Journal* continues to be registered as a newspaper for transmission abroad, though the newspaper privilege in this country, which it has enjoyed for 21 years, is cut off; and instead of having impressed stamps, as hitherto, I am obliged to stick postage stamps on the wrappers, which involves a large amount of additional labour and inconvenience. In every respect, therefore, the new Postal Act places me at a disadvantge.—I am, &c., WILLIAM B. KING.

Office of the *Journal of Gas Lighting, &c.*

In the letter to the Postmaster-General, besides the points mentioned above, attention was drawn to the following:—"I venture to submit that, by section 7 of the Post-office Act, 1870, a special provision appears to be made for the case of the few journals of this class which have been in existence for a long period of time, and have always been treated by the Post-office as newspapers, inasmuch as it is a publication which, not coming within the description of a newspaper set out in section 7, was yet stamped as a newspaper before the passing of the Act 18 and 19 Vic., cap. 27."

The reply of the Postmaster-General was as follows:—"That as the *Journal of Gas Lighting, Water Supply, and Sanitary Improvement* is published at intervals of 14 days, it is inadmissible for registration as a newspaper for circulation within the United Kingdom. The exception in the 7th section of the new Act refers entirely to the proportion of advertisements to other matter, and does not refer to all publications on which stamp duty was paid previous to the Act of 1855."

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lt.-Col. Scott, R.E., secretary.

The Dusseldorf Academy have given permission for the exhibition of their pictures and sculptures.

The Royal Porcelain Factory of Berlin will send a collection of porcelain for exhibition next year.

The Frieze of the Albert Hall.—One of the most interesting features of the exterior decoration of the Royal Albert Hall of Arts and Sciences is the mosaic frieze running round it. This frieze consists of a series of cartoons, each of which averages four feet in length and six feet six inches high, the whole length being 794 feet. The number of cartoons is 16, and the subjects of them are the various matters connected with the arts, sciences, and industries. Messrs. Armstead, Armitage, A.R.A., Horsley, R.A., Marks, Pickersgill, R.A., Poynter, A.R.A., and Yeames, A.R.A., are the artists, and the subjects are agriculture, astronomy, geodosie, workers in wood, and stone, and iron, music, pottery, construction, sculpture, applied mechanics, &c. These cartoons are in terra-cotta mosaic, of simple outlines and colours, the figure outlines being in black, the figures in buff on a chocolate ground. They have been executed by female students at the South Kensington Museum, and anyone interested in the production of such mosaic may see the students at work on similar cartoons for the East London Museum.

SIR,—In the published descriptions of the Royal Albert Hall of Arts and Sciences at South Kensington, I find it stated, when referring to the capabilities and accommodation provided for the public in the use of the Hall, that, besides space to be used in connection with the exhibitions, there are on the first floor numerous chambers, which will be available as offices for societies using the Hall; and the wing buildings contain a small lecture-theatre and a small concert room. These paragraphs appear to me to point at accommodation proposed to be afforded to the various societies in London, now so much in want of it. My reason for writing is to ask if such accommodation is contemplated? If so, the sooner that fact becomes generally known the better, as for some time past a movement has been on foot for bringing about a combined action on the part of scientific societies, with a view to the erection of a building for their joint accommodation. If my information is correct, it is suggested that two buildings, one for the larger, and another for the smaller, societies shall be erected.[*] A large sum of money is, I am told, proposed to be raised, and it is suggested that the government shall be asked to grant land for a site or sites for such buildings. If the accommodation required is already provided, or nearly so, it will save much time and trouble if the fact is made known. I write to the *Journal of the Society of Arts*, as the interest which the Society of Arts has always taken in the progress of each successive movement at South Kensington is well known; and, moreover, because I have been told that the Society of Arts is ultimately to remove to the new building.[†] If such is the fact, I for one heartily congratulate the Society on the step about to be taken, inasmuch as, since the railways round London have been carried to their present state of completion, South Kensington is rendered much more central and accessible than is its present house in the Adelphi.

I am, &c., C. E.

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[*] There are two propositions, one a large building in which both large and small societies may be accommodated, the other a smaller building, suitable for smaller societies only.—Ed. *J. S. A.*

[†] No such proposition has ever been mooted in the Council.—Sec. Society of Arts.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

SCHOOL BOARD ELECTIONS.

The following is the result of the London School Board elections, so far as they are known at the time of going to press. The figures after the name of the districts give the number of ratepayers according to the last Parliamentary return, but to these must be added the women ratepayers (say ten per cent.) in order to obtain the complete number of electors:—

City of London (20,185).—4 Members.

(*Official Return.*)

Rev. W. Rogers	6,149
Mr. Samuel Morley, M.P.	5,239
Mr. Alderman Cotton	4,836
Mr. W. Sutton Gover	4,796
Mr. G. W. Hastings	3,574
Rev. Charles Mackenzie	3,108
Mr. H. E. Knight	2,154
Mr. John Chubb	864

Chelsea (17,408).—4 Members.

(*Official Return.*)

Rev. Canon Cromwell	9,783
Lord Lawrence	8,254
Mr. G. M. Kiell	7,763
Mr. R. Freeman	7,133
Mrs. W. Grey	7,025
Dr. Gladstone	6,592
Mr. J. S. Dale	4,231
Mr. W. Harry	2,073
Mr. Snell	1,611
Mr. Osborne	610
Mr. Davy	113

About 15,000 electors polled, including 2,000 women.

Finsbury (31,759).—6 Members.

(*Official Return.*)

Mr. E. J. Tabrum	27,822
Mr. W. T. M'Cullagh Torrens, M.P.	10,766
Rev. J. Rodgers	8,690
Mr. T. C. Clarke	7,847
Sir F. Lycett	6,127
Mr. B. Lucraft	5,962

The numbers polled by the other candidates were:—

Mr. C. H. Lovell	4,953
Mr. Hugh Owen	4,378
Mr. W. Rivington	3,674
Mr. F. J. Hartley	3,286
Mr. C. H. Hopwood	3,278
Mr. John Sands	2,802
Mr. E. Mirams	2,122
Mr. J. R. Morrison	844
Mr. F. Tomkins	726

The total number of votes recorded was 93,277, and, as in nearly every case the voter had availed himself of his power to give six votes, it may be computed that 15,546 exercised the suffrage in this division.

Greenwich (15,588).—3 Members.

Miss Emily Davies.
Rev. John Melville Glenie, M.A., Roman Catholic Priest.
Rev. J. C. Miller, D.D., Vicar of Greenwich.

The fourth seat is claimed by the friends of both Mr. John Macgregor, M.A. and barrister-at-law, and the Rev. Benjamin Waugh, Congregational Minister. The other unsuccessful candidates are — Mr. W. D. Barnett, wharfinger; Mr. T. S. D. Floyd, baker; Mr. F. Johnson, builder; Mr. W. G. Lemon, barrister-at-law; Mr. George Offor, gentleman; Mr. W. W. Stanger, gentleman; and Mr. G. White, gentleman.

Hackney (40,613).—5 Members.

Mr. C. Reed, M.P.	11,939
Mr. William Green	8,233
Mr. T. B. Smithies	7,563
Mr. J. H. Crossman	7,187
Rev. J. A. Picton	5,686

The numbers polled by the other candidates were:—

Rev. S. Hansard	5,609
Sir T. F. Buxton	4,952
Mr. John Hales	4,748
Rev. W. Lockhart	4,067
Mr. A. Sonnenschein	3,856
Rev. John Oakley	2,592
Mr. John Runtz	2,518
Mr. R. G. Clements	1,721
Rev. E. F. Coke	849
Mr. G. F. Pardon	156
Mr. C. R. Wood	19

The above returns are only approximative, failing to include one of the wards. The difference in the numbers polled by the Rev. Mr. Picton and the Rev. S. Hansard is so slight, that the return in question might convert a seeming defeat into a victory.

Lambeth (33,377).—5 Members.

(*Official Return.*)

Stiff (Nonconformist)	22,101
Tresidder	16,676
Tilson (Churchman)	14,574
M'Arthur (Wesleyan)	11,936
Few (Churchman)	10,509

The numbers polled for the other candidates were :—

Rev. G. M. Murphy	8,432
Mr. Tugwell	7,830
Mr. Applegarth (working men's candidate)	7,682
Mr. Kavanagh	4,824
Mr. White	3,976
Mr. Selway	3,419
Mr. Mottershead	3,163
Mr. Gibbons	1,473
Mr. Shaen	918

MARYLEBONE (35,575).—7 MEMBERS.

(*Official Return.*)

The successful candidates were Miss Garrett, M.D., who headed the poll, Professor Huxley, the Rev. Prebendary Thorold, Rev. Dr. Angus, Mr. E. J. Hutchins (Roman Catholic), Mr. Hepworth Dixon, and Mr. James Watson. The following statement shows the number of votes given for each:—

Miss Garrett	47,858
Professor Huxley	13,494
Rev. W. A. Thorold, M.A.	12,186
Dr. Joseph Angus	11,472
Mr. E. J. Hutchins	9,253
Mr. Hepworth Dixon	9,031
Mr. James Watson	8,355
Mr. Arthur Mills	7,927
Mr. Francis Sharp Powell	7,852
Mr. William Whelpton	5,759
Sir S. H. Waterlow	4,994
Mr. M. A. Garvey	4,933
Mr. Jas. P. Marshall	4,668
Mr. J. J. Guedalla	4,635
Mr. W. R. Cremer	4,402
Dr. J. Edmunds	3,973
Mr. George Verey	2,130
Mr. J. P. Stanford	1,486
Dr. George Wyld	334
Mr. J. T. H. Dunn	258
Dr. T. G. Brewer	103
Mr. W. Beare	62

The aggregate number of electors who polled was 23,619. The total number of votes they recorded, each elector having seven, was 169,169, and the number of voting papers rejected for informality was 538.

SOUTHWARK (17,703).—5 MEMBERS.

(*Official Return.*)

The Rev. J. Mee	5,835
Mr. Lafone	5,711
Mr. Wallace	5,033
Mr. Ingle	4,920
Mr. Rendle	2,929
Mr. Robinson	2,891
Mr. Bayley	1,653
Mr. Side	1,627
Mr. Clements	1,329
Mr. Stafford	1,254
Mr. Sinclair	785
Mr. Baxter	151
Mr. Herring	127

The four elected members may be classed thus:—Mee and Lafone, Church of England; Ingle, Nonconformist; and Wallace, represents the Roman Catholics.

TOWER HAMLETS (32,546).—5 MEMBERS.

Mr. E. H. Currie	20,129
Mr. T. Scrutton	15,890
Mr. E. N. Buxton	14,363
Mr. W. Pearce	13,427
Mr. A. Langdale	9,788

The numbers polled by the other candidates were :—

Mr. F. Young	2,131
Mr. H. C. Clements	1,841
Mr. T. E. Bowkett	1,351
Mr. H. D. Jeffries	1,012
Mr. J. M. Mathias	586

The above figures are only approximately correct, some of the returns not having arrived.

WESTMINSTER (18,879).—6 MEMBERS.

(*Official Return.*)

Mr. William Henry Smith	13,602
Viscount Sandon	7,119
Rev. Alfred Barry	6,057
Rev. J. H. Rigg	5,722
Mr. Chas. E. Mudie	4,874
Lord Howard	4,310
Mr. George Potter	4,209
Sir Charles Trevelyan	1,621
Lord Fitzmaurice	1,145
Mr. George Wm. Martin	1,137
Rev. J. H. Barber	1,026
Mr. George Shiptan	793

Manchester.—In the election of the School Board, as many as 26,513 ratepayers voted. Two Roman Catholics, Canon Toole and Mr. Richardson (solicitor), were at the head of the poll, the first with 54,000 votes, and the latter with 36,308. Mr. William Birch, jun., merchant, with 35,414 votes; Mr. Birley with 34,026 votes; Mr. W. R. Callender, 31,824; Mr. Robert Gladstone, 24,237; Mr. Lamb, 22,987; and Mr. Dale, 20,688, represent various shades of the Church of England party. Next comes Miss Becker, with 15,249 votes. Mr. Haworth, the Rev. Dr. M'Kerrow, Mr. Rumney, Dr. Watts, Mr. Cooper, and Mr. Heywood, with votes from 13,000 down to 7,902, represent the Methodists and various shades of dissent, and these names complete the Board of 15 members.

Liverpool.—The election of the School Board has been formally completed by the official publication of the names of the 15 gentlemen finally nominated, in accordance with a friendly compromise among the various religious bodies and others.

Leeds.—The election of a School Board, to consist of 15 persons, took place on Monday. Originally there were 61 nominations, but the official voting papers sent by the mayor through the post-office to every person whose name was on the burgess list (the whole being about 45,000) contained no more than 38 names of candidates. Mr. John Jowitt, wool merchant, an Independent in religion, headed the poll with 49,259 votes. Mr. W. J. Armitage, ironmaster, with 39,350 votes; Sir A. Fairbairn, with 33,279 votes; and Mr. W. Middleton, chairman of the Board of Guardians, with 29,912 votes, were three of the five candidates put forward by the Church School Association, all of whom were elected. Next in order was Mr. W. Beckworth, tanner, with 28,806 votes, mainly derived from the Methodist Free Church party. The fourth successful Church candidate ranked next in point of numbers. He was Mr. J. Ellershaw, with 26,126 votes; and Dr. Heaton, one of his colleagues, had 25,081 votes. Then came Mr. W. G. Joy, a nominee of the United Liberal Association and Reform League, with 19,028 votes. Next a Wesleyan, Mr. J. Wilson, jun., with 18,717 votes. The Roman Catholics secured the election of their only two candidates, Mr. Kelly, surgeon, having 18,150 votes, and Mr. W. Long, ironmonger, 17,665. Mr. Woolley, an independent candidate, secured a seat with 15,759 votes; Mr. E. Gamb (Liberal) polled 15,078. The Rev. J. H. Kendal, vicar of Holbeck, 14,627; and the last in order of those who were successful was Mr. W. Barker (Liberal), 14,333. The Church party returned all their candidates.

Sheffield.—The successful candidates are:—Mr. J. Ellison, agent (Catholic), 17,057; H. Wilson, gentleman (Churchman), 12,489; C. Wardlow, steel manufacturer (Wesleyan), 12,464; W. Cobby, goods agent (Wesleyan), 11,372; T. Moore, brewer (Churchman), 10,823; M. Firth, steel manufacturer (New Connexion), 10,316; S. Cole, draper (Wesleyan), 10,315; C. Doncaster, steel manufacturer (Quaker), 9,762; W. Fisher, merchant (Unitarian), 9,756; Sir John Brown, manufacturer (Churchman), 9,344; R. W. Holden, cattle dealer (Primitive Methodist), 9,303; D. Fairbairn, merchant (Wesleyan), 8,310; J. Crossland, soap manufacturer (Churchman), 7,215; A. Allott, accountant (Independent), 6,947; R. T. Eldon, saw manufacturer (Unitarian), 6,624. The highest number of votes recorded for any working man candidate was 5,540.

Gateshead.—The election of a School Board was held on Monday. There was a great number of candidates, but the working classes manifested little interest in the proceedings. Though Gateshead is considered in the north to be one of the most radical towns, the Roman Catholics and members of the Church of England headed the poll, and carried the majority of the seats. The following is the return:—Rev. H. Riley and Mr. W. G. Montgomery, Roman Catholics; Archdeacon Prest, Rev. S. Atkinson, Mr. H. C. Alhusen, Mr. R. R. Redmayne, Mr. G. T. France, Mr. R. S. Newall, Church of England; Mr. John Lucas, Free Methodist; Mr. George Lucas, Unitarian; Mr. W. Brown, Wesleyan. Only about one-third of the constituency voted.

Aberystwith.—At the election of the School Board the following stood at the head of the poll:—The Rev. E. Owen Phillips (vicar), 841; Mr. Thomas Jones, 795; Mr. Lewis Pugh Pugh, 747 (all Churchmen); Mr. John Williams, 679; Mr. William H. Thomas, 628; Mr. David Charles, 613; Mr. Peter Jones, 544; Mr. W. H. Rowse, 496 (the last five being Nonconformists). The first seven were elected.

Bootle.—The election of a School Board was held on Wednesday. There were twelve candidates for nine seats. Five Churchmen, two Nonconformists, and two Roman Catholics were elected, one of the latter heading the poll.

Stockton.—The following seven gentlemen were elected as the Educational Board on Tuesday:—The Rev. T. Law; Mr. James Stothart, banker; Mr. John Dodshon, merchant; Mr. W. C. Newby, solicitor; Mr. G. Lockwood, iron-shipbuilder; the Rev. W. Carlisle, Roman Catholic priest; and Mr. Francis Sanderson, saddler. Messrs. Law, Newby, and Lockwood were nominated by the Church party, Mr. Sanderson by the Methodists, and the Rev. Mr. Carlisle by the Catholics. The other candidates were acting independently.

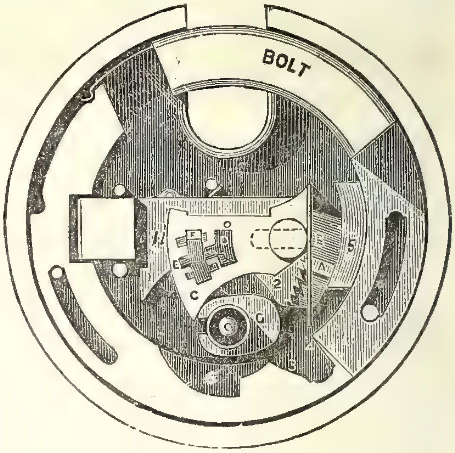
Middlesborough.—The election of a School Board was held on Tuesday. The total number of burgesses polled was 2,895, or nearly one-half on the list. The following members of the Church party were elected:—Mr. W. R. J. Hopkins, ironmaster; Mr. J. Heads, ironmaster; Mr. Wilson, ironmaster; and Mr. Haigh, engineman. Mr. Edward Williams, ironworks manager, and Mr. Eadon, moulder, candidates put up by the Educational League, were also elected. Mr. J. F. Elgee, bank manager; Mr. William Fallows, agent, who worked independently, and Mr. Brentnall, who was supported by the Methodists, were the other candidates elected.

Wolverhampton.—The polling for the election of the School Board took place on Monday. For the eleven seats there were 25 candidates—18 Churchmen, 3 Independents, 2 Wesleyans, 1 Roman Catholic, and 1 working-man's representative. The eleven elected are the Revs. William Augustus Cornwall and Henry Hampton, clergymen; John Morris, agricultural chemist; Rupert Alfred Kettle, County Court Judge; Henry Loveridge, japan manufacturer; William Edwards, edge-tool manufacturer (all Churchmen). Harry Jones (japan manufacturer; Thomas Bantock, coalmaster and carrier (both Independents); John Hartley, ironmaster, and Henry Harley Fowler, attorney and solicitor (both Wesleyans); John Hawksford, attorney (Roman Catholic).

THE "CITADEL" LOCKS.

Many improvements have of late years been introduced in the make of compound lever locks, among the latest are those proposed by Mr. Hodgson in the "Citadel" lock. The principal modifications are the addition to the ordinary tumblers, or levers, as they are more generally called in locks of this description, of a lever acting underneath the bolt, and carrying a projecting stud or wedge, A, of solid metal, which is pressed down by its spring between the tail of the bolt, 2, when it is shot out, and an abutment, 5, which bears against the lock-case; the wedge, A, being in the same plane as the bolt, thus affording a complete security from violence.

In the illustration given the principle is applied to a padlock, which is shown as locked, but it will perhaps be more easily understood if the locking action is explained. The key, on locking, first enters between the "talon" of the orbicular bolt, 3 and 4, which would then correspond with the key-hole; it then acts upon 4 until the orbicular bolt is shot round through the staple of the article to be secured, and leaves it in the position shown. The main bolt of the lock, H, with its notched end, 2, is still back against the abutment, 5, and the wedge, A, is in the slit in the bolt, shown by dotted lines at B. The pin or "stump," F, which is rivetted into and travels with the bolt, is now at D. The key then, having left the orbicular bolt, and continuing its rotation, raises the levers C, and propels the main bolt in the ordinary manner, until its rear end is sufficiently projected for the spring of the wedge-lever to bring the wedge, A, down opposite it, at 2. The "stump," F, would now be in the forward "gatings," E, of the levers, and to secure the wedge-lever from being tampered with, the bolt is caused to recede until its notched teeth, at 2, become firmly engaged with those of the wedge, A. The stump, F, receding with the bolt, takes, as well as the levers, the position shown. This receding motion of the bolt is caused by the action of a camlike projection, G, on a disc of metal called a "curtain," which is turned round by the key. In the engraving it is shown as having just completed its action; the disc of the curtain is removed to show this operation. This action of the locking of the main bolt is precisely that of all the other "citadel locks." The unlocking action is necessarily just the reverse of the locking. The key first raises the levers in the usual



The "Citadel" Orbicular Padlock.

way; it then acts on the incline of the talon, 1, of the main bolt, and sends it forward until it has disengaged the teeth, at 2, from those of the wedge, A, which it then elevates until it is aligned with the slot, B, and withdraws the bolt in the usual way; and in the orbicular padlock revolves until it meets with the point, 3, acting on which it turns the orbicular bolt, until 3 and 4 correspond again with the key-hole, and the orbicular bolt is released from the staple, and the padlock can be removed.

CORRESPONDENCE.

A HINT TO MEMBERS OF THE SOCIETY.

To the Editor of the "Journal."

Sir,—It seems to me that the column or so of General Notes, that you have given us every week for the last year, and which I always look at with considerable interest, might be made very useful and of great permanent utility, if every member of our Society, interested in any scientific or art work, or manufacturing industry, would send up occasional notes of any new fact arrived at, or any new process discovered, or, in fact, of anything with regard to which it is desirable to follow Captain Cuttle's advice, "and, when found, make a note of." There must be a good many matters that are not ample enough to make a paper about for discussion, and yet which would be very interesting to the members of our Society if published in our *Journal*, a legitimate channel for their publication.

I am, &c.,

A Country Member who reads his "Journal" with Interest.

GENERAL NOTES.

Colonisation.—Major-General Sir W. Denison, K.C.B. read a paper on "Colonisation," at the Colonial Institute in which he gave the results of his own experience during forty years at home and abroad, alike in England, Canada, Australia, and India, corroborated by that of other competent judges. The most noticeable changes to be found at home are—the increase of density of population, and the much greater development of capital, resulting in a deterioration of the relations between masters and workmen. Whereas formerly there was a community of interest between masters and workmen, now there exists a feeling of antagonism, and the policy of masters and men alike is suicidal. Contrasting with this the position of the colonies, especially in regard to the relation of labour and capital, and the outlet which they afford alike to the surplus labour and capital at home, the remedy was set forth as being—the altered distribution of surplus population, and the better application of surplus wealth. As regards the subject of colonisation as tending to these results, its influence has hitherto been exercised on individuals, families, and groups, rather than on the national scale. Colonisation, as a remedy of the evils pointed out, was defined to be the transference by government of bodies of people, representing all classes, and with adequate organisation, to the selected countries, and their permanent and regulated location there. Finally, that the cost of transit and maintenance, until rendered self-sustaining, be advanced by government in return for a grant of two hundred acres of land for each family, consisting of two parents and three children on the average, *i.e.*, forty acres per head; an essential feature of the scheme being some reservation for, and consideration of, the claims of religion and the Church.

Stone Waterproofing.—At the recommendation of Professor Abel, chemist to the War Department, the process invented by Messrs. Gay and Co., of Alton, Hants, for waterproofing and preserving stone and other buildings, is, by the order of the Office of Works, to be applied to the decayed stonework of the Houses of Parliament.

The Betel Nut Leaf.—Mrs. Kerr, a member of the Society, encloses two specimens of the "spath" of the betel-nut leaf, and writes as follows:—"The two specimens are the "spath" of the betel nut leaf; the one from the inside part possesses so much fibrous matter as to be commonly used by shop keepers in the Straits' settlements for wrappers for their small articles of merchandise; the other is the outside of the "spath" and appears to be the pith. It is said, at Singapore, that this article may be advantageously used for making paper, and there is a method of separating the fibrous from the pulpy part. I should be pleased could it be converted into an object of general utility. The betel-nut trees, of course, are to be found in great abundance in all parts of India.

New Japanese Mint.—The *European Mail* says that, following the example of Hong Kong, the Japanese are about to have a mint of their own. It will be recollected that, some time since, Hong Kong built a mint, and fitted it up in first-class style, at a cost of over £100,000; and, but for that most conservative power called "vested interests," there is very little doubt but that the Hong Kong mint would have been a successful undertaking. However, it was stopped, to the manifest loss of the whole community, from the Straits Settlements to Japan. The Japanese Government bought the machinery, and it was transferred to Osaka, and placed in a very handsome stone-cut building, expressly constructed for the purpose, where the operation of coining will commence in 1871. The new coinage is to consist of gold 10, 5, and 2½ dollar pieces; silver dollars, and 50, 20, and 5 cents.; and copper 1 and ½ cents., and 1 mil (this latter being probably the smallest modern minted coin). The dies were from Japanese designs, and were sent out from England; but, owing to the "reverse" in each case not proving very effective, some alterations thought judicious have been introduced. On the obverse of the gold coins will be the Japanese dragon in the centre, tied in an inextricable knot, surrounded by the value and date in Japanese. The reverse has in the centre the arms of Japan—the round red "pellet"—above and below which are the flower badges of the Mikado. On either side of the arms are branches of the shrubs that bear the flower—emblems of Japan, and near the two "waveless" flags of the Mikado. The silver coinage is similar on the "obverse," but the "reverse" has the "pellet" in the centre surrounded by rays towards the margin, in which the crests or badges of the Mikado appear with the wreaths before-mentioned. The copper coins are similar to the above, with smooth-skinned dragon instead of a scaly one. It will thus be seen that the fancy of the Japanese for dragons and flags without waves has been fully indulged; while, at the same time, the coin will be handsome and striking, and far in advance of the Hong Kong mintage. With respect to the future working of the undertaking, the work before the officials is undoubtedly heavy, as a population of forty millions of people will have to be supplied; but the machinery is all of the best construction, and Captain T. W. Kinder is a man of considerable acumen, and has had some years' Eastern experience, having occupied a similar position at the Hong Kong mint. The melting department is furnished completely with the well-known manufactures of Morgan's "Patent Plumbago Crucible Company," Battersea. Some regret is felt that the building is so far inland, and on such a dangerous river as is Osaka; Hiogo or Yokohama, therefore, would have been much more preferred as the site.

United States' Cheese.—It is stated that, under the factory system, the cheese product of the United States has risen from 105,000,000 lb., in 1860, to 240,000,000 lb., in 1868; while the demand in the latter year exceeded the supply by 72,000,000 lb. The entire dairy product of the United States, in 1868, it is estimated, was worth 400,000,000 dollars. There were then 792 factories, 660 of them in the State of New York. Since then, 200 new factories have been started in that State, and 54 in Wisconsin.

The New Forest.—Notice has been given of a private Bill in the House of Commons, which has in view the disafforesting of the forest, and the extinguishing of all forestal rights of the Queen and of any person or persons over the same; the ascertaining, declaration, and definition of the nature and extent of such rights, especially rights of common, pasture, turbury, mast, and other estovers; the making of allotments of part or parts of the forest in satisfaction of such rights, or some of them, and the making provisions for the vesting, management, regulation, use, and enjoyment of such allotments on some part or parts thereof; the making provision for allotment, for churches, schools, recreation-grounds, and other purposes; the making provision for the use of lands remaining, after the disafforesting for public or other purposes, and the preservation of such open lands and the timber thereon for public use and enjoyment. Should the provisions of the Bill pass into law, new roads may be made, old ones diverted or entirely stopped, and right of way abrogated; and the Bill finally proposes to deny and extinguish rights and privileges interfering with any of its objects, and the repeal and amendment of certain Acts relating in whole or in part to the forest.

Geological Systems and Endemic Diseases.—Some little time ago, Dr. Moffat read a paper showing that the soil has an influence on the composition of the cereal plants grown upon it, and on the diseases to which the inhabitants are subject. The district in which he practises consists geologically of the carboniferous and new red sandstone, or Cheshire sandstone systems. The inhabitants of the first are engaged in mining and agricultural occupations, those of the latter in agriculture. Anœmia, with goitre, is a very prevalent disease among those living on the carboniferous system, whilst it is almost unknown among those living on the new red sandstone system, and consumption is also more prevalent amongst the inhabitants of the former. As anœmia is a condition in which there is a deficiency of the oxide of iron which the blood naturally contains, Dr. Moffat was led to make an examination of the relative composition of the wheat grown on the soil of Cheshire sandstone, carboniferous limestone, millstone grit, and a transient soil between Cheshire sandstone and the grit. The result of the analysis shows that the wheat grown on the soil of Cheshire sandstone contains the largest quantity of ash, and that there is a larger quantity of phosphoric acid in it than in the soil of the carboniferous and millstone and grit system; also a much larger quantity of oxide of iron than in either of them. He has calculated that each inhabitant on the Cheshire sandstone, if he consumes 1 lb. of wheat daily, takes in nearly five grains per day of the sesquioxide of iron more than the inhabitants of the carboniferous system, and who seems, therefore, to be subject to this liability to anœmia, in consequence of the deficiency of iron and phosphoric acid he consumes. It is not only in the wheat grown upon the carboniferous system that there is a deficiency in the quantity of oxide of iron and the phosphates, says Dr. Moffat, but also in the blood of the animals reared upon it; so that the inhabitants upon that system take in a minimum quantity of these constituents of the blood, compared with that taken in by the inhabitants of the Cheshire sandstone. He stated that sheep were liable to anæmia—a fact which he attributed to sheep-walks being upon trap and limestone hills, in the soil of which there is but little if any iron.

A New Gun.—There is in the course of erection, on the east side of New York Bay, a gun that will throw 800 five ounce balls in one minute, to a distance of about two miles. The shot may be either red-hot or cold. The gun is circular, and appears like two discs of heavy iron plate, about 4 feet in diameter. Upon one side is a funnel to convey the balls through to the proper chamber, without cessation of firing or diminution of speed. The muzzle projects upon the periphery of the circular machine, and may be elevated or depressed at the will of the gunner, by the trunnion upon which it rotates. The guns may be worked by steam power or manual labour; if by the former, it will throw from five ounce balls to eight-pound shot and shell, thus making it a destructive implement of warfare.

Para Rubber.—*Nature* observes that, "considering the many uses to which india-rubber is now applied, one of the most important being its recognised superiority over gutta-percha for deep-sea telegraphs, and remembering the fears entertained some time back of the probability of a decrease in the supply, owing to the exhaustion of the forests consequent upon the immense demand, it is gratifying to learn that the quantity of rubber exported from Para during the past year exceeded that of the previous year by 22,731 arrobas, and by £241,250 in market value. It is true that the more accessible rubber districts are becoming exhausted, and give a smaller yield than in former years; but the rubber-bearing country is so extensive, and its rivers so incompletely explored, that the newly-discovered sources will, no doubt, more than make up any deficiency arising from the exhaustion of the old. It is difficult, however, to obtain accurate or reliable information from those engaged in the collection of the rubber. The continued demand for rubber, which is collected with comparatively little labour, and requires but little skill and experience, absorbs all the attention of the natives over other products, and the constant rise in its value so stimulates its production, that it is now more than probable there will be, for some years to come, an annual increase in the quantity imported of at least 10 per cent.

MEETINGS FOR THE ENSUING WEEK.

Mon. ....SOCIETY OF ARTS 8. Cantor Lectures. Mr. F. S. Barff, "On Artists' Colours and Pigments." Lecture III. "Chemistry and Manufacture of Colours and Pigments."
Entomological, 7.
Social Science Association, 8. Dr. Stallard, "Treatment o Vagrant and Able-bodied Paupers."
British Architects, 8.
London Institution, 4 Prof. Odling, "On Chemical Action" (Educational Course).
Medical, 8.

Tues. ...Civil Engineers, 8. M Jules Gaudard, "On the Theory and Details of Construction of Metal and Timber Arches."
Pathological, 8.
Anthropological, 8.

Wed. ....SOCIETY OF ARTS 8. Mr. H. M. Jenkins, "On the American System of Associated Dairies, and its Bearing on Co-operative Farming."
Geological, 8. 1. Dr. George Gray, "On Fossils from Cradock, Cape of Good Hope" Communicated by Prof. T. Rupert Jones. 2 Mr. G. W. Stow, "On some points in South-African Geology." Part II. Communicated by Prof. T. Rupert Jones. 3 Mr. C. L. Griesbach, "On the Geology of Natal" Communicated by Mr. H Woodward 4 Mr. G. Gilfillan, "On the Diamond-districts of the Cape of Good Hope." Communicated by Mr. W. Smyth.
Pharmaceutical, 8.
Royal Society of Literature, 4¼.
Obstetrical, 8.

Thurs...London Institution, 7½. Mr W. Mattieu Williams, "On Count Rumford and his Philosophical Work."
Royal, 8½
Antiquaries, 8½.
Royal Society Club, 6.
Mathematical, 8.

Fri.......Astronomical, 8.
Quekett Club, 8.

Sat ......Royal Botanic, 3¾.

Journal of the Society of Arts.

No. 942. Vol. XIX.

FRIDAY, DECEMBER 9, 1870.

PROCEEDINGS OF THE SOCIETY.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The following report from the Musical Committee was laid before the Council at its last meeting, when the same was adopted :—

1. In order to carry on the work already begun by the Society of Arts, with the view of establishing a National Training School for Music, the Committee recommend the Council to make music—as one of the Fine Arts—an object of the Society's attention.

2. For promoting this purpose, the Committee recommend that a musical section of the Society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall.

3. These concerts to consist of performances of vocal and instrumental music of the highest character.

4. After paying the expenses of the concerts, the profits to be applied to the establishment of a National Training School for Music.

5. Members of the Society, for every subscription of one guinea paid to the musical fund, to have the privilege of obtaining a transferable ticket for six evening concerts in the arena and balcony without further payment, provided that no member as such shall have the privilege of receiving more than five tickets on these terms.

6. Persons not members of the Society shall have the liberty to purchase tickets on such terms as the Council may from time to time determine.

7. That the Musical Committee of this Society, consisting of :—

The Lord Henry G. Lennox, M.P., Chairman of the Council, or the Chairman of Council for the time being, and
S. Redgrave, Esq.,* and Seymour Teulon, Esq., Vice-Chairmen of the Council, or Vice-Chairmen of Council for the time being
Lord Gerald FitzGerald *
The Right Hon. Sir J. Pakington, Bart., M.P.*
Sir John E. Harington, Bart.*
Sir. Francis Sandford *
E. A. Bowring, Esq., C.B., M.P.*
Henry Cole, C.B.
A. S. Cole, Esq.
Capt. Donnelly, R.E.*
The Honourable Seymour Egerton
W. Hawes, Esq.*
C. Wren Hoskyns, Esq.
Frank Morrison, Esq.
J. Puttick, Esq.*
Lieutenant-Colonel Scott, R.E.*
E. C. Tufnell

be authorised to carry out the arrangements for the six concerts, as soon as a guarantee fund for not less than two thousand pounds has been obtained, and one thousand subscriptions of one guinea.

That Sir Michael Costa be asked to meet the Committee, to discuss the necessary details.

A guarantee fund for assuring the Society against loss has been commenced, and the following gentlemen have guaranteed the amount set opposite their names respectively :—

	£	s.
F. A. Abel, F.R.S.	10	0
William Beamish	10	0
Sir W. H. Bodkin	10	0
Edgar A. Bowring, M.P.	10	0
George Brough	10	0
C. Minton Campbell	100	0
A. Cassels	10	0
E. Chadwick, C.B.	10	0
Hyde Clarke	10	0
Alan S. Cole	10	0
Henry Cole, C.B.	50	0
Earl de Grey and Ripon, K.G.	50	0
Sir Charles W. Dilke, Bart., M.P.	20	0
Capt. Donnelly, R.E.	20	0
Christopher Dresser	25	0
Lieut.-Gen. C. Eardley-Wilmot, R.A.	10	0
Hon. Seymour Egerton	10	0
John H. Evans	10	0
Lord Gerald Fitzgerald	10	0
G. E. Forrest	25	0
J. A. Franklin	10	0
C. J. Freake	100	0
Capt. Douglas Galton, C.B.	20	0
George Godwin, F.R.S.	10	10
Frederick Gordon	10	0
Lieut. Grover, R.E.	10	0
Dr. Hogg	20	0
Bartlett Hooper	10	0
C. Wren Hoskyns, M.P.	10	0
Professor Huxley, F.R.S.	10	0
Samuel Lovegrove	10	0
Messrs. Lucas Bros.	250	0
T. A. Masey	10	0
Admiral E. Ommanney, F.R.S.	10	0
J. Pollen	10	0
J. F. Puttick	10	0
Samuel Redgrave	10	0
Sir Francis Sandford	10	0
Lieut.-Colonel Scott, R.E.	50	0
G. A. Spottiswoode	10	0
Seymour Teulon	10	0
Henry Thring	20	0
Henry Vaughan	10	0

List of Subscribers for Tickets.

R. W. Bartram	2
W. Beamish	2
Sir W. H. Bodkin	2
George Brough	2
Christopher Dresser	2
John H. Evans	22
Freeland Filliter	1
P. Le Neve Foster	2
Frederick Gordon	2
Lieut. Grover, R.E.	2
Arthur Hall	2
Bartlett Hooper	2
C. Wren Hoskyns, M.P.	2
W. G. Larkins	2
Samuel Lovegrove	5
Messrs. Lucas Bros.	10
T. A. Masey	1
Henry Thring	2

The Council earnestly hope that the members of the Society will support, and co-operate with them in, this important public undertaking, and by joining in the proposed guarantee, and by availing themselves of the privilege of subscribing for tickets at the reduced rate, aid in securing the establishment of a National Training School for Music.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

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* These signed the Report on Musical Education, 1866.

FOURTH ORDINARY MEETING.

Wednesday, 7th December, 1870; Lord Vernon in the chair.

The following candidates were proposed for election as members of the Society:—

Bird, P. Hinckes, 1, Norfolk-square, W.
Bosanquet, Charles B. P., 8, Lansdowne-road, W.
Gamgee, Professor John, 26, Horbury-crescent, Notting-hill-gate, W.
Greene, Benjamin, 102, Piccadilly, W.
Hart, James L., 20, Pembridge-square, W.
Hartley, Dr. Edmund, 31, Warwick-square, S.W.
Hookey, Henry G., 28 Westbourne-park, W.
Hurtzig, Charles, Danford-house, the Grove, Boltons, S.W.
Puxty, W. C., Erdington Orphanage, near Birmingham.
Saunders, James T., 143, Oxford-street, W.
Taylor, William, Great Driffield, Yorkshire.

The following candidates were ballotted for and duly elected members of the Society:—

Bantock, J. William, Eyeworth-lodge, New Forest.
Barff, Frederick, M.A., 2, West Abbey-road, Kilburn, N.W.
Bing, L., North-end, Bishop's Stortford.
Campbell, Archibald, M.D., 104, Lansdowne-road, W.
Cole, Rev. Arthur Raggett, M.A., Hurstbourne-priors, Whitchurch, Hants.
Goode, W. James, 19, South Audley-street, W.
Gower, William Sutton, Dartmouth-point, Blackheath.
Kilner, Rev. J. M., the Castle, Chester.
Matheson, Sir James, Bart., F.R.S., Lewis-castle, Stornoway, N.B.
Noble, John, Park-place, Henley-on-Thames.
Pollen, John Hungerford, 11, Pembridge-crescent, Bayswater, W.
Rawlinson, Sir Christopher, Manydown-pk., Basingstoke.
Robbins, J., 104, Portsdown-road, Maida-vale, W.
Sargeaunt, William Charles, 12, Spring-gardens, S.W.
Satchell, Walter A., 42, Argyll-road, Kensington, W.
Smith, George, Spring-cottage, Coalville, Leicester.

The Paper read was—

ON THE AMERICAN SYSTEM OF ASSOCIATED DAIRIES, AND ITS BEARING ON CO-OPERATIVE AGRICULTURE.

By H. M. Jenkins, F.G.S.,

Secretary of the Royal Agricultural Society of England.

Introduction.

My chief object in this paper is to contrast the English system of private dairies with the American system of dairy-factories, and to point out the mechanical, financial, and other advantages of the latter. It is unnecessary for me to urge the importance of my subject, as milk, butter, and cheese are materials of everyday consumption; but I may observe that our importations of dairy products from foreign countries and the colonies were, in 1869:—Butter, 1,259,089 cwts., and cheese, 979,189 cwts. About one half of the cheese came from the United States, and the computed value of that moiety was nearly a million and a-half sterling.

Cheese-making in a Private Dairy.

As some of my audience, and possibly some of those who may afterwards read this paper, may be unacquainted with the *penetralia* of a dairy-farm, I must trouble you with a slight sketch of certain *Dei penates* and their uses in a private dairy and in a factory respectively. Dairy cows are milked twice a day, and the morning's "mess" of milk is, for the purpose of cheese-making, which I shall take for our type, added immediately to that obtained the previous evening. The whole of the milk is poured into what is known as a "cheese-tub" in private dairies, or a "vat" in factories. In the former case, straining or some other device is resorted to, for the purpose of thoroughly mixing the two lots of milk, and evenly distributing through them the cream which had partially risen on the evening's mess during the night; but in many cases this difficulty is evaded by skimming the cream before the addition of the morning's milk, and thus whole-milk cheese is not made in those dairies. In a well-arranged factory, however, the cream is prevented from rising by a simple mechanical contrivance, which will presently be described.

From this point I will now, for the sake of clearness, sketch a particular instance of English cheese-making in a private dairy as it came under my own observation. The "cheese-tub" was simply a tub—and nothing more—of unpainted wood, as clean as a "new pin." It was placed on a stand to raise it to a height convenient for the dairymaid; and at the time when I arrived at the dairy the rennet and annatto had just been added, a portion of the milk having been first heated and added to the remainder to raise the whole to the temperature thought necessary, which was guessed at by dipping in the hand. In the course of about an hour the curd became separated from the whey, most of which was then baled out, and a portion put into a saucepan to warm. The curd, being thus left exposed, was cut up by the dairymaid and her two assistants with long-bladed knives, first into long slices, then into large cubes, and finally into pieces about the size of nuts. The whey, when warm enough, was poured on the cut curd, which was stirred about with the hand to ensure its being as thoroughly scalded as the rudeness of the process would permit. The whey was then, for the second time, separated from the curd, but now as carefully and as thoroughly as possible. The circumstances of the case soon exhausted the resources of the baler, although she had been aided by her coadjutors, who gathered up the curd to one side of the tub, and retained it there with their hands, as well as raised that side by means of pieces of wood placed beneath it in succession as they were required. When the curd was taken out it was put into a temporary cheese-vat in a cloth, and placed in a cheese-press for a short time, with a view of squeezing out as much as possible of the whey that still remained in. It was then taken out, broken again, put into the usual mould, and again pressed. From this time, for several days, beginning with twice a day, following with once a day, and lastly missing a day, the cheese would be well salted on the outside, and would have a new cloth or bandage after every salting. Finally, the cheese would go to a cheese-room, where it would be turned every day, and where, by means of sundry devices, the dairymaid would court the production of a coat of mould of the fancied colour, contour, and condition.

Such, although an antiquated, is still not an uncommon method of cheese-making in an English dairy. On the farm which I have more particularly kept in view during the foregoing description, and on which 50 cows were kept, the presiding dairymaid was the farmer's daughter, a delicate-looking girl, whose dress and address, manner and conversation, would have made one conceive it impossible that this was her daily occupation, had she not been bending over a primitive cheese-tub, the sleeves of her dress pinned back over her shoulders, and her whole attention absorbed by the curdling mass before her. But, as a fact, her laborious duty commenced at six o'clock every morning, and there can be no doubt whatever that the quality of the cheese turned out of that dairy depended almost entirely on the sensitiveness of the tips of her fingers.

Factory Cheese-making.

Now let us see what an American cheese factory is like. To enable you to thoroughly appreciate the great advance which this system exhibits over the one just described, Mr. Gilbert Murray, of Elvaston, Derby, has kindly exhibited a model of the cheese-factory on the American system, recently established at Derby; and I have taken the following description of the operations from the report of the implement trials at the Royal Agricultural Society's meeting at Oxford,* where a silver medal was awarded to this model. It is on the scale of 1½ inch to the foot, and represents a factory designed for the manufacture into cheese of the milk of 300 cows:—

"The cans used for conveying the milk from the farm to the factory are cylindrical, of the same width throughout. The lid exactly fits the cylinder like a piston, and so accommodates itself to the supply of milk, thus preventing waste or undue agitation. In the centre of the lid is a tube projecting six inches inside; this, when filled with cold water, tends to lower the temperature of the milk. As the evening's milk arrives, it is emptied into a large tin which stands on the platform of a portable weighing machine, the weight being duly entered in duplicate, one entry going back to the sender. In the bottom of the weighing-tin is a brass valve, corresponding to a hole in the centre of the weighing-machine platform; to this valve a small brass chain is attached, by which it can be raised and the milk allowed to escape into a tin tube, which conveys it direct to the vats in the making-room. The vats consist of two separate parts; the outside part is constructed of two-inch deal board, tongued and grooved, and supported on wooden legs; the inner case consists of strong tin secured to a rim four inches deep and two inches wide; in the inside, between the bottoms of the outer and inner vats, is a space of two inches, which contains the steam pipes, and into which cold water is carried in order to lower the temperature of the milk when required. As soon as the whole of the evening's milk has arrived, and been run into the vats, the cold water is turned on, and soon fills the space between the vats, about six inches from the bottom; and at the contrary end to which the water enters, an overflow-pipe is inserted; this pipe conveys the water to a small overshot water-wheel, the small quantity of water gives a regular but intermittent motion to the wheel; this motion is communicated to a shaft running longitudinally through the building; to this shaft are again attached a series of wooden rakes, which float on the surface of the milk, and by their action keep up a continuous action, thus preventing any cream from rising. When the morning's milk arrives, it is weighed and run into the vats, and mixed with that of the previous evening; by opening a tap at the bottom of the vat the cold water is all run off, and steam turned on by an inch pipe running round the inside of the vat. This pipe has small perforations throughout its length, and through these the steam is equally distributed; when the proper temperature has been attained, the rennet and annatto are added, the mass is well stirred, and is then covered up until the curd has formed. To facilitate the separation of the whey, the curd is cut with knives specially constructed for that purpose; the temperature is then slowly raised, until the whey has arrived at a proper state of acidity; it is then run off, by means of a syphon, into a drain in the floor, which conveys it into the whey-cistern outside; the curd is then tipped into the dry vat, and is here well stirred by the hand and exposed to the atmosphere, the principal object being to lower the temperature of the curd before salting. In order to reduce manual labour to the minimum, in many of the American factories there is a difference of three feet in the level of the floor of the making-room. By opening a trap in the end of the milk-vat, the curd is emptied into the dry vat without being touched by hand. The curd, when salted, is put into hoops; these are placed in the presses, and pressure of from three to five tons applied."

In the course of about an hour, the compressed curd is taken out of the press, for the purpose of receiving the permanent bandage, which was formerly distinctive of American cheese. It is then returned to the press, where it remains until the next morning, when it is taken to the curing-room and greased. Two men and a lad can, by the American method, make the cheese from the milk of 300 cows, whereas we have seen that, in the old-fashioned instance of English cheese-making just described, it required the aid of three women to make cheese from the milk of 50 cows.

Advantages of the Cheese-factory System.

These will probably have already suggested themselves to you. They may, however, be conveniently epitomised under two heads, viz.:—(1) *Economy of Production*, and (2) *Superiority of Produce*. Under the first, the most importent item is the saving of labour, and more especially of skilled labour. The same processes have to be gone through whether the milk under treatment is yielded by 50 cows or by 500; and it is not too much to say that, whereas 10 private dairies, of 50 cows each, would require at least 10 skilled dairymaids and as many unskilled assistants, one factory, receiving the milk of 500 cows, would not require more than one skilled hand, and, three or four, at most, assistants. As a matter of £ *s.* *d.* alone, this difference is sufficiently important; but dairy-farmers know perfectly well that a still more important consideration is the difficulty of getting and keeping skilled dairymaids. Indeed, this difficulty has become so great, that it is a recognised fact that prime cheese is made, as a rule, only by farmers' wives and daughters. Other items conducing to economy are: saving of outlay in the purchase of dairy utensils, in the annual expenditure for repairs, and many smaller considerations.

Under the second head, *Superiority of Produce*, a still greater advantage is obtained. It is not pretended that a factory is a talisman which makes good cheese by magic; but it is claimed for the factory system that cheese made in large quantities, by skilled workmen, using the most approved machinery, and working by definite rules, will make cheese of better and more even quality than that made in the majority of farm-houses. No doubt the very best cheese-makers will make as good cheese at home as can be made in a factory; but, as a practical fact, the quantity of the prime article thus produced is very limited, and the ordinary private make of American cheese fetches in the market at least 10s. per cwt. less than that made in factories.

Origin and Development of the Cheese-factory System.

The earliest attempt at establishing an associated dairy, so far as I know, was made in the year 1848, in certain counties of Ohio, United States. The method adopted was the following:—Some person or persons having erected a suitable building, and furnished it with the necessary apparatus, would purchase "curd" of the neighbouring farmers, who brought their product to the factory, saw it weighed, and received a stipulated price per pound. Curd, as we have seen, is the first solid stage in the manufacture of cheese, the quality of which depends on the manner in which it is produced and treated. Now, as nearly every make of curd differed from nearly every other, it was clearly impossible to produce good and uniform cheese from such diverse elements. This attempt therefore failed. The next attempt was really involuntary, and was resorted to in the hope of averting the consequences of a little excess of "smartness." It appears that a Mr. Jesse Williams, a farmer living near Rome, Oneida County, New York, was a very skilful cheesemaker at a time when American cheese was generally poor. He therefore obtained a ready sale for his cheese at high prices, there being great competition amongst the dealers to secure the product of his dairy. In the spring of 1851, or nearly 20 years ago, one of his sons married, and commenced farming on his own account. The father, however, took an opportunity of selling, in advance, the whole of the cheese to be made during the ensuing season in his own and his son's dairy, at a very high price. When this little bargain was made known to the son, he naturally expressed his doubts as to being able to fulfil the contract; for although his father was a great cheesemaker, he was not. Here was a difficulty; but the contract being a remarkably good one, Mr. Jesse Williams determined that, by some means or other, the difficulty should be overcome. The curd system had been exploded; it would be highly inconvenient, if not impossible, to superintend cheese-making at two different farms every day; so, finally, it was suggested that the son should deliver his milk every day to his father's dairy. As Mr. Willard has remarked, "from this thought sprung the idea of uniting the milk from several neighbouring dairies, and manufacturing it at one place."

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* *Journal of the Royal Agricultural Society*, 2nd series, vol. vi., part 2, page 519.

The example thus set by Mr. Jesse Williams was not immediately followed, but his factory was the object of many a pilgrimage by American dairymen. After the lapse of three years, however, it appears that some of his brother-farmers, encouraged by his continued success, managed to establish four new factories in the year 1854. Two more were erected in 1855, three each in 1856 and 1857, and four each in 1858 and 1859. Thus, by the end of 1859 there were 21 cheese factories in existence, and all in the State of New York. We now come to another period of development, coincident with a remarkable increase in the exportation of American cheese. Seventeen factories were established in 1860, eighteen in 1861, and twenty-five in 1862. Then follows what I have termed the third period in the development of cheese-factories in the State of New York, a period which is characterised by the almost total abandonment of cheese-making in private dairies, nearly the whole of the milk being sent to the factories. The figures are very remarkable, no less than 111 factories having been erected in 1863, and the maximum of 210 in 1864. From this time the numbers decline, for, wonderful as are the resources of the Empire State, there must be a limit to the number of cows it can maintain. However, 52 new factories were erected in 1865, and 46 in 1866. I have calculated that, assuming an average of only 400 cows to each factory, which is a very low estimate, the milk of 200,000 cows was made into cheese in these factories in the year 1866. Since then, the movement has extended, and been still further developed, as we shall see presently.

In 1862, the cheese-factory system was introduced into the State of Ohio, where it became rapidly developed, and it has since penetrated other States of the Union as well as British America. Great, however, as was the previous extension of the cheese-factory system, it had not reached its climax until the commencement of this year, as will be seen by the following extract from the report of Mr. T. D. Curtis, of New York State, to the Department of Agriculture, published in the "Report" of the Department for August and September of this year:—"Making allowance for old factories discontinued, we think that at least 200 factories have been added to last year's number in this State (New York) alone. In Ohio, Illinois, Iowa, and Wisconsin, large numbers of new factories have opened this season. We have no accurate information as to the number, but it is the opinion of good judges that the number of cheese-factories in the country has been doubled. The number of cows, however, has not been materially increased, though a good many have been diverted from butter-making to cheese-making. In the older dairy regions, the increase in the number of factories has not materially increased the make of cheese. The tendency is to smaller factories and carrying milk shorter distances. Most of the new factories in central and northern New York divert patronage from older factories, and absorb private dairies. In the Western counties they take cows from butter-making. So also in the Western States, which are this year making not only enough cheese for home consumption, but are shipping quite freely for the first time to New York. It is calculated that the new factories this year will add fully one-sixth to the total make of cheese."

The latter portion of the foregoing extract refers to a variation in the cheese-factory system, which has recently risen into favour in the United States. It is known as the branch-factory system, and is distinguished by the cheese being made at several branch factories, each receiving the milk of about 250 or 300 cows, and then conveyed to the central factory to be cured and sold. No doubt, where roads are bad, it is important that the milk should be conveyed only a short distance, and in such localities branch factories tend to remove one great objection to the factory system. But with such roads as we possess in England, it is not probable that branch factories will ever be erected in large numbers.

Organization of Cheese Factories.

Under this head I cannot do better than quote from a letter which I have received from Mr. Willard, in answer to my inquiries on this subject:—

"There are but few factories where the milk is purchased and business carried on wholly under control of one or more proprietors, thus making it a separate and distinct interest from that of patrons.* The popular method of organising factories, and one which seems to give the best satisfaction, is to make them joint-stock affairs.

"The ground is selected, an estimate made of buildings, machinery, and fixtures; then the whole cost is divided up into shares of 50 or 100 dollars each.† The neighbouring farmers, or those favourable to the movement, take stock in proportion to the number of cows from which they are to deliver milk. Officers are chosen, and the company managed on the joint-stock principle. Usually, some one of the party is selected as salesman, who makes sale of cheese at best prices, makes up the dividends, and pays over shares to patrons whenever a sale is effected, deducting, of course, the price of manufacturing, which is fixed at a point to cover any expenses, including ten per cent. on cost of buildings and fixtures. A good cheese-manufacturer is employed as manager, either at a salary or at a certain price per pound of the cheese made. This manager employs his own labourers, and is at all the expense of running the factory, keeping record of milk delivered, entering it in books of the company, and on the pass-books of farmers; and also is to care for the cheese while curing, &c., &c. The milk is weighed at the factory as it is delivered, as experience has shown that every 10 lbs. of milk will, on an average through the season, make 1 lb. of cured cheese, firm, solid, and in good marketable condition. Each farmer thus has a daily record in his own pass-book of what his herd is yielding.

"The manager is employed with the understanding that he is to make a good article, and his product is examined from time to time by committees of the company and experts, and by farmers, when they deliver milk as they choose, and hence any mismanagement is soon discovered. If his work is not satisfactory he is discharged, or held responsible for damages.

"The stockholders and those delivering milk meet from time to time and deliberate as to sales, each voting according to his number of cows; and thus instructions are issued to the salesman.

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* In the United States and Canada the farmers who send their milk to a factory are termed its "patrons."

† £10 to £20.

"But there is another method. One man, or a company, erects buildings, and is at all expense in running the factory, charging by the pound for manufacturing. In this case, the farmers of a neighbourhood bind themselves under contract to deliver milk at the factory for a series of years, as an inducement for the investment of capital in the factory, &c. In this case the manufacturer, or proprietor of the factory, has no interest or claim upon the cheese, which belongs to the patrons. They appoint a salesman, and control the product precisely as in the first instance.

"It will be seen that, under this system of checks, every one delivering milk is upon an equality, as each man, if he choose, can weigh his milk at home, and compare it with the weight of the factory as entered on his pass-books. The company is responsible for milk delivered, the account being payable in cheese. In other words, the institution is a kind of bank, where milk is deposited instead of money."

In addition, I will merely remark that, as a general principle, it seems to me far better for the farmer to make a factory his bank than a factor his banker.

Extension of the System.

Having endeavoured to give an idea of the cheese-factory system, let me pursue the subject a little further, and describe what other associations it has already produced, and endeavour to show that it contains the germ of what I venture to term co-operative agriculture. The cheese-factory system having proved so successful in America, notwithstanding the sinister predictions and even the active hostility of a multitude of farmers and factors, it is natural that we should look there in the first instance for evidences of its further development. These we find in two other branches of dairying. The first of these off-shoots of the cheese-factory system was termed by its originator (Mr. Alanson Slaughter), a Creamery Association; and by this name are still known numerous joint-stock establishments for the supply of large towns with milk and cream. Mr. Willard states* that "within a few years past 'creameries' have been established within convenient distances along the route of the railroad, where the milk is cooled, and there shipped to the depôt. Here farmers daily deliver their milk, night and morning, as at our cheese-factories, where it is measured and credited, and no further trouble is had with it on their part. At the creameries, however, a very important operation has to be performed, viz., that of cooling the milk. As the milk-trains run only once a-day, a portion of the milk when it arrives in New York, and is ready for the milk-carts, is 36 hours old. To carry milk sweet for that length of time in hot weather requires some art in handling, and this seems to be well understood by the Orange County farmers. The milk, as soon as it comes from the cow, is strained, and put in long tin pails, which are set in water, care being taken that no portion of the milk be higher than the water. These pails look like sections of stove-pipe, being 8 inches in diameter, and from 17 inches to 20 inches long. The milk is occasionally stirred so as to keep the cream from rising. It is deemed important that the animal heat be removed as soon as may be, at least in an hour's time after it comes from the cow. . . The milk stands in the pails until ready to be carted to the trains, when it is put in cans holding from 50 to 60 gallons."

The other development of the factory system has taken the form of butter factories. Their establishment was in great measure forced upon the farmers in consequence of the counter-combination amongst town dealers in milk, after they perceived the effect of the creamery associations. The interests of the producer and those of the dealer were of course antagonistic, but the farmer was placed at a disadvantage, in consequence of the perishable nature of his commodity. The butter-factory system, however, rendered him quite independent, as he could convert his milk, if need be, into an equally saleable commodity; possessing higher keeping qualities. In addition to this, he reaped similar advantages with regard to quantity and quality of produce, as well as economy in production, at the butter-factory, as he had previously done at the cheese-factory. In fact, we are told "that the butter factories have been a great success, because they have been enabled to turn out a very superior article, uniform, and one that can be relied upon in the market. This uniformity and superiority in the quality and flavour of the butter made at these establishments are such that it is eagerly sought after, and commands extraordinary prices.'

The only point in the management of a butter-factory which it is necessary to notice in this paper is the manner in which the manufactured article is disposed of. The butter is usually entrusted to persons who are known as "captains," and who make it a business to collect it from the factories for sale on commission. Mr. Willard remarks that "these captains go with their "freight" twice a week, are men of standing and responsibility, who are well posted in the trade, and know how and where to obtain the best prices." Special offers for large lots of butter are sometimes received by the captain, but in such cases the decision rests with the authorities at the factories.

Swedish Dairy-factories.

Leaving, now, the American Continent, let me describe briefly what has been done in the same direction on the Continent of Europe. Beyond the primitive associations of Switzerland, there is, so far as I know, but one country, viz., Sweden, to which I can turn for examples, and there the dairy-farmers have eminently succeeded in profiting by the American example, and both their butter and cheese now command high prices in the English market. In a letter received this summer from Mr. Juhlin Dannfelt, that gentleman informs me that "the greater part of the land of Sweden is divided into small farms, which are cultivated by the peasants owning them, and on which the number of cows kept for breeding, or for the production of milk seldom exceeds ten or fifteen. The quantity of milk obtained on these farms is therefore small, especially as the animals generally receive insufficient nourishment during the long winter. One consequence has been that, as large quantities of milk are indispensable for a regular and rational method of dairying, this branch of industry has not, until lately, been developed to any considerable degree, although the climate, the nature of the country, and the manner of living of its inhabitants, are all favourable to its advancement. In order to further this object, various measures have been taken during the last ten years, both by the government and by agricultural societies, and efforts have been directed towards drawing the attention of the small farmer to the advantages to be gained by the application of the idea of association to this branch of husbandry. These endeavours are, however, of too recent a date to have as yet produced any very obvious results; but from what has already been gained, it is evident that the dairy-factories constitute the most powerful means of obtaining, on small farms, a considerable revenue from dairy produce. The price which the milk has realised by such associations greatly exceeds what the small farmers—especially those in the northern provinces—have hitherto been able to obtain for it single-handed. The system is therefore gaining ground daily, and is exercising a beneficial influence on this class of farmers, as well as stimulating a more careful treatment of the cattle; and this influence is already reacting in a salutary manner on the other branches of agriculture.

"The modes in which dairy-factories have hitherto been arranged varies in different places. In some districts a person—generally some wealthy farmer—

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* Trans. New York State Agricultural Society, 1865, pp. 245 and 246.

purchases, at a certain price, the milk produced on neighbouring farms, and subsequently prepares butter and cheese from it, the owners or tenants of the farms taking no part either in the profits or losses. In other places, on the other hand, where more agreement and confidence prevail between neighbours, several persons residing within the same village, or in each other's neighbourhood, have established a dairy-factory, which is worked on the account of all the proprietors, and the profits of which are divided *pro rata parte*. The best results have been obtained by the latter method; and it will, beyond doubt, become the more general, being of incomparably greater advantage to all concerned."

Sweden thus affords an example of the adoption of the system of association in a small-farm district, where peasant proprietary is by no means rare, and it seems to me that this example is, at the present moment, of the highest possible interest to those who seek to improve the agriculture of Ireland, and the condition of the small farmers. I trust, therefore, that I may be pardoned for giving an extract from another of Mr. Dannfelt's interesting letters, as it may have an influence on one of the most important agricultural products of the south of Ireland, I mean butter, of which about 400,000 firkins are annually exported from Cork:—

"A farmer who resides in the neighbourhood of Stockholm, and who, though almost blind, has nevertheless devoted himself, with unshrinking energy and great perseverance, both to the theoretical study and the practical management of butter and cheese-making, commenced, a few years ago, purchasing milk from neighbouring farms for making butter; the skim-milk being partly sold in the markets of Stockholm, and partly made into skim-milk cheese. The favourable result of his endeavours caused him gradually to extend this business, for which purpose, and in order to obtain an easy sale for the buttermilk, he established a central dairy in the capital, to which cream was brought from the numerous places where the milk was received from neighbouring farmers; the unsold skim-milk, on the other hand, being made into cheese at the places where the milk was delivered, and where branch dairies were erected. This business has, within a few years, been extended to such a degree that, during this spring, the quantity of milk purchased by the farmer and employed in the above-mentioned manner, has amounted to 4,000 gallons per day. During a previous year he had associated with himself a capitalist, likewise warmly interested in this branch of husbandry. The production of milk, however, being constantly on the increase, and its price having on account of that considerably diminished, the partners have now decided upon transferring the entire business to a limited company, for the purpose of extending it in such a manner as circumstances may require, and render profitable. Of this company, they themselves are the largest shareholders.

"The object of the company is to purchase milk at different places, situated within the provinces surrounding the lake "Malar," for the making of butter, cheese, and other dairy products, partly on the spots where the milk is delivered from the surrounding farms, and partly at the central dairy at Stockholm. The branch factories are to be established partly near railway-stations in daily communication with the central factory, and partly at places from which a daily communication with the capital cannot be reckoned on all the year round, and which latter, on that account, must be so arranged as to be able to carry on a more independent existence.

"Branch dairies, at places which are in daily communication with the capital all the year round, are established by the board of directors whenever and wheresoever they find it advisable. The establishment of branch dairies in districts which are deprived of daily communication with the capital requires more direct co-operation between the company and the neighbouring dairy-farmers; but such dairies are always established as soon as sufficient means, by subscription for shares, have been obtained at the place, and a guarantee has been given for the delivery of the requisite quantity of milk."*

Adoption of the American System in England.

Under this head I propose to give a summary of the steps which have been taken towards the introduction of the system of associated dairies into England. I regret that the more striking of the two endeavours which have been made does not at present possess the characteristic features of a truly commercial enterprise. This deficiency is, however, to the farmer, more than counterbalanced by another and a greater advantage. I mean, by the evidence which it affords of the good understanding which exists between landlord and tenant in the dairy district of Derbyshire. Whatever may be the ultimate result of the experiment from a pecuniary point of view, there is no doubt in my mind that the energetic and enlightened manner in which the experiment has been projected and sustained by some Derbyshire landlords, has convinced many of their tenants that the interests of themselves and their landlords are identical. Considering how wide-spread is the belief amongst the smaller class of farmers, that what benefits the landlord must necessarily be taken out of the pocket of the tenant, I cannot help feeling that the Derbyshire experiment is likely to have a very beneficial effect, entirely apart from the question of the merits or demerits of the American system of associated dairies.

Leaving this aspect of the question, I wish to give a very brief history of the English cheese-factories. Three of these factories have been in operation during the past summer, viz., two in Derbyshire and the other in Cheshire.

The Derbyshire Factories.

At the annual dinners of the Midland and the Derbyshire Agricultural Societies, held in the autumn of last year, the cheese-factory system, its results, and its effect on the English dairy-farmers' interests, were prominently brought before the notice of Derbyshire dairymen, in the former case by a tenant farmer (Mr. Nuttal), and in the latter instance by a Derbyshire landlord (Mr. J. G. Crompton). The words thus spoken were vigorous and well-timed, and they produced a corresponding result. I need not trouble you with a history of the subsequent meetings, the appointment of a committee, the discussion on its report, and the other details which led to the final result. I have, however, taken a lively interest in the whole of the proceedings, and I must own to having failed to make much impression on the Derbyshire dairy-farmers in the preceding spring, when engaged in collecting materials for a report on the factory system and its adaptability to the English dairy districts, for the Royal Agricultural Society.

It is sufficient for me to state that, by the beginning of last April, an adequate guarantee fund was subscribed, a suitable building secured in the town of Derby, and a manager obtained from the United States. The chief subscribers to the fund were our chairman (Lord Vernon), the Hon. E. K. Coke, and Mr. J. G. Crompton; and their efforts were ably supported by Mr. Alderman Roe, Mr. Nuttal, Mr. Gilbert Murray, and other farmers and landlords. The building secured for the first cheese-factory is a warehouse which had formerly been used for storing cheese. It adjoins the timber-yard of Mr. Alderman Roe, who has generously allowed the guarantors to use it rent-free for the first year. As the model of this factory has been already described, and is on the table before you, I need say very little more about it. The probability of its success, however, induced the guarantors to make another venture. After some considerable difficulty, and after canvassing the tenants on the different estates in the neighbourhood, it was found that the tenants on the estate of the Hon. Mr. Coke, and in the vicinity of

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* *Journal of the Royal Agricultural Society*, 2nd series, vol. vi. part 2, pp. 329 and 330.

Longford, were willing to send a sufficient quantity of milk to a second factory, if it were erected at Longford. Mr. Coke thereupon undertook to build the factory, and to give it and the plant charge free to the guarantors for one year. This matter being arranged, a second manager was telegraphed for from America, and thus the guarantors have been enabled this season to test the merits of the American system under a variety of conditions, viz., (1) in a town, and in an old building adapted to its present use; and (2) in a rural district, in a building specially designed for the purpose. I wish to state my opinions on these experiments with due submission. They are (1) that a factory is likely to be more successful in a rural district than in a town; and (2) that where an old building as capacious and as suitable as the Derby factory can be procured, it is not worth while to build a new one.

Until after the close of the present year, it will be impossible to say what are the pecuniary results of the Derbyshire experiments; and even then it will be difficult to place the account on a purely commercial basis, as both factories and their plants are lent rent free, while, on the other hand, large sums have been spent in bringing from America and keeping in England two skilled American cheese-makers.

Two items, however, are very striking, viz., labour employed, and price of produce. At the Derby factory, two men and a boy are sufficient to make and cure the cheese yielded by the milk of 300 cows; and at the Longford factory, the milk of nearly 500 cows is treated by two men and two boys. Then, with regard to receipts, without going into details, as the guarantors have not yet published their financial statement, it is sufficient to mention that the cheese hitherto sold has obtained prices varying from 80s. to 85s. per cwt. I will ask, however, how many private dairies in the county of Derby can boast of such a result?

Doubtless, there are many points of detail which require improvement, such as the more economical disposal of the whey, especially at the town factory; and a more important consideration is the proper cooling of the milk before it is sent to the factory. These and some other items might be profitably discussed before a more purely agricultural audience, but here I will merely refer back to what has already been said as to the system of cooling milk adopted at the creameries, and ask the promoters of the Derbyshire factories whether they cannot obtain a hint by carefully considering it.

The following list of rules and bye-laws will give a better idea of the manner in which these establishments have been worked than any mere description:—

Rules of the Derbyshire Cheese Factory Association.

"That this association be called the 'Derbyshire Cheese Factory Association.'

"That it be managed and governed by a central committee, the members of which shall be those persons subscribing no less a sum than fifty pounds to the guarantee fund, or their agents, and the representatives of the managing committees, of not more than three members from each. Seven members of such central committee to be a quorum.

"That the central committee shall appoint a managing committee for each factory; such committee not to exceed six members, two of whom shall be selected from the suppliers of milk to such factory. These committees to have the entire control of their respective factories, and of the officers of such factory, the manufacture of the cheese, and the disposal of the whey. A sub-committee of not more than three members, including the chairman of such managing committee or his deputy, to be appointed the finance committee, and for the sale of cheese at such factory.

"That the managing committee of each factory shall have power to make such bye-laws as they may consider expedient, and carry them into effect. Such bye-laws to be submitted to the central committee.

"That Messrs. Crompton, Newton, and Co., of Derby, be the treasurers of the association.

"That the central committee shall appoint a secretary to the association, who shall be required to audit the manager's books of each factory every month, prepare reports and accounts for such committee; record the minutes of their meetings, and carry out their instructions; pay the suppliers of milk their due, and transact generally the business of the association.

"That all payments above £1 shall be made by cheques signed by the chairman (or his deputy) of the managing committee of the factory to which such payments belong, and the secretary.

"That the accounts of each factory be kept separate and distinct.

"That persons supplying milk to either of the factories shall be required to send, twice each day, the pure milk from the whole of their dairy cows (except such milk as shall be required by them for their family consumption) during the manufacturing season, the termination of which shall be determined by the managing committee of each factory.

"That the terms for the current year on which the milk is to be obtained shall be a guaranteed payment of sixpence-halfpenny per gallon, of ten pounds weight, payable the first Friday in every month, between the hours of ten and one o'clock, at the secretary's office in Derby, together with a share of the profits of the factory, according to the quantity of milk supplied (after payment of working expenses of such factory), which shall be paid as soon after the close of the manufacturing season as the central committee can arrange.

"That the manager of each factory shall have power to refuse milk that is of an inferior quality, sour, dirty, or otherwise impure, without reference to the central committee; and any person detected in sending milk that has been skimmed or adulterated shall be reported to the central committee, and render himself liable to a forfeiture of his share of the profits that may be derived from the factory, and not be allowed to supply milk to it afterwards.

"That every supplier of milk shall sign a declaration that he will submit to the rules of the association, and the bye-laws made for the proper working of such factory with which he is connected. And in case of his failing to comply with such rules and bye-laws, he shall forfeit all claim to any profits that may be derived from such factory, and not be allowed to supply milk to it afterwards. But in case of his inability to supply the milk from the number of cows he had previously declared, under circumstances over which he has no control, he may be relieved from his agreement on such terms as the central committee shall decide to be just and proper.

"That persons on the working staff of either factory shall not allow the admission of any person, other than a guarantor, or by the written consent of one of the managing committee, to such factory, excepting he be on business connected therewith.

Bye-laws of the Derby Factory.

"No milk will be received after half-past seven o'clock in the morning, and half-past seven o'clock in the afternoon.

"Milk from a newly-calved cow must not be sent under four days after the cow calves.

"The cans used for carrying milk to the factory, and other utensils connected therewith, must be kept thoroughly clean and sweet.

"Cans for carrying milk to be supplied by the committee at cost price.

"A ticket of the weight of milk received at the factory to be given to the person who brings the milk each time.

"I, the undersigned, do hereby declare that I will agree to supply the milk of cows to the Derby Cheese Factory, on the terms stated in the beforementioned rules and bye-laws, and that I will submit to, and carry out, the said rules and bye-laws, made and to be made, during the season for making cheese in this present year, 1870.

"Signed————
"Date————

"Witness————"

The Cheshire Factory.

The remaining English cheese-factory is on a more modest scale, and owes its existence to the enterprise of Mr. G. Jackson, of Tattenhall-hall, near Chester, who has advocated the adoption of the factory principle for many years. The following account of his factory is in his own words, as given in a letter which I have recently received from him:—

"It will be seen from your favourable review of my farm management in the "Report of Cheshire Dairy Farming," in the *Royal Agricultural Journal*, vol. vi., part 1., pp. 172-3, that my arrangement here is for 110 dairy stock, and two miles off I hold a dairy farm with 40 cows. Since the cattle plague I have been gradually decreasing the sheep flock and adding to my dairy stock, and this summer at both farms I have had in milk 90 cows, and purchased the milk from only one farm of 12 cows. In adopting the cheese factory system on a small and safe scale, I had in contemplation

"1st. To bring all the milk from the three homesteads to one place, and put it under skilled management.

"2nd. To save labour, and so reduce the cost of cheese-making.

"3rd. To dispense with the annoyance of having together dairy and domestic servants, leading to frequent misunderstandings, and worse.

"I am happy to be able to assure you that, so far, the experiment has more than realised my expectations, although the season has been most unpropitious, both as to quality and quantity of milk, owing to the hot, dry summer.

"For the milk I have purchased, I have paid 6½d. per 10 lbs., and as a gallon of milk should weigh 10 lbs. 8 ozs., it follows that I have given 6¾d. per gallon. We cannot, until the end of the year, tell the quantity of cured cheese obtained per gallon, but in the month of July (the cheese sold early in September) 10 lbs. 14 oz. of milk gave but 1 lb of cheese, so that either the milk in July, owing to the hot, dry season, was unusually poor in casein, or we shall not equal the American factories, who average over 1 lb. of cured cheese from 10 lbs. of milk.*

"From the whey we take per week about 8 oz. of butter per cow; this and the sour whey for the pigs will more than pay the expense of working the factory, and as milk at 6½d. per 10 lbs. is equal to 72s. 6d. for 120 lbs., at 10 lbs. 14 oz. for 1 lb. of cheese (and the price I made was 75s.) I have no cause to regret having given 6½d. for the small quantity of milk I purchased, although the farmer got the advantage equal to 72s. 6d. per cwt., or 10s. per cwt. more than those small farmers who have made their cheese at home.

"A register is kept in which is recorded—1st. The date. 2nd. The temperature of the dairy and of the milk at the time the rennet is added. 3rd. The weight of the milk in each vat or cheese-tub. 4th. The number of drachms of rennet. 5th. The time required for coagulation. 6th. The number of lbs. of curd when the salt is added, and the quantity of salt used. [In April and May it was 1 lb. of salt to 40 lbs. of curd; in the summer, 1 lb. to 35 lbs. of curd; and now, autumn, 1 lb. of salt to 35 lbs. of curd.] 7th. The time the cheese is put in the vats; 8th. The number of cheese made. 9th. The date when each cheese was made. From this it will be seen that for the old Cheshire rule 'of thumb,' we have substituted a systematic rule, which cannot fail to give more satisfactory results."

It must be noted that the Derbyshire and the Cheshire experiments differ in one important feature—the former is the result of enlightened liberality on the part of landlords; the latter is the consequence of commercial enterprise on the part of a tenant. The inference, therefore, seems just, that the cheese-factory system, properly managed, will be a national as well as an individual benefit. In another feature, however, both experiments present a striking coincidence, viz., in being based on the system of the purchase of milk. I regard this coincidence as striking, because, both from America and Sweden, as I have already stated, my informants remark that this system has been found to produce the least satisfactory results. The reason of its adoption in these English endeavours was simply, I believe, that the farmers were either materially unable, or mentally unwilling, to run any risk in the experiments. Therefore the promoters of these factory-schemes were obliged to pay the farmers for their milk a price even larger than that they usually obtained for it in the form of cheese, besides taking the labour and risk off their shoulders.

I have stated that the cheese-factory system had its origin in America, in consequence of an excess of "smartness" on the part of Mr. Jesse Williams. I am sorry to be obliged to add that its adoption in England has been attended by an analogous phenomenon. One of the cheese-makers who were engaged by the Derbyshire committee (Mr. Levi Schermerhorn) has taken out a patent for cheese factories, and the implements used under the American system of cheese-making; he has, in fact, patented the Longford factory and its appurtenances. In England we do not interfere with the liberty of the subject so long as the subject does not violate the law; and if a man chooses to amuse himself by taking out useless patents he is allowed to spend his money in that manner. If I were to apply for a patent for the establishment of Societies for the Encouragement of Arts, Manufactures, and Commerce, for instance, the patent would doubtless be granted, with the usual formalities of payment of fees, Great Seal, and so forth; but I doubt whether our worthy secretary would be really apprehensive of my success in an action at law against him for the violation of my patent, years before it was granted, in the establishment of the Society before which I have the honour of reading this paper. Therefore the dairy-farmer need not tremble.

Co-operation in Agriculture.

I now turn to the subject indicated by the second division of the title of this paper. By the term "co-operative agriculture" I do not refer particularly to those joint-stock farming companies which have recently attracted considerable attention. I attach to the phrase a much wider signification, and this evening it has been my endeavour to trace the history of the development of its most vigorous manifestation. We have in England, however, other examples which bear the impress of a vigorous youth; such are, for instance, the Driffield Linseed Cake Company, the Northumberland Steam Cultivation Company; but, with regard to the utilisation of our home-grown produce, co-operation in agriculture can, as yet, hardly be said to have come into existence; but the efforts recently made towards the establishment of cheese factories shows that the day has nearly gone by when the English farmer will continue to be both producer and manufacturer. Butter and cheese are probably the only remnants of a system which once extended to all the wants of daily life, from the bread that was eaten to the clothes that were worn. The American farmer and the Swedish peasant-proprietor have both gone a step further. They produce the milk, and send it to the manufacturer to be made into butter or cheese. This is as much a matter of course to them as it is for the English farmer to dispose of his wheat to be ground, and of his wool to be woven.

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* The American factories this year, during the months of May, June, and July, averaged 1 lb. of cheese to 10·54 lbs. of milk, instead of the usual rates, 1 to 9·97.

The reasons why a practice, which has been so long abandoned by us in the instances of corn and wool, should still be retained in the case of milk are simply these—first, corn and wool may be kept for months or years after they come into the farmer's hands, while milk must be dealt with in a few hours; therefore, without co-operation, it has been a necessity to manufacture the milk at home into a product that will keep, except where there exists a daily market for it at a moderate distance. A second reason is, that the processes of cheese and butter manufacture leave a residuum which, until now, could not be dealt with profitably except on the farm; but this is not the case with the other articles of agricultural produce.

The cheese-factory system meets both these requirements of the milk producer; therefore I believe it will ultimately succeed.

I am not aware that any organisation or company comparable with a butter-factory exists either in England or Ireland; but with regard to milk the case is different, as the Aylesbury Dairy Company, for the supply of London, and Harvey's Dairy Company, for the supply of Glasgow, are both founded on the same principle as the cheese-factory experiments which I have already described—that is, on the basis of the *purchase* of the milk.

The further development of the principle of co-operation is a striking characteristic of continental agriculture. Every student of foreign farming must have noticed the great extent to which "industrial crops," as they are termed, are grown in certain parts of France, Belgium, and Germany. Sugar-beet, one of the most important, is a fair example. It will not bear the cost of being conveyed a long distance, it will not keep for an indefinite length of time, and the residue of the sugar factory or the distillery can be profitably used only on the farm. But the farmer is enabled to grow this very lucrative crop by co-operation with the manufacturer.

I do not intend to discuss the comparative advantages and disadvantages of growing sugar-beet in England—the question is too large and too complicated; but it seems quite clear that, if the beet-sugar manufacture is to be established in England, the farmers and the manufacturers must co-operate for that purpose. At present, the farmer does not grow the root because there is no sugar-factory in his neighbourhood, and the manufacturer does not erect a factory because no sugar-beet is grown.

Similar reasons have prevented the extension of the cultivation of another lucrative crop, vix., flax. The English farmer will not grow it for straw (its most valuable portion) because it must be retted before it is sold if he wishes to obtain the fair value for the fibre. His people do not understand the process, and the quality of the fibre is, therefore, more or less ruined. But if the example of the Belgian farmer were followed, the flax would be sent to an English Courtrai, to be retted by competent people, just as, under the system of associated dairies, milk is sent to a factory to be made into butter or cheese by a skilful dairyman.

DISCUSSION.

Mr. Botly said that if a company was to be formed on the co-operative principle, they must not expect any great profits to result from it. There must be security of tenure for the tenants, so that they may be reimbursed for their capital and labour.

Mr. Trask said he had taken a great interest for over twenty-four years in, and had made many tons of, cheese, but, as a Somersetshire man, he differed from Mr. Jenkins in his description of the system of making English cheese. He could produce cheese made in the Somersetshire dairies at a price that would beat the American, and be better in quality. The greater part of English cheese was of middling quality; still there were some cheese-makers who do make a superior article. The price of 6½d. a gallon for milk would not do, in his opinion. At the early part of the season it would not make a pound of cheese, but at the latter end of the season a gallon of milk would make above a pound. Mr. Jenkins had not said anything about the value of the whey, which he looked upon as very important.

Mr. Nuttall would just say that the whey ought to pay the working expenses of the dairy. He felt sure that cheese could be made at 2s. 6d. per cwt., and not 7s. or 8s., as stated by Mr. Jenkins. This was a difference at once of 5s. England could make cheese that would be unequalled by any other country. He would undertake to say that the American cheese was not a bit better cheese than the English. There might be dairies that could produce as fine, but not finer cheese than he could, in this country; and he would not hesitate to say, that in this country it was made quite as good as in any other.

Mr. Neild congratulated Mr. Jenkins upon not only bringing up the question of the quality of cheese, but also the question of competition with the Americans. He tendered him his thanks, as an old farmer's son, for his having introduced this question in London. If proper attention had been paid to the industry in England, it would not have been necessary to have touched upon it at all. The delicate fingers of the dairymaid were most valuable. It was a remark of his father's, that if a man wished to be successful, he must marry the dairymaid—in other words, the wife must be the foundation of the dairy. Cheese was not to be made by limited liability companies, but by co-operative associations. What must be patent to all was the gradual improvement in the quality of the cheese which was received from the United States. The spirit of competition was starting up all over the country. He was pleased that the gentlemen present had taken up the question, which augured well for England.

Mr. Greening (of the Agricultural Co-operative Society) said a clear distinction must be drawn between a joint-stock company and a co-operative company. A joint-stock company, as he understood it, was where the capital was found by one class, and the use of the society by the other. The profits belonged to the capitalists, and the management was placed mainly in their hands. If a joint-stock company is very profitable, the shares are bought up for the sake of the dividends. If it fails the shares again go down; but the co-operative undertakings in Lancashire and Yorkshire, which have been so successful with the Society which he represented, were based upon the condition that the capitalist should take a fair interest, and that all interest of the profits should be taken by the users of the factory. The working men of Lancashire and Yorkshire had gone so far as to have three buyers of their own out in Ireland collecting the butter for themselves. Could not the English farmers unite and compete with this, and put a little profit into their own pockets?

Mr. Hayes said the factory system was started in America. A number of farmers met together, and it was agreed that a certain number should find milk sufficient to work the factory. One or two built the factory at their own expense, and in return were paid a small sum per pound; others looked after the making, and that included their capital. In Wiltshire, Dorsetshire, and the whole West of England, the average of English cheese was deteriorating in value yearly; on the other hand, American is yearly improving. The quality this season of English cheese was very low. What was wanted was a school for cheese-making. The dairymaid who can make good cheese has the greatest objection to tell her neighbours how she does it, because she is afraid she will not get a good price for her own. Under the factory system all that sort of thing is done away with. In this country there are upwards of 80,000 lbs. a year of English cheese made. If they reduce the cost of making that from 7s. 6d. to 2s. 6d., what a saving that would be to the dairy-farmer.

Mr. Rigby agreed with Mr. Jenkins that, in regard to economy of production, there is a very great advantage on the side of the American plan. He did not, however, agree with him in what he said in regard to the mode of making cheese in Cheshire. He knew it was the practice to put the milk together, and to be guided very much by the touch, but he believed that the thermometer was now very largely used. In Cheshire, the residuum of the milk was used for the pigs. The farmer argues that if he sends his whey away he prevents the fattening of his pigs, and thus loses manure, which is very valuable to him. He believed Cheshire cheese as now made to be better than American; but if they could make cheese on the same extensive scale as they do in America, it would be to the interests of the farmer to adopt that system.

Mr. J. G. Crompton said he was a member of the Derbyshire Committee of Management of the cheese factory about which they had heard so much that evening in the paper read. It was asked what do they do with the whey in America, and how is that whey utilised in an English factory? In America the co-operative system is carried out pure and simple. The proprietors of the factories are the resident factors or farmers, who come together, build their factory, buy all that is necessary, appoint their managing committee, make the best cheese they can, sell it, and, at the end of their season, divide the profits. The profit on the sale of the hogs is divided among the contributors, and in some factories the contributors have a right of taking back whey in proportion to the milk that they have supplied. With regard to the associations which are in existence and working in Derbyshire, they are not at the present moment conducted on a complete co-operative system, simply because it was not probable that any number of farmers would come together and enter at once upon an entirely new system, which would involve a great amount of risk and a large amount of capital. The only method of giving the system a trial was by following the Derbyshire plan. Landowners and farmers interested in the experiment came together and a guarantee for a large sum of money in case of its proving a failure was got together. So far as the experiment had gone it had been successful, the expectations being more than realised. The highest price realised this year has been between 70s. and 80s. per cwt.

Professor Voelcker, F.R.S., thought it would be well if two things were kept totally apart in the discussion—first, the system of co-operation as applied to the manufacture of cheese; and, secondly, the mode of operation adopted in the manufacture. A good deal had been said about the American plan of making cheese, but the Americans had simply adopted the only plan calculated to produce good cheese on a large scale. He agreed with Mr. Rigby, that co-operation had produced good milk in London, and co-operation produced a very much better class of cheese than that had at the present time. He believed that co-operation would be beneficial to poor farmers, and he was an advocate of the Cheddar system of manufacture. Cheese could be made of excellent quality, in Scotland, Derbyshire, America, or anywhere, under a system of co-operation. The land had very little to do with the quality of cheese, which really depended principally on the hands which made it. He should observe that this Cheddar cheese was produced by a plan which could be followed by any ordinarily intelligent man.

Mr. Hayes said, from his experience, Cheshire cheese did not fetch the highest price.

Dr. F. Crace Calvert, F.R.S., said he had heard in Lancashire and Cheshire, that, with a large number of farmers, it was not a question of making good cheese, but of making cheese at all; they had a great sale for the butter, and it paid them better to sell the butter, and make poor cheese, than to make good cheese and no butter.

Lord Lichfield complained that the discussion had been allowed to dwindle into a controversy on subjects totally irrelevant to the question in hand. They had perfectly succeeded in establishing co-operation in Derbyshire. He should be happy to put before the public a statement showing the entire history of the movement.

The Chairman moved a vote of thanks to Mr. Jenkins for his paper. So far as the question of 6½d. a gallon for milk was concerned, that price was fixed upon after calculations had been gone into in his district most carefully by four or five leading dairy-farmers, and they considered that milk at 6½d. or 7d. was equivalent to 70s. or 80s. per cwt. for cheese. He was not prepared to say that the cheese made in their dairy was the best, but he anticipated that the quality would very far exceed that produced from an equal area elsewhere in the county. It had been stated that the Royal Agricultural Society had neglected questions relating to the manufacture of cheese, but he held in his hand articles published in the *Journal* of that Society in 1860, on the subject of cheese-making, which showed that this accusation was not true. The Royal Agricultural Society had had letters from America, asking scientific questions with regard to this subject, but hardly one had been sent by the farmers of England. He had, however, received a letter from a gentleman in Derbyshire, whose name he was not at liberty to divulge. That gentleman had, however, given him leave to make use of the letter. He said:—"By the kindness of Mr. C—— I had the pleasure of looking over the Longford cheese factory, and was much pleased with the general arrangements, and with the uniform good quality of the cheese, which, though not equal to the finest Derbyshire cheese, is really above the average quality. The flavour is generally good, and there is no really bad-flavoured cheese in the factory. The main fault is that the meal is rather too close, and not so "fleaky" as is the fashion with English cheese. The reason of my troubling you with these remarks is that Mr. C—— informs me that you are going to take the chair at a lecture to be given to-morrow upon cheese factory and cheese making, and he particularly wished me to write you my opinion upon the Longford factory, and the factory-made cheese." The statements in that letter were true, for he had seen the factories, and could speak personally on the subject. He trusted the system would take root and spread all over the country, and thus enable them to improve their dairies, and to successfully compete with the American and other nations in the manufacture of cheese. He thought the paper a most useful one, and that the thanks of the meeting were due to Mr. Jenkins for the attention he had bestowed on so important a subject, and the information with which he had favoured them that evening.

The vote of thanks was seconded by **Lord Lichfield**, and carried unanimously.

ANNOUNCEMENTS BY THE COUNCIL.

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CANTOR LECTURES.

The third lecture of the course "On Artists' Colours and Pigments," by Frederick S. Barff, Esq., M.A., F.C.S., and Fellow of the Cambridge Philosophical Society, was delivered on

Monday evening, the 5th inst. The subject of of the lecture was, the "Chemistry and Manufacture of Colours and Pigments" The two remaining lectures will be delivered on Monday evenings, the 12th and 19th inst., and will treat on Vehicles and Media used in Painting; Fresco and Silicious Painting; Destructive Influences on Colours, &c. These Lectures commence at eight o'clock, and are open to Members, each of whom has the privilege of introducing two friends on each lecture.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions: —

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

What is a Closed Parcel?—A correspondent of the *Times*, of December 2nd, says:—"Last night, the postman brought me a book parcel, on which 2s. 10d. extra postage was demanded, on the ground of its being closed against inspection. It contained two pieces of printed music, or copy-drawing-books, as anyone could see by looking through it, the parcel being perfectly open at both ends, and merely wrapped round with paper sealed along the margin. I could not understand how it was said to be 'closed against inspection,' nor could the postman tell me, and in my irritation I refused the parcel. How is the public to know the rules of the Post-office in such cases when their own officers cannot explain them? Can it be that the authorities require wrappers to be so loosely attached that they may slip off; in which case they would be liable to be lost altogether by transmission through the post?"

The Sample Post Question.—Messrs. Sutton and Sons, says the *Gardeners' Chronicle*, have forwarded to us the following letter, received from the Secretary of the General Post-office, with reference to the sample post question:—

"November 23, 1870.

"Gentlemen,—Referring to your further communication of the 22nd instant, I have to inform you that the question has been submitted to the Solicitor to the Department, and that he is of opinion that the Postmaster-General has no power, under the new Post-office Act, to permit the transmission of any other articles than *bonâ-fide* trade patterns or samples of merchandise at the sample rate of postage. It is to be regretted if the rule has in any case been evaded.—I am, &c.,

(Signed) "G. Hardy (for the Secretary),

"Messrs Sutton and Sons."

Natural History Specimens.—Mr. Wonfor, in the *Brighton Herald*, calls attention to another very large class which is affected by the extraordinary change, viz., students of natural history or science, who have been accustomed to send and receive specimens of natural history, &c., to and from all parts of the country:—"My own case illustrates that of thousands. I have, from time to time, received by sample post wild plants, seeds, insects, caterpillars, geological specimens, microscopic objects, and various other articles, plentiful enough in the districts from which they are sent, but rare or uncommon in the south of England. I have sent to my correspondents in exchange objects common here, but not so with them. All this is at an end, for the increase of postage puts a prohibitive duty on such specimens, and our collections, whether individual, national, or local, will be the poorer in consequence. I advisedly say *local*, for I could name objects in the Town Museum which would not have found their way there under the present rate of postage. United and not individual action is the only lever which will act on the Post-office authorities."

Recent Postal Regulations and Commerce.—Mr. W. J. Bramwell, in the *Brighton Herald*, says:—"The pattern and sample post has been in operation some years, and has proved a boon of which the public have largely availed themselves. Originally, no articles of intrinsic value could be sent by it; but, after a while, permission was given to send goods of intrinsic value (that is, goods not only sent as patterns, but goods actually sold); the rate being ½d. per oz., and the weight not to exceed 24 ozs. Last January an alteration was made, reducing the weight to 12 ozs., and also reducing the rate to ¼d. per oz. On the 1st of October last, another alteration was made, in the following words:—'The pattern and sample post is restricted to *bonâ-fide* trade samples and patterns of merchandise. Goods sent for sale, or in execution of an order (however small the quantity), are not admissible.' The only apparent excuse for this alteration is reduction of weight; but the same authority states, 'books, papers, &c., &c., may be sent, up to fourteen pounds in weight, by book post.' The alteration seems to me, and to many influential traders in Brighton, to be harsh and injurious to trade, while we fail to see how it can materially benefit the Post-office."

A Question for the Postmaster-General.—"One of the first questions," says the *Daily News*, "the Marquis of Hartington will have to answer when Parliament meets is one which is being asked every day by the whole community. What have the Post-office authorities been doing with the pattern and sample post? They have been asked by the Manchester Home Trade Association to extend the principle of the book post to all other small parcels, and the Association very justly complains that, in reply, the very liberty to send patterns and samples had been restricted. Till the halfpenny post was introduced it had become quite the custom to send little parcels by post under the pattern post regulations, but since the halfpenny post was conceded the pattern post has been made stricter, till nobody quite knows what a pattern is. The Manchester memorialists state a case in which a *bonâ-fide* pattern, consisting of a yard of calico, sent out by a Manchester-house, was charged 1s. 8d. on delivery, and, on remonstrance, the Post-office authorities replied that they intended so to treat everything that could become an article of sale. Is there any reason for this arbitrary distinction? What can it matter to the Post-office whether a pattern it carries for a penny is saleable or not? Even if it did matter, why should a different rule be applied to the book trade? It will cost the Post-office no more to carry a roll of silk weighing a pound than to carry a book of the same weight; and we should be glad to know why the one is taken and the other left. It may be quite as much to the convenience of the public to get goods by post from Leeds or Manchester as it is to get books from London. The obvious principle for the Post-office is to care nothing at all about the insides of parcels, and only to consider their bulk and weight. A parcel post is the logical result of the book post, and is greatly needed to complete the convenience of the postal system. This frivolous and vexatious restriction on the pattern and sample post will not stand a moment's investigation in Parliament. It is piece of pure red-tapeism, and has simply resulted in confusion. We hope the Marquis of Hartington will resolve to settle the difficulty by taking all small parcels of regulated size, shape, and weight at the Book Post rates."

The Post-office and the Public.—The *Pall Mall Gazette* say:—"There are abundant signs that the Post-office is forfeiting the favour with which it has hitherto been regarded by the public. For years it has been the model public office of the country. All men spoke well of it. It seemed to do its work thoroughly, and was continually extending the sphere of its labours. Besides carrying our letters, it obliged us by carrying parcels, first of books and then of so-called "samples," which represented all sorts of small wares for which this was found to be the cheapest and most suitable mode of transmission; it did a large banking business in the shape of money-orders, and added savings banks and life assurance for the benefit of the working and lower middle classes. In thus multiplying its services it sacrificed none of its efficiency, and instead of being a burden to the State, it paid all its own expenses, and furnished a considerable and never-failing surplus, on which the Chancellor of the Exchequer could always rely for rounding off his Budget. The success of the Post-office was a stock argument in defence of governmental adminstration, and a ready answer to the claims of private enterprise. Even severe economists excepted the institution of St. Martin's-le-Grand from their denunciations of ministerial extravagance and mismanagement. It was, perhaps, too much to expect that this sunny state of things could last for ever. At any rate, there are certainly symptoms of a change—and of a change for the worse. That the revenue of the Post-office has begun to decline is, in itself, a small matter. The Post-office is a legitimate source of revenue, but revenue is not its main, only its second object. Even if it were carried on at a positive loss, it would be a public gain if its services thereby stimulated trade, and rendered more intimate and speedy the intercourse between all parts of the kingdom and all classes of the community. In point of fact, there has been a heavy annual loss on the foreign and colonial mails, and there is no reason why, on similar grounds, it might not be equally worth while to submit to a loss on inland letters. The present grievance against the Post-office is that, in regard to public accommodation, it is retrograding rather than advancing, while, at the same time, it is becoming more costly to the country. In one sense, no doubt, the accommodation afforded by the Post-office has been enlarged. Telegrams are cheaper, telegraph offices have been multiplied, and the halfpenny postage has extended the circulation both of printed and written matter. The actual amount of work done in these respects is larger than it used to be; but the question is, whether this is really a greater service to the country? We cannot help thinking that it is not, and that whatever advantage there may be in these new facilities is much exceeded by the injury and inconvenience which have resulted otherwise. As regards the telegraphs, it is the universal experience that messages occupy a much longer time in delivery than they used to do; so long, that on the Stock Exchange, and in all business requiring speedy and punctual transmission of despatches, there has been a marked reduction in the number of telegrams. In the same way, the letter service is, we fear, being disturbed by the influx of postal cards, and other articles of halfpenny postage, and it is at least certain that the facilities of the sample post have been seriously curtailed in order to make way for the increased number of communications under the new tariff for cards and printed matter. In itself, the sample post was a much greater convenience to a large body of people than the halfpenny card; and the dead level of delay which now takes place in the delivery of telegrams is a public loss. It must not be supposed that we object to the recent reduction in the telegraph and postal charges. It is quite right that these facilities should, if possible, be afforded for ordinary and even trivial communications. All we say is, that they should not be allowed to harass the more weighty correspondence to which we have referred. Again, the sample post is also curtailed, probably because it would be impossible to continue that service and, at the same time, carry out the postal-card experiment. No doubt there is some truth in the assertion that the sample post, as hitherto established, has been greatly abused. But surely the service is capable of regulation. And the fact is, that the sample post has become an important element in all kinds of provincial trade; it enables shopkeepers to have at command the stores of the wholesale warehouses, and customers of course profit also. It is the more important that the Post-office should take charge of these small parcels, because, if it will not, there is practically no other way in which they can be carried. The railway parcel rates are prohibitive, especially when the overcharges are taken into account."

History of the Postal System.

Commerce is a result of intercommunication between peoples, and correspondence is the offspring of advanced civilisation. Previous to the reign of King John, but little is known about postal habits and customs in this country, but as early as his reign the payment of the expenses of the establishment of Nuncii, charged with the conveyance of letters, formed a large item in the charges of the royal household. Nuncii also formed part of the establishment of the more powerful nobles. It is probable that the Nuncius at this period provided his own horse, but in the reign of Edward II. he was able to hire horses at fixed posts or stations. In 1548, a penny a mile was fixed as the rate to be charged for the hire of post-horses; and the earliest recital of the duties and privileges of a postmaster seem to have been made by James I.

The letters patent of Charles I., in 1632, recited that James constituted an office called the office of postmaster, who was to have "the sole taking up, sending, and conveying of all *packets and letters* concerning his service or business, to be despatched into foreign parts, with power to grant moderate salaries." In 1644, a weekly conveyance of letters into all parts of the country was established; and, in 1656, an Act was passed to settle the postage of England, Scotland, and Ireland, and the erection of one general post-office. It enacted that there shall be one general post-office, and an officer styled the Postmaster-General of England. All other persons than those appointed by the postmaster-general were forbidden to employ any foot-post, horse-post, or packet-boats.

In the reign of Queen Anne a metropolitan penny post was established, and from 1711 to 1838 upwards of 150 acts regulating the action of the post-office were passed. In 1670, the farming of the post-office revenue yielded £43,000, and from 1716 to 1733 the average yearly net revenue was £97,540; in 1769, the net receipts amounted to £164,760, while thirty years later, viz., 1799, they had risen to £657,388, and in 1839, the year preceding that in which our present penny post system was introduced, the net revenue was £1,676,522, and the average number of mail coaches leaving London was 32 daily.

The recognition of the fact that a high rate of postal charges was injurious to the commerce and industry of the country, and led to postage being evaded most extensively by all classes of society, induced the House of Commons to pass a Bill on the 17th August, 1839, authorising the carrying out of Mr. Rowland Hill's plan of postal reform, viz., the introduction of a uniform penny postage, and the use of postage stamps as a means of enforcing the prepayment of all letters.

Sir Rowland Hill's great conception of penny postage had to be forced upon a reluctant authority. The Postmaster-General of the day, in the first debate on the subject that followed the publication of Sir Rowland's pamphlet, vowed before God that, "of all the wild and visionary schemes he had ever heard of, this beat all for extravagance."

The penny postage came into operation on the 10th January, 1840, and the number of letters passing through the post-offices of the United Kingdom weekly was then 1,500,000; in ten years it had risen to 7,239,962, for the week ending February 21, 1850; and eighteen years later, in 1868, the last year for which returns have been published, show a weekly average of 15,540,730, or about ten times as many as were sent thirty years ago under the old postal regulations, and to that number must be added 105,845,000 book-packets, newspapers, and pattern-packets delivered by the Post-office during the same year.

It may be asked, is the commerce and education of the country to be retarded in future by restrictions and absurdities forced upon the public by those who conduct and regulate the use of our great national establishment? Do foreign nations aim at restricting the use of the post-office by high charges, and attempting to draw invisible lines of demarcation between one class of postal matter and another. In England, our postal system has grown out of individual enterprise, set aside from time to time, or adopted by the government as best suited the views of those in office. "Thus the London district post, which existed as a distinct branch of the General Post-office up to 1844, was the offspring of a scheme set on foot, in 1688, by one Murray, an upholsterer, who assigned his right to Dockwray, for the delivery of *letters* and *parcels* at the uniform charge of one penny, a scheme which, as detailed in the pages of Macaulay, brought its author to grief, by subjecting him to suspicion as an agent of the Popish plot, and then as an infringer of the Post-office profits, which had been assigned to the Duke of York for seven years from 1691, and afterwards for three years longer." Dockwray "was made comptroller of the London Penny Post, but was dismissed in 1700," with a pension of £500 a-year.

The money-order department of the Post-office was originated as a private speculation by three clerks of the Post-office, in 1792, they traded under the title of Stow and Company, and carried on a vastly profitable business till 1838, when the government took it up.

The telegraph system, it is unnecessary to point out, was created by the private enterprise of men of science and capitalists, who, having developed their plans upon a remunerative basis, which it took them thirty years to work out, have been superseded by an enactment of the government, which came into force in January of the present year, and placed the telegraphs in the hands of the Postmaster-General as part of the postal system of the country, but we do not yet know to what extent we have benefited by the change.

Since the 1st of October, we have had a halfpenny system of newspaper, book, and sample and pattern post introduced. "A Mr. Povey set up a private post in 1708, under the name of the Halfpenny Carriage, and appointed receiving houses and persons to collect and deliver letters for hire within the city of London, Southwark, and Westminster. But this attempt was suppressed by the Post-office authorities." Under what circumstances has it now been granted by the government, if it be not as a means of improving the education of the people. In America, in many cases, newspapers are allowed to be circulated and carried free. In Switzerland, where a special regard is paid to mental culture, the postage of a newspaper does not exceed one-third of a farthing; in France and Belgium, it is one-tenth of a penny; in Portugal, one farthing; and surely what other states have done for years past for their people, it is not hard to believe could long since have been done in this country for our own; but it was left for private enterprise to attempt to do this. No sooner had the attempt been made for the second time to organise a system for carrying, at a cheap rate, circulars and printed matter, than the authorities of the General Post-office interfered to prevent the working of the scheme; and we have now a halfpenny postal system established for the carriage of printed matter, a halfpenny post having been established by Mr. Povey 168 years previously.

In 1688, Murray and Dockwray attempted to establish a penny post and parcels system for London. In 1840—152 years afterwards—we obtained it through the exertions of Sir Rowland Hill, so far as letters are concerned, but small parcels are not yet allowed to pass as such; and it is probable that, till individual commercial enterprise has demonstrated the feasibility of carrying small parcels economically and profitably, and organised a system of working such as the post-office can interfere with and then adopt, the public will still be deprived of the free use of the post-office in the discharge of a duty to the public which it is fitted for, and was established to perform.

H. G. H.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lt.-Col. Scott, R.E., secretary.

Paintings.—The Committee of Selection met on Tuesday, the 6th inst. Present—Lord Elcho (in the chair), Lord Bury, Messrs. Henry Cole, C.B., Alfred Clint, F. Dillon, Alfred Elmore, Alfred Hunt, H. S. Marks, Richard Redgrave, and Samuel Redgrave.

Albert Hall.—The iron balustrades for the front of the balcony and for the staircases, are being rapidly set up. The design, executed by students of the School of Art, consists of an elegant scroll, which includes a monogram of the letter A, and is very effective. The extent of the iron-work required may be gathered from the fact that the gratings for the passage of hot air into the building exceeds a mile in length.

Visit of the Queen to the Exhibition Buildings and Royal Albert Hall.—The Queen, accompanied by Princess Beatrice, visited the Royal Albert-hall, on Saturday morning, for the purpose of inspecting the progress of the works. Her Majesty first looked at the exterior of the building on the west side, and examined the mosaic frieze; then passed through the amphitheatre into the body of the hall, and afterwards ascended to the royal box. In order to have evidence of the acoustic properties of the hall, Frederick Britten, one of the contractor's boys employed in the building, was permitted to sing, and Mr. Healey, an officer of the Science and Art Department, was called upon to play a set of scales on the violin with the most delicate harmonies. The Queen then commanded that an amateur singer, Miss Anna Williams, should afford an opportunity of judging of the effect of a female voice. This her Majesty heard from the royal box, and afterwards from the balcony on the third story, where the most delicate notes were perfectly audible. The Queen passed into one of the small lecture theatres. Her Majesty was pleased to express to Mr. Thomas Lucas her gratification at the manner in which the contractors had carried out the design, and her interest in the early completion of the building, which Mr. Lucas stated would certainly be accomplished before the end of January.

India.—Extract from the proceedings of the Government of India in the Home Department (Public), under date Simla, the 11th October, 1870:—"It was at one time feared that, in consequence of the war on the Continent of Europe, the first of this series of International Exhibitions might be postponed. Information recently received from England shows, however, that this view was incorrect, and that the first Annual Exhibition will be opened at Kensington on the 1st of May next. His Excellency the Viceroy and Governor-General in Council, taking into consideration the high place assigned to Indian exhibitors at former exhibitions, is unwilling that the manufactures of India should be entirely unrepresented on the occasion of an International Exhibition to be held in London under the direction of Her Majesty's Commissioners for the Exhibition of 1851, and designed specially to demonstrate the progress made in arts and manufactures during the last ten years. His Excellency in Council is disposed to believe that, with the assistance of the local governments, and of many gentlemen, official and non-official, who on several occasions have evinced much interest in such undertakings, a collection might be made which would worthily represent the products and industry of India. At the same time, if the specimens are carefully and intelligently selected, they would probably find a ready sale in Europe, and the expenses connected with the arrangements would be comparatively small. His Excellency the Viceroy and Governor-General in Council is therefore pleased to appoint a central committee, composed of the following-named gentlemen, to consider the best means of giving effect to the proposals of Her Majesty's Commissioners, to assist the efforts of private individuals and others who may be willing to forward the objects of the Exhibition, and to collect the results of those efforts on a systematic plan:—President: The Hon. Sir Richard Temple, C.S., K.C.S.I. Members: His Highness the Maharajah of Jeypore, G.C.S.I.; the Hon. B. H. Ellis, C.S.; Major-General the Hon. H. W. Norman, C.B.; the Hon. J. Bullen Smith; the Maharajah of Vizianagram, K.C.S.I.; E. C. Bayley, Esq., C.S., C.S.I.; Colonel the Hon. F. Thesiger, C.B.; W. G. Romaine, Esq., C.B.; Allan Hume, Esq., C.S., C.B.; H. Rivett-Carnac, Esq., C.S.; Lieutenant-Colonel Baigrie, B.S.C.; Major Burne, private secretary to His Excellency the Viceroy. Honorary Secretary: H. Rivett-Carnac, Esq., C.S. The names of several gentlemen, European and native, who have been invited to serve on the central committee, will be added to this list on receipt of their answers. The local governments also will be invited to appoint local committees, to act in communication with the central committee, and to encourage and direct the exertions of the district officers and others in preparing and collecting specimens of local manufactures. The honorary secretary to the central committee should be directed to place himself in communication with the local governments, and to supply full information regarding the terms on which articles will be admitted to the Exhibition, and other particulars furnished to the government of India by Her Majesty's Commissioners. (Signed) E. C. Bayley, Secretary to the Government of India.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

SCHOOL BOARD ELECTIONS.

It appears that 133 candidates competed for the 49 seats at the London Board. Chelsea has elected a peer, Lord Lawrence. Five members of the House of Commons will be on the Board, viz., Mr. Morley, Mr. C. Reed, Mr. W. H. Smith, Lord Sandon, and Mr. M'Cullagh Torrens. There are two lady members, Miss Garrett and Miss Emily Davies, both having been returned at the head of the poll. The Roman Catholic body is represented by three, Mr. Hutchins, Mr. Wallace, and Mr. Arthur Langdale. The educational institutions directly represented are St. Mark's College, Chelsea, by its principal, Canon Cromwell; the Wesleyan College, Westminster, by its principal, Dr. Rigg; King's College, by its principal, Dr. Barry; and the Baptist College, Regent's-park by Dr. Angus. Only one working man's candidate has been elected, Mr. Lucraft. Of the clergy, the Rev. W. Rogers, the Rev. A. W. Thorold, Canon Miller, the Rev. J. Rodgers, and the Rev. J. Mee, have been successful. Hackney is the only borough which has returned five Dissenters.

The results of the election have been generally favourably received by the press.

The *Times* says, "The election of a School Board for the metropolis has been an experiment, and yet, under every point of view, a great, if not an unqualified success. The chief object of securing an Educational Parliament, fitted to deal with the problem of providing primary education for the capital, has been clearly secured." The successful candidates "will form a Board of such power and ability that it may be doubtful whether a Minister of Education could have nominated a better one, had the metropolis consented to sacrifice the securities of municipal freedom, and resign the responsibility to him. The single element in which the Metropolitan Board may be accused being deficient is an adequate representation of working men." The *Times* thinks that little, if any, advantage was gained by the ballot, but much by the cumulative vote. "If it had not been for this novelty, the election of a proper Metropolitan Board would have been hopeless. Sectarian energy has been prominent, as it ought to have been, but the cumulative vote has saved it from degenerating into sectarian passion. Each sect knew that it could secure its share of the representatives on the Board, and looked out for its best man or men; and where sects combined to form a complete 'ticket' it was, happily, found impossible to maintain an effective combination, and the 'tickets' were put aside by the independence the power of accumulation of votes gave to the voters."

The *Daily News* observes that the election "has produced some remarkable and unexpected results. The battle has been won by individuals rather than by parties, and the new Board will be at least representative of all opinions, and may perhaps give predominance to none. . . . . In its general features the Board may be described as a middle-class body, composed of persons far more cultivated than mere parochial bodies ordinarily include, though with fewer well-known promoters of education, and far fewer notable persons than we should have expected. There is, however, quite a sufficient infusion of eminence, knowledge, and earnestness to ensure its efficient operation, if not to guarantee its success. The election has thrown singular light on one or two tendencies of public opinion. In an election in which the widest possible household suffrage and the ballot put enormous power into the hands of the most numerous class, it is singular that only one actual working man has been returned. It is abundantly evident that the working classes do not support candidates of their own class. Obviously they prefer men who represent their views, or are concerned in movements in which they are interested, rather than men who represent their class or are supposed to embody their social claims."

The *Daily Telegraph* especially touches upon the success of the lady candidates:—"If Miss Garrett and Miss Davies make excellent members of the Educational Parliament, we shall be rather at a loss for good arguments to level at them when they attempt to enter the House of Commons. They certainly have got in the thin end of the wedge. . . . . . We believe that this election of ladies to seats in a great metropolitan body is of more moment than may be thought. It is through chinks of unexpected precedent like the event we are criticising that English revolutions begin to trickle in. If the day should come when women will sit in 'the House,' on the Bench, and in the Cabinet, the result will be due, we suspect, to this now unconsidered innovation."

The Metropolitan Board of Works have agreed to allow the meetings of the Board of Education to be held in their Board-room, should an application for that purpose be made to them. The 15th instant is to be the day of the first meeting. A *quorum* is to be fixed upon by the Board, and in the metropolis is to consist of not less than nine members; a chairman and vice-chairman are to be appointed for three years.

The results of some of the most important provincial elections are given:—

Birmingham.—28 candidates for the 15 places. The following is the result:—Rev. Canon O Sullivan (Roman Catholic), 35,120; Mr. S. S. Lloyd (Churchman), 30,799; Rev. Dr. Burges (Churchman), 21,925; Rev. Dr. Wilkinson (Churchman), 19.829; Mr. John Gough (Churchman), 17,481; Rev. F. S. Dale (Churchman), 17,365; Mr. G. Dawson, 17,103; Mr. Dixon, M.P., 17,087; Rev. R. W. Dale, 16,387; Mr. C. Vince, 15,943; Mr. Hopkins (Churchman), 15,696; Mr. W. L. Sargeant (Churchman), 15,683; Mr. Joseph Chamberlain, 15,090; Mr. J. S. Wright, 15,007; and Mr. A. J. Elkington, 15,925. Out of 53 000 voters, only 29,103 registered their votes.

Salford.—Out of 20,543 persons on the register, 12,955 voted. The result was as follows:—Henry B. Harrison (Methodist), 13,035; T. Briggs (Wesleyan), 9,623; A. Somers (Roman Catholic), 12,819; T. Davies (Wesleyan), 11,433; J. F. Mart (Roman Catholic), 12,819; H. Birley (Churchman), 12,852; T. Boddington (Free Church Methodist), 12,320; W. Warburton (Independent), 10,451; W. Mather (Independent), 7,694; E. Hardcastle (Churchman), 11,685; R. Radford (Churchman), 10,171; G. Robinson (Churchman), 9,845; T. Shelmerdine (Churchman), 10,600; J. Pearce (Churchman), 10,465: and W. Whitelegg (Churchman), 9,866.

Bridgwater.—Successful candidates:—Mr. Hammell (Independent); Mr. Wilton, Mr. Sully, and Mr. Barham (Nonconformists); Mr. Smith, Mr. Winterbotham, and Mr. Poole (Churchmen).

Nottingham.—The number of voters on the register is nearly 14.000, but only about 7,000 voted. The following were the successful candidates:—The Rev. H. Wright (rector of St. Nicholas), 6,930; Mr. Charles Paget (Unitarian, formerly M.P. for the borough), 6,415; Mr. Thurlow (Church schoolmaster), 6,291; Rev. Mr. Dwyer (Roman Catholic priest), 5,494; Mr. T. Bentley (Churchman), 5,079; Mr. J. S. Browne (Churchman), 4.295; Mr. Lewis (Wesleyan), 3,559; Mr. W. G. Ward (Churchman), 3,561; Mr. E. Gripper (Quaker), 3,146; Rev. F. Morse (vicar of St. Mary's, mother church of the town), 3,377; Dr. Lorry Marsh (Churchman), 2,815; Mr. G. B. Rothera (Baptist), 2,680; and Mr. Smith (working man's candidate), 2,485.

Coventry.—Mr. John Gulson (Churchman), 4,162 votes; Mr. Alderman Lynes (banker), 3,854; Mr. Edward Petre (Roman Catholic), 3,854; Mr. John Rotherham (Churchman), 2,795; Mr. Alderman W. H. Hill (Independent), 2 635; Mr. John Bill (Churchman), 2,629; Mr. William Franklin (Baptist), 2,500; Mr. Lawrence S. Booth (working man and a Dissenter), 2,482; Mr. Dennis Barnes (auctioneer), 2,375; Mr. Frederick Bird (druggist), 2,261; and Mr. William Odell, jun.

Canterbury has elected to have a Board, although the clergy have raised funds for additional schools.

Compulsion and Voluntary Schools.—The Education Department was recently asked whether, in a district containing voluntary public elementary schools, recognised by the Department as sufficient and efficient, a Board could be created, with power to enforce attendance at them, but with no power to levy a rate or to interfere with the management of the schools. The answer of Sir F. Sandford was—"In a district which is fully furnished with voluntary schools, there may be a Board for that district to put in force compulsion with reference to the schools which are public elementary schools."

NATIONAL EDUCATION IN IRELAND.

The Report of the Commissioners of National Education in Ireland, for the year 1869, contains a lengthened analysis of the results ascertained from the more voluminous accounts of the inspectors and others engaged under their direction. We learn from the summary, to which the secretaries have appended their seal, that on the 31st December, 1868, there were in operation 6,586 schools, having on their rolls 967,563 children, with an average daily attendance of 354,853. At the close of 1869, the schools in operation were 6,707, and the number of children on the rolls, 991,335, and average attendance, 358,560. There has been, therefore, an increase of 23,772 on the rolls, and 3,707 in attendance. Much more marked appears the progress of education when we glance at a table extending back to 1833, when there were only 789 schools in operation, and 107,042 children in attendance. These figures have gradually advanced year by year since that date, with scarcely an exception, until the present time; and this is all the more gratifying, since it shows that both parents and children appreciate the advantages of education in an eminently steady and increasing degree.

We find the schools were distributed throughout the provinces as follows:—In Ulster, 2,486; Munster, 1,657 Leinster, 1,500; Connaught, 1,064. According to religious denominations, there were in attendance belonging to the Established Church, 72,918; Roman Catholics, 802 834; Presbyterian, 108,831; and other persuasions, 6,752, making up the total of 991,335 pupils on the rolls of the year. In the model schools there were 1,870 pupils of both sexes; and during the year there were trained and supported at the public expense, 293 teachers. Of these, 63 were of the Established Church; 149 Roman Catholics; 75 Presbyterians; and 7 of other persuasions. Besides the teachers trained in the ordinary course of literature, science, and school-keeping, an additional number were instructed in the principles of navigation and the use of nautical instruments. In admitting teachers to this department, it is usual to select those only who are possessed of the attainments necessary to profit by the special instruction given.

There were in the service of the Commissioners at the end of 1869, 6,305 principal teachers; 2,311 assistants; 373 junior assistants; making on the whole, 8,989, of whom 3,440 were trained. There were also 386 workmistresses and teachers of the higher industrial branches, and, in addition, 3,944 paid monitors.

The number of workhouse schools in connection was 146, and of district and minor schools 27. The total pupils on the rolls of these was 17,507, and in daily attendance 8,136. The number of school-farms was 135; 21 were of the first class, under the exclusive management of the Board; 18 were schools of the first class under local management; of the remaining number, 90 were ordinary school-farms, and 6 were school-gardens, one of the latter being under the management of the Board. Of new teachers who entered the service in 1869 there were 881. The net increase to the schools was only 121, which shows the vast majority were to fill up vacancies, and from the applicants, compared with former years, it appears the occupation of the teacher is assuming a more attractive and permanent character. With regard to the results of the tuition given, we learn that the inspectors examined 490,984 in reading and writing; 124,321 in writing from dictation; 203,127 in arithmetic; 185,406 in grammar; and 205,898 in geography. In 197 schools vocal music was taught, and drawing in 274. The inspector found in 1,803 schools the advanced pupils instructed in one or more extra branches, namely, geometry, mensuration, algebra, and book-keeping. Of the ages of all those examined, it was ascertained that 73,148 pupils were under seven; that 113,985 were seven, but under ten; 95,626 were ten, but under thirteen; and 38,317 were thirteen years of age and above.

The number of applications for grants to new schools, in 1869, was 227; to 196 of these the required assistance, either for building or for salaries and requisites, was granted. The total amount paid by the Commissioners in salaries, premiums, gratuities, and allowances to the teachers, assistants, &c., appears to have been £328,009, only 18 per cent. of this sum having been locally provided, whilst the large proportion of 2 per cent. was derived from funds placed at their disposal by the State.

EUROPEAN MINTS.

The alterations in the Royal Mint have led to an extended tour of inspection, undertaken by the Deputy-Master, Mr. Freemantle, accompanied by two officials, and an account has been published containing the result of their investigations.

Having made every necessary arrangement for the conduct of the business of the department during its absence, the commission proceeded, on the 1st May, by way of Paris, to Madrid, and thence successively to Milan, at which place the mints of the Kingdom of Italy are in process of concentration, to Florence, Rome, Constantinople, Vienna, St. Petersburg, Stockholm, Copenhagen, Berlin, Utrecht, Brussels, and Paris. In each country the greatest courtesy was shown by the officers of the mint, and by such officers of the finance department as were met with in the course of the inquiry. The object of the inspection was to ascertain with accuracy any special arrangements, in force in continental establishments, that it might be thought advisable to introduce into the Mint in this country, and it is scarcely possible to overrate the advantages arising from an inspection of the arrangements themselves by persons already experienced in such operations.

It was observed that in every mint there exist many details, both of management and working, which can only be appreciated by personal examination; and many processes which, even if not in themselves perfect or novel when seen in operation, suggest changes or new arrangements likely to be attended with very beneficial results. Although the time devoted to the inspection of each mint was necessarily short, no point of importance relating to its management or working was suffered to escape attention.

The report published under the direction of the Deputy-Master, contains an exhaustive account of the various processes of minting, of the machinery and apparatus used in the twelve establishments visited. In the publication of this information, it has also been considered desirable to avoid unnecessary comparisons between the establishments which have furnished the material. Their stores of experience have been freely placed at the service of this country, and while no one of them can be regarded as a complete model, each and all have supplied valuable information.

There is one department, consisting of the engraving and preparation of dies, which presents a striking contrast to our own, and involves the employment of a much larger staff in the continental mints. In foreign countries, it is usual for the government to have the monopoly of striking medals, and the engravers and their assistants thus engaged are borne upon the establishment of the mint. It is found advisable, therefore, to appoint as chief engraver an artist of eminence. This officer is responsible for the medals struck in the mint as well as the dies for coinage, which latter, of course, form but a limited proportion of the total number of dies produced. Our own Mint only produces dies for coinage, in the designs of which alterations are rarely made, and the dies required for such war medals as may from time to time be issued. The production of these interesting and enduring rewards of art and history is, as a rule, carried on either in a department within the building or attached to it. The process differs from that of coining, on account of the larger size of the medals, and the comparatively small number required, which does not render necessary the employment of self-acting machinery; small medals, for personal decoration, are, however, made in the same manner as coin, and are struck in the coining-press, sometimes with the projecting attachment piece in one with the medal. In the production of the dies for medals, engraving or copying machines are largely used. By their means the model can be more quickly copied in steel than by hand; the graver is, however, used for finishing. At most of the larger mints, and at Rome, the medal department forms an important feature.

Having in prospect the probable removal of the Mint from its present site, attention has been directed by the commission to the situation of the buildings which have been visited, and certain valuable suggestions were obtained in the event of such removal taking place. The cost of the inquiry has but little exceeded £500, and the Deputy-Master expresses a confident belief that the effect of this inspection will materially conduce to the establishment of the new Mint upon a footing of thorough efficiency, and the maintenance of the position which it ought to occupy in regard both to scientific accuracy and mechanical excellence.

BRICK-TEA, ITS COMMERCE AND MANUFACTURE.

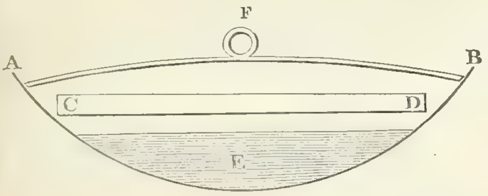
By James McPherson.

Brick-tea is very extensively used all through North-Eastern and Central Asia; the Chinese and Russians do a very extensive trade in the article. Up to the year 1861, the great centre of the Russo-Chinese trade was the frontier town of Kiachta, in Eastern Siberia, where a first-class guild of Russian merchants had established themselves, and monopolised the barter trade with China for more than half a century. These Russian merchants carried on commercial intercourse with a body of Shansi merchants, who were established in the adjoining town of Mai-mai-chêu, separated from the Russian town by only an open square of neutral ground. The Kiachta trade ceased to be a barter trade in 1854, and the monopoly was also abolished in 1861, and in 1862 the importation of sea-borne tea into European Russia was legalised, in order, if possible, to put a stop to the enormous contraband trade in the staple which was fostered by the high tariff on the one hand, and the extravagant prices charged by the Kiachta monopolists on the other. Our merchants find that it does not pay them to import this tea. One or two experiments have been made, and the result has been the abandonment of the trade. I am not at all aware to what extent brick-tea may be used in European Russia, nor do I know if the brick-tea brought into the London market, and re-exported to St. Petersburgh, was intended to be used there; but if not, I cannot quite understand how it could be expected that sea-borne tea could compete with caravan tea in Central Asia.

The Taeping rebellion exercised a considerable influence on the Kiachta trade, attended by disastrous and unlooked-for results to the Chinese merchants at Mai-mai-chêu. Previous to 1853, Fukien tea had alone been taken to Kiachta for sale, but from 1853 to 1856 its price had risen about 50 per cent., owing to the proximity of the Taepings to the tea-producing districts of Fukien; and as access to those districts became more and more difficult, some purchases were made of Hupei and Hunan tea, with which the chests destined for Kiachta were half filled, and then filled up with Fukien tea, for which it was all sold. Hupei tea was thus first taken to Kiachta under false pretences; but the mixed lots sold well, and the far-sighted Chinese, anticipating that the new tea would suit the Russian taste better than the old, began openly to import it, but the great majority still imported the Fukien tea; to this great majority the result proved most disastrous, and Mr. Morgan (to whose report I am indebted for these remarks) was informed that they sustained losses amounting to more than 2,000,000 taels, in consequence of the marked preference of the Russians for the Hupei tea. In 1864, the Russians had pushed their agents into the producing districts, and had learnt to manufacture brick-tea, and, in 1865, more than half the quantity sent *viâ* Tien-tsin to Kiachta was prepared by them, or under their immediate supervision, in the interior of Hupei. This tea proved of much better quality than the native made article. At this time nearly all the brick-tea passing through Tien-tsin for transport to Siberia is made under Russian supervision.

The quantities passing through Tien-tsin for Kiachta were 2,399,291 lbs. in 1866; 8,679,501 lbs. in 1867; and 7,083,029 lbs. in 1868. But these quantities are only a fraction of the actual amount prepared for transit, and Kiachta is only one out of many frontier marts.

Brick-tea is made of the young branches and leaves of the tea plant; sometimes these are chopped up, sometimes the coarse leaves alone are used, and at other times all manner of rubbish is fabricated. In the manufacture of green brick-tea of a good quality, the leaves are steamed in some such manner as the following:—



A B represents the section of a tea-pan containing water, E, in which rice is often cooked; above the water is placed a triangular frame of bamboo, the ends of which rest upon the inside of the pan, and resting upon this is a bamboo sieve, C, containing the tea leaves to be steamed, while F is a wooden lid, effectually preventing the escape of steam. When the leaves are sufficiently done, they are kneaded under the hands to perfectly express the bitter juices, and then pressed into moulds measuring inside 13 inches × 6½ × 1¼ deep; or for small bricks, 8½ inches × 5¼ × ⅞ of an inch deep. When the leaves are sufficiently compact, they are turned out and stacked up under sheds, through which a free current of air can circulate (in the same manner almost as bricks are dried under sheds here), and well protected from the rays of the sun. The bricks, when quite dry, are each wrapped in paper, and are then fit for sale.

The method of using the tea is as much unlike the ordinary plan as the method of manufacture is. Moorcroft says:—"All classes of Tibetians eat three meals a day. The first consists of tea, and the second of tea, or of meal porridge if that cannot be afforded. For a breakfast of ten persons this would be the preparation—about an ounce of black tea (Zan-Cha), and a like quantity of soda, boiled in a quart of water for an hour, or until the leaves of the tea are sufficiently steeped. It is then strained and mixed with ten quarts of boiling water, in which an ounce and a half of fossil salt has been previously dissolved. The whole is then put into a narrow cylindrical churn, along with butter, and well stirred with a churning stick until it becomes a smooth, oily, and brown liquid of the colour and consistence of chocolate, in which form it is transferred to a tea-pot. Each person drinks from five to ten cups of tea." The whole mess may be described as a mixture of water, butter, flour, alkali (or common salt), and coarse tea, to which is often added milk. These are all intimately blended together into what is more like a broth than tea as we understand it.

It is well worth while to consider whether India cannot supply a portion of these teas to the people of Central Asia; and, to further this, more minute descriptions of the manufacture and details of the commerce are desirable.

CORRESPONDENCE.

MR. ALLOWAY'S IRISH PEAT.

Sir,—It is to be regretted that Mr. Alloway, in his interesting paper on the utilisation of peat, did not give some analytical data as to the composition of his peat when ready for use. Had he done so, much valuable time would have been saved in the subsequent discussion, and members would have been in a position to form an opinion as to the practical value of such peat as a material for fuel.

I was myself anxious to ascertain the actual amount of water still contained in the samples of dried peat exhibited on the table, and have therefore carefully examined two specimens, which gave the following results:—

	No. 1.	No. 2.
Moisture at 212°Fahr.	16·13	15·97
Organic matters	78·50	78·84
Ash, chiefly oxide of iron and carbonate of lime	5·37	5·19
	100·00	100·00

—I am, &c., John Hughes.

16, Penn-road-villas, Holloway, N., December 5th, 1870.

GENERAL NOTES.

California Wines.—The total shipments from San Francisco to New York, from the beginning of 1868 to about the 1st of July of the current year, was 848,637 gallons of all grades.

The Tunnel through Mont Cenis will be completed by the end of the year. Commenced in 1857, it has consequently been thirteen years on hand. At the close of October, the whole distance remaining to be pierced did not exceed 880 feet, and the works have been advancing of late at the rate of from 409 feet to 500 feet per month. In anticipation of the completion of the tunnel, the South Italian is endeavouring to secure the support of the Egyptian Government, in aid of the establishment of a line of steamers between Brindisi and Egypt.

Iodine.—The manufacture of iodine from Chili saltpetre already amounts to 30,000 lbs. per annum. The method of obtaining it from the crude material is as follows:—The liquors resulting from the manufacture of saltpetre are treated with a mixture of sulphurous acid and sulphite of soda in proper proportion, and the iodine falls to the bottom as a black precipitate. The precipitated iodine is put into earthern jars, on the bottom of which are layers of quartz sand, fine at the top and coarse at the bottom; from these it is transferred by earthern spoons, into boxes lined with gypsum. A greater part of the liquid is thus removed, and it is further purified by sublimation.

The Archæology of India.—A committee has been appointed in Ceylon to investigate the ruined sacred cities, and to collect inscriptions. Several ancient cities have been cleared of jungle, and many unknown antiquities have come to light. Photographs have been taken of the ruins of Anuradhapura.

The Weather.—In *Symons's Meteorological Magazine* a letter has just appeared from Mr. Brumham, saying the present winter will be very severe (2 degrees below the average), and very probably the cold still more intense, viz., 3 degrees below the average. It should be stated, says a correspondent, that Mr. Brumham's theory is founded on scientific data, and that his former prognostications have been, on the whole, verified.

The Wellington Monument, St. Paul's.—The *Builder* says it hears, with equal surprise and regret, that the Chief Commissioner is inviting tenders from sculptors for the completion of Mr. Stevens' monument. It is impossible wholly to exonerate Mr. Stevens from blame in this matter; but to suppose that any one but himself can satisfactorily complete his work is nonsense, and we suppose few sculptors will be found willing to attempt it. When Dicken's died, leaving his last book unfinished, Chapman and Hall might as well have advertised for some one to finish it. A proper arrangement ought at once to be made with Mr. Stevens himself.

Danger from Union of Metals.—Some time ago, at the Institution of Engineers in Scotland, Mr. Clinkskill exhibited several pieces of boiler plates cut out of destroyed boilers for supplying houses with hot water; the boilers were used with Loch Katrine water. The action on the plates was evidently due to a more active agent than ordinary corrosion, the surface of the plates being irregularly honey-combed to a considerable depth. In the case referred to, the cistern was of lead, the boiler and connecting pipes of iron, thereby forming a galvanic battery, sufficient to account for the destruction of the plates. From the experience obtained, it appears advisable that, in the construction of such hot-water apparatus, the cistern, boiler, and the connecting pipes should all be of iron, or, at least, of one kind of material.

Drying of Wood.—The following is an abstract of a lecture delivered before the Polytechnic Society of Munich, in reply to the query, what means are applied at Munich for the proper drying of wood for architectural, joiners', and other purposes? The author enters, first, into a series of particulars relating to the very varying quantity of water (moisture and juices) contained in various kinds of wood at different periods of the year, from which it appears that, according to Dr. Hartig's experiments, woods (trees) generally contain, during the winter months, about an average of 50·7 per cent. of moisture; in March and April, about 46·9 per cent.; in May, June, and July, about 48 per cent.; while up to the end of November the quantity of moisture increases but little. Air-dried wood (timber) contains from 20 to 25 per cent. of water, and never less than 10 per cent. Wood which, by being artificially dried, had been deprived of all moisture, is thereby entirely altered as regards its cohesive strength—it become brittle, loses its elasticity and flexibility. In order to dry all kinds of timber by artificial means, so as to preserve the essential physical structure, and thereby the good properties of the wood, the drying should be effected slowly, and the temperature to which the timber is submitted should be moderate to begin with, and care should be taken not to eliminate all the water. The author enters into details, illustrated by engravings, on the best means of drying timber on the large scale, and states that small pieces of wood, such as are intended for joiners and furniture-makers, may be readily and efficiently dried by being placed in dry sand, and then heated to 100°. The sand acts in the manner of an absorber of the moisure, as well as a diffuser of the heat.

Working up Waste Leather.—The working up of leather scraps into an artificial product resembling the original material has been very frequently attempted, and to some extent carried into practice. Here is a method lately proposed by a Danish inventor. He takes the cuttings, shavings, or other small bits of leather, either new or old, and reduces it to a kind of fibrous pulp, by hand-labour, or by a machine or mill (either by grinding, pounding, cutting, rasping, carding, or grating); if old waste is used, it should first be cleaned thoroughly. This matter or pulp is then kneaded with india-rubber, which is rendered fluid or dissolved in oils or spirits, and treated with ammonia. Here we dissolve the india-rubber in oil of turpentine. To effect this, the india-rubber is cut into pieces and mixed with the turpentine, after which he lets it remain quiet in a closed vessel until it is dissolved. When the india-rubber is dissolved, he adds ammonia of a strength of 30 per cent., in the proportion of about equal parts by weight of ammonia to the india-rubber contained in the solution; when the mass has become of a grayish-white colour, it is ready to be mixed with the pulp.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

*December 14.—"On a new Method of Producing Durable Mural Paintings by Fictile Vitrification." By Alan S. Cole, Esq. On this evening the Right Hon. A. S. Ayrton, M.P., will preside.

December 21.—"On a Method of Lighting Towns, Factories, or Private Houses by means of Vegetable or Mineral Oils." By Albert Silber, Esq.

MEETINGS FOR THE ENSUING WEEK.

Mon. ....SOCIETY OF ARTS 8. Cantor Lectures. Mr. F. S. Barff, "On Artists' Colours and Pigments." Lecture IV. "Vehicles and Media used in Painting—Fresco and Silicious Painting."
London Institution, 4. Prof. Odling, "On Chemical Action" (Educational Course).
Social Science Association, 8. "The Effect of Opening the Civil Service to unlimited Competition on the Curriculum of School Education."
Medical, 8.
Asiatic, 3.

Tues. ...Royal Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Renewed discussion, "On the Theory and Details of Construction of Metal and Timber Arches." 2. Mr. G. B. Rennie, "An Account of Floating Docks, and more especially of those at Cartagena and Ferrol."
Photographic, 8.
Ethnological, 8. 1. Sir John Lubbock, "On Stone Implements from Africa.' 2. Mr. Edgar Layard, "On Stone Implements of the Cape of Good Hope." 3. Mr. C. Spence Bate "Second Report on the Prehistoric Monuments of Dartmoor."

Wed. ....SOCIETY OF ARTS. 8. Mr. Alan S. Cole, "On a New Method of Producing Durable Mural Paintings by Fictile Vitrification"
Graphic, 8
Royal Literary Fund, 3.
Microscopical, 8. 1 Mr. B. T. Lowne, "On the Anatomy of the Ascarus Lumbricoides." 2. Dr. Maddox, "Observations on the Aëroscope."
Archæological Association, 8.

Thurs...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8.
Chemical, 8 Mr. W. H. Perkin, "On some new Derivatives of Coumarin."
Numismatic, 7.
Royal Society Club, 6.
London Institution, 7½. Mr. W. Mattieu Williams, "On Count Rumford and his Philosophical Work."

Fri.......Philological, 8¼.
Architectural Association, 7½. Mr. B. Salter, "The Arrangement and Ventilation of Hospitals."

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*The paper originally announced for this evening is unavoidably postponed through the illness of the author.

Journal of the Society of Arts.

No. 943. Vol. XIX.

FRIDAY, DECEMBER 16, 1870.

PROCEEDINGS OF THE SOCIETY.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The following report from the Musical Committee has been laid before the Council and adopted:—

1. In order to carry on the work already begun by the Society of Arts, with the view of establishing a National Training School for Music, the Committee recommend the Council to make music—as one of the Fine Arts—an object of the Society's attention.

2. For promoting this purpose, the Committee recommend that a musical section of the Society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall.

3. These concerts to consist of performances of vocal and instrumental music of the highest character.

4. After paying the expenses of the concerts, the profits to be applied to the establishment of a National Training School for Music.

5. Members of the Society, for every subscription of one guinea paid to the musical fund, to have the privilege of obtaining a transferable ticket for six evening concerts in the arena and balcony (see woodcut on next page) without further payment, provided that no member as such shall have the privilege of receiving more than five tickets on these terms. Each seat will be numbered and reserved.

6. Persons not members of the Society shall have the liberty to purchase tickets on such terms as the Council may from time to time determine.

7. That the Musical Committee of this Society, consisting of:—

The Lord Henry G. Lennox, M.P., Chairman of the Council, or the Chairman of Council for the time being, and
S. Redgrave, Esq.,* and Seymour Teulon, Esq., Vice-Chairmen of the Council, or Vice-Chairmen of Council for the time being
Lord Gerald FitzGerald *
The Right Hon. Sir J. Pakington, Bart., M.P.*
Sir John E. Harington, Bart.*
Sir. Francis Sandford *
E. A. Bowring, Esq., C.B., M.P.*
Henry Cole, C.B.
A. S. Cole, Esq.
Capt. Donnelly, R.E.*
The Honourable Seymour Egerton
W. Hawes, Esq.*
C. Wren Hoskyns, Esq.
Frank Morrison, Esq.
J. Puttick, Esq.*
Lieutenant-Colonel Scott, R.E.*
E. C. Tufnell

be authorised to carry out the arrangements for the six concerts, as soon as a guarantee fund for not less than two thousand pounds has been obtained, and one thousand subscriptions of one guinea.

That Sir Michael Costa be asked to meet the Committee to discuss the necessary details.

A guarantee fund for assuring the Society against loss has been commenced, and the following gentlemen have guaranteed the amount set opposite their names respectively:—

	£	s.
F. A. Abel, F.R.S.	10	0
G. C. T. Bartley	20	0
William Beamish	10	0
Sir W. H. Bodkin	10	0
William Botly	10	0
Edgar A. Bowring, M.P.	10	0
George Brough	10	0
C. Minton Campbell	100	0
A. Cassels	10	0
E. Chadwick, C.B.	10	0
W. D. Child	10	0
Hyde Clarke	10	0
John Clutton	10	0
Alan S. Cole	10	0
Henry Cole, C.B.	50	0
Earl de Grey and Ripon, K.G.	50	0
Sir Charles W. Dilke, Bart., M.P.	20	0
Samuel Dean	10	0
Capt. Donnelly, R.E.	20	0
Christopher Dresser	25	0
Major-Gen. F. Eardley-Wilmot, R.A.	10	0
Hon. Seymour Egerton	10	0
John H. Evans	10	0
Captain Festing, R.E.	20	0
Lord Gerald Fitzgerald	10	0
G. E. Forrest	25	0
John Fowler	20	0
John Francis	10	0
Jacob A. Franklin	10	0
C. J. Freake	100	0
Capt. Douglas Galton, C.B., F.R.S.	20	0
I. Gerstenberg	10	0
George Godwin, F.R.S.	10	10
Frederick Gordon	10	0
Lieut. Grover, R.E.	10	0
James Heywood, F.R.S.	20	0
Dr. Hogg	20	0
Bartlett Hooper	10	0
C. Wren Hoskyns, M.P.	10	0
Henry Howell	10	0
Henry Hunt	50	0
Professor Huxley, F.R.S.	10	0
J. M. Johnson and Sons	10	0
Lord Henry G. Lennox, M.P.	50	0
Samuel Lovegrove	10	0
Messrs. Lucas Bros.	250	0
T. A. Masey	10	0
Admiral E. Ommanney, F.R.S.	10	0
John Penn, F.R.S.	100	0
J. Pollen	10	0
J. F. Puttick	10	0
Samuel Redgrave	10	0
Sir Francis Sandford	10	0
Lieut.-Colonel Scott, R.E.	50	0
G. A. Spottiswoode	10	0
Seymour Teulon	10	0
Henry Thring	20	0
E. C. Tufnell	10	0
Henry Vaughan	10	0

List of Subscribers for Tickets.

T. W. Baggallay	3
R. W. Bartram	2
W. Beamish	2
Sir W. H. Bodkin	2
William Botly	2
George Brough	2
W. D. Child	2
John Clutton	3
Samuel Dean	2
Christopher Dresser	2
Charles Downes	2
John H. Evans	2
Freeland Filliter	1
P. Le Neve Foster	2

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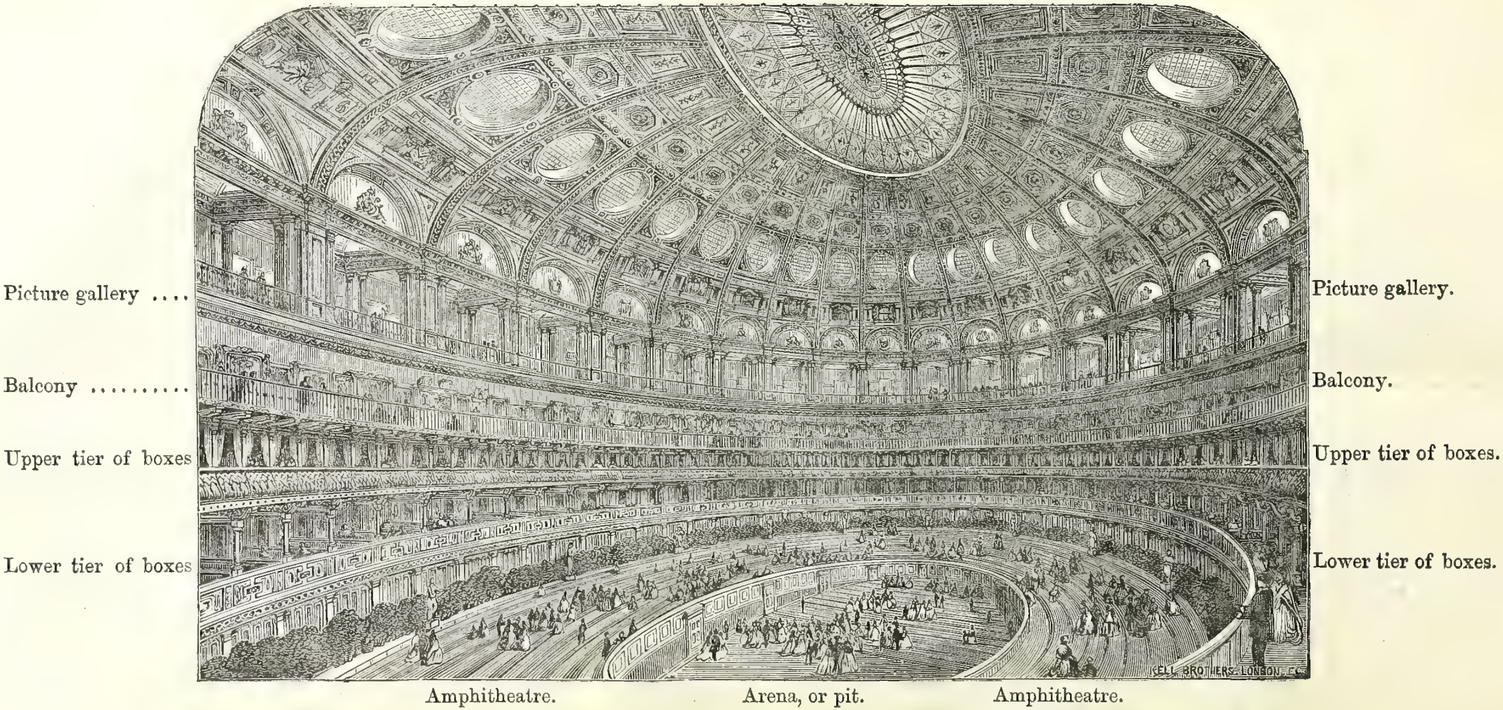
* These signed the Report on Musical Education, 1866.


Picture gallery ....
Balcony ....
Upper tier of boxes
Lower tier of boxes
Picture gallery.
Balcony.
Upper tier of boxes.
Lower tier of boxes.
KELL BROTHERS, LONDON, E.C.
Amphitheatre.
Arena, or pit.
Amphitheatre.

DESIGN OF THE INTERIOR OF THE ROYAL ALBERT HALL OF ARTS AND SCIENCES,

SHOWING THE ARRANGEMENTS FOR THE ACCOMMODATION OF AN AUDIENCE.

John Francis	2
I. Gerstenberg	1
Frederick Gordon	2
Lieut. Grover, R.E.	2
Arthur Hall	2
Bartlett Hooper	2
C. Wren Hoskyns, M.P.	2
Henry Howell	3
J. M. Johnson and Sons	2
Samuel Lahee	4
W. G. Larkins	2
Samuel Lovegrove	5
Messrs. Lucas Bros. (two members)	10
T. A. Masey	1
J. C. Nickisson	2
M. E. Rodocanachi	2
W. F. Simpson	2
Seymour Teulon	2
W. H. Thomas	2
Henry Thring	2
R. L. Trollope	2
E. C. Tufnell	2

The Council earnestly hope that the members of the Society will support, and co-operate with them in, this important public undertaking, and by joining in the proposed guarantee, and by availing themselves of the privilege of subscribing for tickets at the reduced rate, aid in securing the establishment of a National Training School for Music.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

FIFTH ORDINARY MEETING.

Wednesday, 14th December, 1870; the Right Honourable Acton Smee Ayrton, M.P., in the chair.

The following candidates were proposed for election as members of the Society:—

Catmur, T., 13, Sidney-terrace, Grove-road, Victoria-park, E.
Crossley, Edward, Park-road, Halifax.
Noad, Henry M., Ph.D., F.R.S., 72, Hereford-road, W.
Penny, Henry, Wincanton, Somerset.
Porter, Frederick William, 16, Russell-square, W.C.
Roberts, Thomas Nicholls, 2, Torrington-street, W.C.
Rosher, Edward, 23, Upper Hamilton-terrace, N.W.
Saunders, Richard Charles, 17a, Great George-street, S.W.
Waldram, John, 38, Kingsland-road, N., and Sunnyside, corner of Manor-road, Stamford-hill, N.

The following candidates were ballotted for and duly elected members of the Society:—

Anderson, John MacVicar, 6, Stratton-street, W.
Berghtheil, Z., 48, Clifton-gardens, Maida-hill, W.
Cooke, John, Darlington.
Couch, Thomas Ross, 172, High-street, Wapping, E.
Green, Robert E., Church, near Accrington.
Hughes, Henry, 25, Green-street, Grosvenor-square, W.
Hulme, F. W., 8, St. Alban's-road, Kensington, W.
Jayne, James Barton, 17, Park-street, Croydon.
Moser, L., 18, Upper Bellevue-place, Southampton.
Noble, James, 71, Warwick-gardens, Kensington, W.
Pearse, Robert William, Frank-cottage, Lewisham-road, Greenwich, S.E.
Phillips, William C., 73, New Bond-street, W.
Pratt, Major, 17, Grove-end-road, St. John's-wood, N.W.
Robinson, Randolph, 4, Cranley-place, Onslow-square, S.W.
Rogers, Edward, 33, Inverness-terrace, W., and 56, Friday-street, E.C.
Rola, Vincent, 22, Leinster-square, Bayswater, W.
Sansom, C. T., Queen's Bench-offices, Temple, E.C.
Waltham, Edward, Watcombe-house, Stockwell-green, S.W.
Winsor, George, 58, Russell-street, Bermondsey-street, S.E.

The Paper read was—

ON A NEW METHOD OF PRODUCING DURABLE MURAL PAINTINGS BY FICTILE VITRIFACTION.

By Alan S. Cole, Esq.

1. The many remnants of Greek and Roman mosaic, more than two thousand years old, prove the possibility of obtaining by one method at least, permanent decoration. Although frequently to be found only in fragments and much injured, their colours remain as fresh as when they were first produced. I would not propose to repeat a minute history of mosaics. I merely mention their existence, in almost all ages since Solomon's temple, as proof that architects and decorators have striven to obtain a permanent process of ornamentation. In Rome, cœval with mosaic-working were wall paintings. It is hardly necessary for me to remind you of the remnants of mural decoration which have been brought to light, after an entombment of many centuries, at Pompeii, or to tell you that these are merely a species of painting in distemper. Now, however, their disinterment and exhibition are the causes which effect their irremediable destruction. The catacombs of Rome possess many similar mural paintings, but these again are crumbling away and being destroyed by the smoke and drippings of the candles of inquisitive and careless tourists. At San Clemente, in Rome, Padre Mollooly has caused excavations to be carried on, and he has discovered, at a depth of twenty feet or more beneath the earth's surface, Christian mural paintings well preserved as early as the 5th century. But these again are being destroyed fastly by even the occasional exposure to which they are subjected for the sake of visitors. Happily, copies of them have been obtained for England, and we shall thus be able to preserve good mementoes of them. But, as regards mosaics or coloured tesseræ, there is no vanishing, peeling, or decaying. The colours and materials remain the same under any circumstances. Exposure of them to atmospheric influences does not, as with the mural paintings, effect damage.

2. In spite of these warnings as regards distemper paintings and frescoes, the Houses of Parliament were decorated with fresco as works likely to last. The fact that these works are fast perishing may seem to point to an ignorance in the mixing of the ingredients used to produce the painters' surface; but it is more likely that the damp and other bad incidents of the London atmosphere are the primary causes of their unfortunate and premature decay. The impossibility of preventing any smoke and dust which may attach themselves to the surfaces of the frescoes from sinking into the material is, with the above named ill-effects, sufficient warning against the further use of this kind of fresco-painting, at any rate in our variable climate. It may be urged that there appeared no other feasible method of permanent decoration, besides this fresco-painting, than mosaics, which were not probably considered appropriate. Mosaics are not always suitable substitutes for other processes of permanent decoration. In the rendering of broadly designed compositions it is possible that nothing could surpass their effectiveness, but for actual pictures or for small or delicate work mosaic working is immoderately expensive and undesirable. Sufficiently close to inspection, the unavoidable

joinings of the tesseræ become tiresome, and quite dispel the sought-for impression of an oil painting, while one regrets the laborious attention and patience which must inevitably have been given by the mosaicist. Any one who may desire to see such a work can find it in the mosaic of George IV. at South Kensington Museum, lent by Mr. T. Jones. Its original proprietor paid the Pontifical mosaic workers at Rome £4,000 for it, although only about a yard square. Under any circumstances, however, I would remind you that mosaic work, at least in modern times, is another artist's version of the first artist's creation. In saying this I do not desire at all to depreciate the second artist's share in the undertaking. The mosaicist must undoubtedly possess a feeling for art, for form, for colour, still his result, like that of the engraver, or the tapestry worker, is his rendering of another one's invention.

3. Attention has thus been directed to processes whereby art-compositions, decorations, &c., not appropriate to mosaics, may be carried out in a manner to make them lasting, and be the actual results of their authors. Enamelling of various kinds have been known for a considerable time. Enamelling is an art which is very durable, but as Mr. Horsley, R.A., says in his report on the Class 2 at the 1867 Paris Exhibition, "from the very nature and hazard of the processes employed, the power of the material is limited, and the result of its use far from satisfactory in an artistic point of view." All kinds of enamelling on metal bases were shown at Paris, but none of any size afforded suggestions for the employment of such a method for large works.

4. Within the last few months it is well known that the Right Hon. the Chairman has given some attention to the use of enamelled iron as a vehicle for decoration. I believe, however, that certain mechanical difficulties appeared to him to render such a method undesirable. The surface is always curved, and cannot be made perfectly flat. Perhaps I may add that one inevitable feature in enamelled iron-work alone, irrespective of the mechanical difficulties, ought to decide persons against adopting it for highly artistic work. Variations of temperature affect the iron and enamel unequally. The expansion or contraction of the materials must be unequal; hence, occasional cracking and chippings ensue in a work executed in this manner; and these defects, serious in any decoration, are highly objectionable in any high art work. But these defects do not greatly interfere with the present uses of enamelled iron. For advertisements, station names, street names, &c., enamelled iron is capital, and I sincerely trust that a constant demand for such kinds of work may prevent its ingenious and enterprising producers from being able to try to insinuate enamelled iron into the ranks of processes for permanent decoraton, of a high artistic kind.

5. Turning from this kind of work, one comes to painting on pottery. For examples of small fine painting on majolica the Frenchmen certainly excelled, and produced some highly-praised pieces. But these small works do not present the difficulties of firing, &c., which large painted surfaces do. It has long been the aim of those desirous to promote the art of mural decoration to further the production of large slabs of a fictile material suitable for painting upon. I may here perhaps be allowed to mention one or two of the difficulties which beset a manufacturer in such work. The clay is squeezed into a mould. To obtain a level surface it is necessary that this clay should be subjected to an uniform pressure. In clay, as in many other substances, the particles when compressed have a tendency to re-act and attempt to regain their former position. Again, there is the contraction of the clay in the process of drying, during which the water is expelled. A similar effect takes place when the clay is fired, and this results in a distorted plaque, unless a scrupulously regular thickness has been preserved. Thus the production of large slabs of more than three or four feet square is purely a matter of chance, and one which a manufacturer would avoid rather than encourage.

6. In spite of the many failures and inevitable risks, attempts have been made to produce painting on large surfaces of different kinds of pottery. Members of the Society of Arts will probably recollect the two important paintings by M. Yvon, upon slabs of terra cotta, outside the Sèvres court at the Paris Exhibition. They have since become the property of the British public, and are remarkable links in the chain of fictile painting. At the time of their production, they, with justice, were held in great estimation, although it was impossible to avoid criticising certain palpable defects, such, for instance, as the dulness of the colours; the encouragement—from the absence of any protective enamel—for dirt and dust to begrime the works; and, moreover, the uncomfortable irregular pieces into which the entire composition is cut up by the several junctions of the plaques.

7. About the same time, M. Rousseau, also a Frenchman, designed and painted a large composition, now exhibited in the Keramic gallery of the South Kensington Museum. He adopted a system of large slabs or mosaics of terra cotta and surface-painting combined. Each plaque is made in the form of some part of the entire work. Thus, a man's body constitutes one plaque, his head another, a tree another, &c. Each piece is separated, fired, and glazed, and then, being brought together, they are cemented. The effect is artistic, but the junctures of the plaques are such salient features that the process is only suitable for large decorative works, placed at some altitude from the eye. Moreover, this kind of work is liable to rapid decay, unless great precautions are taken. The painting alone is protected by a glaze. The back and junctures remain pervious to damp. The porosity of the material naturally absorbs damp, and this, in time, working its way through to the surface, the design may become defaced.

8. I hope I shall not be considered hypercritical or fastidious in saying that the processes to which I have just alluded do not appear to meet a want which I presume exists, viz., that of producing, in a permanent manner, and without the intervention of a second worker, as in the case of engravings, mosaics, &c., the actual compositions and creations of artists.

9. I do not think that artists generally know what it is to paint their own works in any more permanent way than the conventional oil on canvas, and water-colour on paper. Some, perhaps, may not desire to experience this new sensation.

10. One of the obstacles to artists painting upon porcelain or terra-cotta as they would upon canvas, has hitherto been the difficulty which arises from the necessity of an intimate acquaintance with the materials to be used. A piece of pottery painting, before firing, presents a very different appearance to the result when it issues from the kiln. Artists do not turn their attention to the effects produced by firing colours in pottery painting. They cannot, therefore, of course, paint their works themselves upon pottery. If an artist ever desires to have his work painted on pottery, such transfer is undertaken by the pottery painter. It is in this, then, that painting on pottery is like the placing of mosaics, the work of an intermediate worker, who is, necessarily, well acquainted with the effects which are obtained in the process of firing. Thus the artist makes his design on paper, and the trained pottery painter does his best to interpret the artist's intention. The want of a system whereby an artist might without difficulty paint his own work permanently, has been felt. And a successful method of supplying such a want would, without doubt, be welcomed by those interested in these matters.

11. In the course of my official and other occupations, I have had the advantage of seeing and comparing decorative works intended to be endurable and imperishable. The latest system, the results of which seem to combine

all the requisites I have believed necessary for durable decoration, is one invented by Mr. Colin Minton Campbell, the nephew of the late Mr. Herbert Minton, of European fame, and successor to his manufactory at Stoke. This process at once recommended itself to every one to whom it was shown, and upon its excellent and patent merits I now bring it before you.

12. The production of it is due, in a great measure, to the attention which the right hon. chairman directed to the subject upon his advent to office as First Commissioner of her Majesty's Public Works and Buildings. Aware of the perishable nature of frescoes, and holding the opinion that a rough mosaic rendering of decorative works was not suitable (such as is now placed in the Houses of Parliament), he sought the co-operation of those who had shown an interest in the subject of permanent decoration. As I have already stated, he decided against enamelled iron work, and instigated experiments in pottery-painting. I have authority for saying that he suggested two modes to Messrs. Minton, whereby flat surfaces might be produced for decoration; first, by making small plaques, having regard to the outline of the picture; and, second, by putting together hexagons, which might be broken up into convenient shapes, so that, besides the flatness of surface, greater convenience in firing would be assured. With the latter suggestion Mr. Minton Campbell was much struck, and thoroughly considered and decided upon the means to be adopted for maturing and perfecting the excellent suggestion made to him. These means were to be found by the application of new principles in the use of well-known materials. The result was the production of the process of vitrified keramic painting patented, by Mr. Campbell.

13. By the permission of Mr. Campbell, I visited his works at Stoke, and he has kindly given me every information and facility for making myself acquainted with his process. He is, I am happy to say, present this evening, and will gladly answer such questions as you may desire to put to him hereafter.

14. Before, however, entering upon a description of the process, I request leave to revert to the mosaics of the Romans. The *opera musiva* is, as you know, the generic term applied to all kinds of mosaics. I cannot pretend to be able to deal in a recondite way with the archæological bearings of the subject. But I think I may say that all kinds of mosaic work, founded on the ancient methods, have been revived in modern times. Messrs. Salviati, of Venice, are foremost with their glass and gold mosaic, like the *opus alexandrinum* and the *musivum auratum*.

15. Then there are revivals of the *opus sectile* in the common modern mosaic pavements of rough stone and marble; and in this section I should like to call attention to a pavement executed in bits of marble for the South Kensington Museum—white, grey, and black—the work of the convicts at Woking, under the direction of Col. Ducane. I think, without disparagement to the work, it might be suitably named *opus criminale*. As regards a reference I made to M. Rousseau's employment of a species of mosaic, I would reply to any exception which may be taken to my having called it "mosaic," that it certainly comes within the category of the *opus vermiculatum*, or mosaics made of shaped pieces which are not merely cubes. Mr. Yvon's process is also a kind of mosaics. Unlike M. Rousseau, he tries to do away with the effects of the joins of the plaques. He does not make a feature of them as M. Rousseau does.

16. A somewhat new process is now in use by Messrs. Minton Hollins, and Messrs. Maw and Co. It is remarkable, as the tesseræ are mechanically produced. The idea of these tesseræ originated with Mr. Prosser, and was worked out by the late Mr. Herbert Minton. They are made by compressing into metallic moulds powdered clay with such a force that the atoms of the clay bind themselves together, and retain the shape of the moulds sufficiently that they can be manipulated and carried to the kilns, where once fired they become homogeneous and imperishable bodies. The colours given to these tesseræ are, in the main, produced by metallic oxides, principally oxide of iron. The scale of them is limited to a certain extent, though much progress in making new colours is being effected by Mr. Michael Hollins, head of the firm of Messrs. Minton, Hollins, and Co. To this kind of mosaic I propose to give the name *opus anglicanum*. I believe this term has been applied to certain English needlework. I think it is more appropriately applied to mosaic work than to needlework, so that I trust some other name may be given to the needlework, as a confusion of names is always to be regretted. And now I get to Mr. Campbell's process, which I suggest should be named *opus fictile pictorum*, and considered as a sub-section of the *opus anglicanum*.

17. To Mr. Arnoux, the scientific juror and reporter upon pottery shown at the various international exhibitions, I am indebted for many most valuable explanations and notes upon Mr. Campbell's invention.

18. Adopting the principle of the late Mr. Prosser in 1840, to which I have alluded, Mr. Campbell produces tesseræ, by compressing a composition of stone and clay into metallic moulds. I have here specimens of such unfired tesseræ. By this means the greatest economy in time and in workmanship is insured. By using ordinary clay in a plastic state, several days must elapse before it becomes dry enough to be placed in the oven. The advantages of this system of compressed dry pulverised clay are so manifest that it has quite superseded the former modes adopted for the the making of tesseræ or tiles. These compressed tesseræ are then removed to the oven where, by virtue of the components of the material, they become vitreous bodies.

19. The hexagonal shape was adopted in the first instance at Mr. Ayrton's suggestion. The agglomeration of regular hexagon produces a net-work of lines generally accepted as being more pleasing in effect than the union of squares.

20. When the tesseræ are fired, they become similar to these I have here. You can perceive the facility with which plaques may be formed. These plaques are of a small and convenient size, thus rendered free from the ordinary risks of firing large plaques. In the first instance the tesseræ are cemented at the back by a species of mortar and then fired. This operation concluded, their surfaces are covered with a stanniniferous flux, which fills up any spaces which may occur between the tesseræ. Again, they are fired, and upon issuing from the oven are ready for the artist's use. I must here tell you that each individual tessera is a vitrified body impervious to any effects of damp. These tesseræ cemented together therefore produce plaques whose nature as one body is identical with the imperishable nature of each of its tessera. The cements at the back and the flux on the surface cannot be injured by any atmospheric effects. Thus, I repeat, the plaques are, so far as science of the present day can teach, perfections of imperviousness to any evil effects from damp, dirt, gas, &c. Now, by placing the plaques together, it is obvious, for the artist who likes to have a large space before him, he may thus obtain an acre of tesselated canvas to work upon if necessary.

21. The artist can make his preliminary blocking out or sketch with charcoal or pencil, and with the same ease as he effaces his work from canvass can he rub it off the Keramic plaques. When he has completed his sketch, he may then proceed to the colouring of his composition.

22. The detrimental effects of light upon vegetable colours, the hurtful results of the exposure of colours composed of metallic oxides or their salts, to the action of oxides of carbon, of ammoniacal gases, sulphuric acid, sulphurous acids, and caburetted hydrogen, precluded the adoption of such materials. The use of the

various essential oils and varnishes seemed likewise forbidden by the well-known volatile character of such fluids.

23. Again, the mural paintings, by means of mineral colours, worked with alkaline silicates as a pigment (such, for instance, as have been tried in Berlin some twenty-five years ago), require for their execution considerable practice and study, and a delicate manipulation. This process cannot be said to have yet received the sanction of time, and it appears they have already suffered from their exposure to the atmosphere; at all events it is not proved that they can resist the action of the nitrate of potash, which the capillary attraction of the wall is sure to bring to the surface.

24. Thus it will be seen that there seemed to be obstacles in the way of the right species of colours to be used; however, Mr. Campbell's resources have enabled him to contrive a complete palette of vitrifiable colours almost quite similar to the ordinary oil colours. The artist can apply them to the plaques in precisely the same way as he would oil colours to his canvas. The plaques, when painted, are fired, and upon withdrawal, should the artist desire to make alterations, he can do so by painting in his corrections, which may be fired into the composition. The number of firings is quite immaterial, and may be multiplied without damage to the plaques. If you will examine the finished specimen exhibited, you will see that the actual strokes and touches of the artist remain as they do in oil paintings. The texture, if I may so call it, is identical to that of an oil painting. Herein, therefore, is a most valuable feature.

25. Before leaving this subject of the colours, I wish to call particular attention to the vast difference existing between the colours used for ordinary pottery painting and those used in Mr. Campbell's process. I cannot better exemplify this than by showing you, first, this china plate, the colours of which have not been fired; here is, second, a plate with precisely similar colours, which have been fired; third, this is a plaque of Mr. Campbell's tesseræ, with the colours unfired; fourth, I have one with the colours fired. These facts speak more strongly than anything I could say.

26. I wish to make one remark upon the durability of the colours. Their nature, like that of the tesseræ, is vitreous. By the heat of the kiln a fusion between the colours and the plaques takes place. The vitreous components in both combine, and the result is an endurable and impervious work.

27. I would sum up, therefore, the virtues of Mr. Campbell's process thus—permanent painting, upon a true and level surface, illimitable, if necessary, in its size.

28. It will be seen that this species of basis for painting upon is eminently suitable to supersede the canvas or panel, for paintings which are required to be as lasting as possible. The process decidedly may take the place of fresco-painting. The flatness of colouring, if desired, is as easy to be obtained upon the keramic surface as it is upon the mortar prepared to receive the fresco. I hold the opinion that these very wide limits are the limits of the uses to which this process of painting by fictile vitrifaction should be put.

29. I am sure no one wishes to see this process supersede the ancient monumental art of mosaics. For broad decorations, inside or outside buildings, such as churches, &c., mosaics rank first as a means of permanent decoration. The middle ages provide splendid examples of frescoes and mosaics placed in juxta-position. The climate of cities like Orvieto, Florence, and Rome has not wrought the mischief which our own climate would have done to the frescoes. But with the advance of time, the nature of the materials is to decay, and in the progress of such decay one would feel inclined to regret that the fresco-painters of Italy had not the knowledge of painting their works by this method whereby they should last as long as the mosaics. We are surely to be congratulated in now possessing a process which seems to avert the misfortune of fresco-painting, and render the future mural decorations permanent in our country, worthy to be handed down to posterity.

30. By the nature of the materials, mosaics possess characteristics which any other mode of decoration fails to render. The broadness of effect produced in good examples of mosaics cannot be imitated by other processes. As an example of the right use of mosaics, I mention the frieze on the outside of the Royal Albert Hall. Again, I think that the mosaic reproduction of Mr. Watt's design for the spandrils of the dome of St. Paul's are very suitable, as are also the mosaics for the ceiling and figures in the Wolsey Chapel at Windsor.

31. I do not wish to raise a controversy in any way, but I question if the series of portraits of artists in the South Kensington Museum should have been rendered in mosaic. With few exceptions, none are designed specially for reproduction by mosaics. The generality of them appear to be attempts to reproduce small paintings, in small mosaics, but with a rough glistening surface; attempts, I think, which should be discouraged as far as possible.

32. It would, no doubt, be very difficult to define the precise limits of the uses of either mosaics or of painting by fictile vitrifaction, and I do not know any one who would like to do so. Before, however, I sit down, I ask leave to say this, which I think no one will deny, that, when an artist makes a design especially having in view its reproduction by mosaics, mosaics should be used. And when he wishes to carry out his own work unassisted, he may do so by adopting the process I have tried to explain to you. He will not attempt to give mosaic effects to his work. The mosaic effects are quite foreign to the nature of this process. They can be obtained solely by using mosaics themselves. The good points of painting by fictile vitrifaction should not be contrasted unfairly with the bad points of mosaic working, or vice versa. Both methods are arts to be cultivated and encouraged. The results of them are absolutely different, and should not be confounded together.

DISCUSSION.

Mr. C. W. Cope, R.A., said he was very much interested in the paper read by Mr. Cole, and thought there was a great deal of promise in what was suggested, but he should first like to make one or two remarks about what had been said with regard to fresco-painting, which he thought had been a little unfairly treated. There was an idea abroad that fresco-painting had altogether failed in this country, which he hoped was not the case, for a great many experiments had been made lately which he believed had led to the ascertaining of the causes of the decay of frescoes, which were owing, in a great degree, he understood, to the extensive use of gas. A very able chemist had been going into the subject carefully, and he had shown that by coating frescoes with a certain preparation, which had been applied to the frescoes of Mr. Dyce, they were perfectly protected from atmospheric influence. If this could be carried out, he did not see why they should not last for hundreds of years. He should be very reluctant to see fresco-painting given up, or that any mechanical art should take its place. It was evident that, in our damp climate, the method needed a sort of waterproof clothing, that he believed would effect all that was desired. It was really a very beautiful method; certainly in beauty, luminousness, and artistic qualities, it was infinitely beyond anything that could be accomplished in any other way. With reference to the process now brought forward, it seemed an admirable system except in one respect, upon which he wished to make a remark. There was a comparative absence of gloss in the specimen before them, but still the surface was not a thoroughly dull surface. The red colour, particularly, was extremely glossy; and it was hardly necessary to observe that any appearance of this sort rendered it entirely unavailable for mosaic purposes. He wished to ask, therefore, whether there was a probability of this being remedied.

Mr. Minton Campbell said he believed the gloss referred to did not exist in any other colour except the red, and this was the first trial of that particular colour. He had no doubt that the evil complained of could soon be remedied; and considering it was not six months since the matter had been taken up, he had very little doubt that any points of this character could be satisfactorily dealt with.

Mr. E. M. Ward, R.A., said Mr. Cope had referred to the most important part of the subject, namely, the shiny surface. If anything of that sort were attached to the process, it must condemn it for mural decoration. But for that, there would be no difficulty at all. He believed Sir Thomas Lawrence once said that there were three things necessary in oil-painting, the first of which was expression, the second expression, and the third expression. Now, he should say that in wall-painting there were also three essentials, the first being a dry surface, and the second and third being the same. Without this everything else was useless. It was only necessary to look at an oil-painting to show the reason of this. In looking at it from above there was no difficulty, but all large works were placed at a considerable height, and it was there the great difficulty lay. He quite agreed with Mr. Cope that this was a most excellent method, and as the inventor had stated that there was a probability of this evil pointed out being remedied, he thought it worthy of consideration. With regard to fresco-painting he, with all other artists, was only anxious that the truth should be known, and for this purpose nothing but discussion was requisite. With regard to the works of Mr. Dyce, which, at one time were threatened to be destroyed, being really in a most doubtful state, he was glad to say that the compound which had been referred to had been placed upon them by Mr. Wright, of Kensington, and it had brought up colours which had appeared to be totally destroyed. In one of his own frescos, he was astonished to find that the parts which he had thought entirely destroyed were resuscitated, and appeared again in all their brilliancy, while, in fact, he should not have known that anything had been applied to the surface at all. With regard to the many things that had been stated on this subject in the public prints, he was not at all astonished at the reports which had gone about, as it had even been stated in the House of Commons, on one occasion, that his own works were in a very bad state, when it happened that the greater part of them had only just been completed, and they were not even in fresco. He mentioned this to show how careless public writers were on this subject.

Professor Archer said the question seemed to him to be one of mosaic, and not of picture-painting; and this process seemed to be painting in a manner in which mosaic painting might be rendered more available under the English climate. With regard to the question of a shiny surface, he thought this fact had been lost sight of, that in all glass mosaics it was a prominent feature. In cutting glass mosaics, great care was taken to secure that fracture which had a large reflective power; but there was this peculiarity about glass, that after it had been exposed to atmospheric influence for a considerable time it toned down. They all knew that the old glass of cathedrals was perfectly unrivalled by modern manufacture, and that was entirely due to age. What he had just heard and seen was entirely new to him, and he certainly was of opinion, that if they could only manage to endure the shiny appearance for a short time, the climate would do all the rest, and the vitrified surface would, in time, have its soda so nicely eaten out, that there would be that beautiful, smooth, and mellow surface so much desired.

Mr. E. J. Poynter, A.R.A., asked if the pigments used in this method flowed freely from the brush, or whether they dried rapidly, and also if they might be diluted with oil or turpentine in the same way as oil-colours.

Mr. M. Campbell said the colours flowed very freely, and could be used as thick or as thin as desired, turpentine being the vehicle used in the preparation.

Mr. Richard Redgrave, R.A., thought they had been rather led astray by entering on the question of the durability or non-durability of frescoes, and should rather consider whether the process under discussion was in itself a good one for mural decoration. Looking at the specimens which Mr. Cole had exhibited, he found that Yvon's works had many of the qualities of a fresco, but the great disadvantage was that it was laid together in broad slabs. On looking at the work itself, it appeared very absorbent in its qualities, and that was a thing which a painter was very desirous of having, provided the surface did not shine. He was afraid that Mr. Campbell had provided a surface almost too good, for it gave artists such great facilities that he feared lest they should degenerate into littleness of manner. There seemed so much detail and so much texture in the specimen before them, that the effect was really more or less that of an oil painting. His brethren who were workers in fresco, however, would, he believed, agree with him that the distinguishing quality of that class of work was that those details could not be got, and that, therefore, the grandeur of the whole to produce the desired effect must be depended upon. In that respect fresco would always beat mosaic. Looking at Rousseau's work, it had one very disagreeable quality, viz., that the material was laid on in such a way that it appeared like a very thin, flimsy water-colour painting. The specimen of the new process shown by Mr. Cole had, however, all the substance and solidity of an oil painting, and in this respect it was very superior. One very great advantage was, that in using it the artist produced his own work, which was not the case in mosaic. It had been once said, that if you wanted to find out the faults and defects in a painting, you should get it copied, for the copyist would be sure to exaggerate all the defects, and so it was if a work was converted into mosaic. Mr. Campbell had obviated this, and if artists would only strive to avoid any littleness of manner, which he feared they might be betrayed into by the great facility afforded them, he was perfectly satisfied that most beautiful results could be obtained.

Mr. Campbell wished to remark, with regard to the absorbent qualities of the material, that he had endeavoured to obtain a surface which would render a painting imperishable, and for this very purpose an absorbent surface was inapplicable, inasmuch as it was not impervious to the dust and smoke of a London atmosphere, and must become soiled and deteriorated. It was quite as easy, and, in fact, easier, to obtain an absorbent material, but in such a case the painting required glazing afterwards. In the process described, the surface was vitrified before the colours were laid on.

Mr. J. G. Crace said this subject interested him very much, as it must all who were connected with pictorial or decorative art. It appeared to him that this invention, from its great good qualities, must supersede almost every other process which pretended to render everlasting artistic talent. Every other medium almost with which artists were acquainted had some weak points. Even the Roman mosaics, if executed in marble, when brought to this climate very soon showed signs of decay; whilst, with regard to glass mosaic, the disadvantages peculiar to the material must always have an injurious effect upon the picture. In St. Peter's, at Rome, where the most beautiful specimens existed, the glare upon them was found in peculiar lights to be very disagreeable, worse even than in oil paintings; they presented such a surface that, when the light struck at certain angles, they reflected the light instead of showing the picture. These defects were very visible in the glass mosaic in the central hall of the Houses of Parliament, particularly by gaslight. It was therefore most important to acquire a medium which conquered these defects, and not only so, but presented a surface to the artist upon which his own hand produced the work. After a picture had been executed a short time in this manner, he believed it would be found that a certain film of condensed moisture, or some other action of the kind, would completely cure any small degree of glare that might be apparent upon a newly formed picture. For himself, he must say he was astonished at the great perfection which had been already obtained, which was absolutely marvellous in so recent an invention. There was one point which had not been touched upon by previous speakers which he thought most important, viz., that this seemed the only material that could be used for exterior decoration. For this purpose he need hardly say that fresco was inapplicable. It never did and never would last, however protected, in this climate; and even in the warmest countries the action of the air had in the course of time began to destroy almost every specimen with which he was acquainted. Even those great works of Raphael, in the interior of the Vatican, were found to show signs of decay; and therefore if any process could be introduced by which, with very little more labour than in fresco-painting, superior results could be produced, which would be practically imperishable, it was an advantage too great to be calculated.

Mr. R. Westmacott, R.A., while accepting most gratefully the value of Mr. Campbell's invention, agreed with Mr. Cope and Mr. Ward that it could not be put in competition with fresco. The former gentleman had most fully indicated the importance of fresco-painting, which was executed in a totally different manner, and which had a speciality of its own, as could be seen by the works of the great masters in this particular line. The great value of the present invention appeared to be that it afforded a means by which the damaging influences of the English climate on works of art could be overcome; and, in this point of view, it would be difficult to overrate its importance; but he should be very sorry if it were undertaken with a view of superseding the efforts now being made by some of our most distinguished artists in fresco-painting. It was certainly wonderful to see such excellence in so recent an invention, and he had no doubt that any little difficulty which might be experienced at first with regard to the glazing of some of the colours would be removed. Mr. Redgrave's remarks as to the facility which it afforded, and the danger to which it might lead, were most valuable, as he believed it would be most injudicious and lamentable to introduce such a style of work as had been referred to into mural decoration. What all lovers of art admired in the frescoes of the great masters was the breadth of treatment, owing to the necessity they were under of drawing and painting rapidly.

Professor Donaldson said painting was not a branch of art with which he was much acquainted, but as this particular process was intimately connected with architecture, he of course felt great interest in it. About two years ago he visited Rome, and was then much grieved to see the change which had taken place in many of the finest frescoes since his former visit, fifty years previously. Some of the finest works in the Vatican were decaying rapidly, parts which he remembered nearly perfect being now almost obliterated; and the Romans themselves were conscious of this, for they had been double glazing some of the windows, and taking other measures to preserve the frescoes. It was the same in other parts of Italy; the works of the great masters were rapidly fading from our eyes, and leaving only a memory of their former glory. If, therefore, any process could be perfected by which the works of artists of the present day could be preserved, and handed down to posterity in all their freshness and beauty, every lover of art must feel deeply indebted to the inventor. They were told by historical painters that there were certain difficulties in producing on this kind of surface the same effect as was obtained in fresco, and with a certain class of subjects it might be so, but there were other kinds of decorative embellishments to which the same objection would not apply. In the decoration, both of the interior and exterior of churches, some process of a permanent kind was much wanted, and this system seemed to promise very well for such purposes. It had been spoken of as a kind of mosaic, but he hardly thought that was an accurate description, the hexagonal pieces being merely the base upon which the painting was placed. The great merit of it consisted in the artist having full scope for his own talent in executing his own work.

Mr Fisk (who was introduced by the Chairman as the artist who had painted the original from which the specimen exhibited was copied) said he had had but slight experience in this method of painting, but it had been sufficient to show him one or two great merits in the process. For instance, you could produce as good an *impasto* as in a painting; you could also use a colour perfectly transparent; and although it dried opaque, it would, after passing through the kiln, come out perfectly transparent. Brush-work could be distinctly and strongly marked, a firm, clear line with the brush leaving the colour raised in ridges, as in an oil-painting; and even after firing, that character was well preserved. After what had been said by such authorities as had spoken that evening, it would not become him to enter upon a discussion of the relative merits of this new process, as compared with fresco, but he quite agreed with Mr. Redgrave that care would be required, in order not to sacrifice breadth to finish; but he might remark, that if the specimen exhibited were painted with a landscape background instead of gold, it would be found that not only transparency, but also the effect which artists termed "scumbling" could be produced without difficulty, and this would be of considerable importance in many cases. There were some small specimens on the table which illustrated this, and it would be seen that the scumbling seemed to lie on the surface, and to produce all the effect obtained by the same process in an oil painting.

Mr. Hyde Clarke said that as all the gentlemen who had hitherto spoken had been in some way connected with the artistic profession, it was only right that some one, speaking in the name of the general public, should add his testimony to the unanimous opinion as to the great value of the process so ably brought before them by Mr. Alan Cole. The subject of mural painting was one of prime importance, inasmuch as in this way it was that art was brought more especially before the notice of the public. Oil paintings, and still more frescoes, required, in this country, to be carefully preserved, and to that extent, therefore, the area of their influence was limited, whereas, if by such a process as had been described the interior and even the exterior of public buildings could be worthily and permanently decorated with high-class paintings, it must have the effect of making art more popular, and that, after all, was the great end to be kept in view. However high might be the prices paid for pictures by individuals, and whatever the amount of luxury attended art, it would never be so beneficial, either to artists or society, as when encouraged and supported by the public at large. It was evident that any means by which works of art could be rendered more permanent and less fragile would greatly conduce to this end, particularly if, as seemed to be the case here, paintings could be produced, not like exotics or hothouse plants, but like the beautiful flowers which afforded healthy enjoyment to thousands in the open air. He, therefore, felt deeply indebted to Mr. Cole for having brought this matter so ably before them, and not less so for having indirectly raised an issue with regard to fresco-painting which had led to some most valuable information being made public on this point, which must certainly have raised all their hopes with regard to it. But there was no reason in the world why the domain of art should not be extended, or why there should not be ample employment both for fresco painters and artists, who might employ their talents in a new direction. To those who had at a somewhat distant period looked forward, as many present had, to the revival of fresco-painting as a means of employment for English artists, there was great encouragement in what had been said, particularly the assurance that not only could such works be preserved, but even that they might be to a great extent restored. He must, at the same time, confess to a little feeling of alarm on hearing Mr. Ward describe how his own works and those of his brother artists had been made as good as new, or better, lest an economical government—though he hoped not under the auspices of the Chairman—might be tempted to devote the public money to the restoration of our old pictures instead of bestowing a reasonable portion of it on the production of new ones. Speaking as one of the public, and looking at the matter from the economical point of view, there seemed one very great advantage in the new process, that it did away with the necessity for employing what he might term a mechanical artist, who intercepted a large portion of the reward which should go to the creative genius only. There was also a great advantage attending the use of any material which was not affected by gaslight; that it greatly extended the sphere of the artist's labours; and he saw no reason why, in the same way as ladies sometimes adorned themselves with especial reference to artificial light, so artists should not compose and execute paintings specially adapted for evening exhibition. In conclusion, although he sympathised with the natural desire of Mr. A. Cole to appropriate so beautiful an invention for his own country, even by name, he thought that as the term *opus anglicanum* had for centuries been applied to a particular kind of needlework, it would be a pity to disturb it, especially as art was in itself of such a cosmopolitan character that it would not be right to bestow a national name on any branch of it. He begged leave to propose a most cordial vote of thanks to Mr. Alan Cole for his valuable paper.

The Chairman, in seconding the proposal, said he should consider it a great misfortune if, from anything which had been said, anyone should go away with the idea that he, holding the office he did, was going to take up a position with regard to any art-process other than that which he deemed to be within his proper duty, viz., to see that those only who were skilled in all the arts which the public required were duly and properly employed. The cause of his interference in this matter had been the numerous and conflicting statements which had been made with respect to the efforts which had been going on for some years to decorate the walls of the Houses of Parliament; so that it really became necessary to consider what steps should be taken, if anything of the sort were to be continued, rather than give the whole thing up in despair. It must not be supposed that, in anything which had been brought forward that evening, any reflection whatever was intended on the efforts heretofore made by artists of great eminence to adorn the walls of St. Stephen's. On the contrary, there was so much excellence in what had already been done, that he had felt it his duty to invite artists of the greatest skill and experience in that particular branch to form themselves into a committee, for the purpose of investigating thoroughly what had been done, and determining how far it would be practicable to continue the use of fresco-painting in that building. That question, therefore, was now remitted to the hands of the most competent gentlemen, who were pursuing their researches with great zeal and ability—with a perfect consciousness of the properties and characters of fresco-painting, and with an anxious desire to continue its use if they could fulfil that which he ventured to tell them was an essential condition, that future works should be more durable than former ones had proved. These gentlemen might, therefore, be left to deal with the subject of frescoes, the beauties of which were patent to all, as shown by some very fine specimens in the building he had referred to, particularly those in the Queen's robing-room, which looked almost as fresh as the day they were painted. No doubt he was officially in the position of a patron of art, but in the case of private individuals it did not in the least matter to society at large how they expended their wealth; if they liked to exchange the contents of their pockets for another man's artistic skill, there were only two parties to the bargain, and they alone were concerned. In his case, on the other hand, having to deal with public money, he had no right to exercise any fancies or impressions of his own, but was bound to do what was necessary to promote art upon grounds which the public could perfectly understand, and which was at the same time conducive to the interests of art. If, therefore, he had suggested anything to Mr. Minton Campbell, he must not be considered as in any sense prejudiced in favour of what he had done or proposed. He had no feeling whatever in favour of any particular scheme, his only object being to see that carried out which would in the end be most useful to the country in the advancement of art, and in protecting those works of art which were executed at the public expense. He first took an interest in this question because, when doubting what could be done, he naturally went to the South Kensington Museum, and with Mr. Cole, the director, carefully considered every effort that had been made for the purpose of painting in an enduring and imperishable manner. They found running throughout every attempt, which were chiefly in plaque, one great defect, namely, that you could not get a continuous true surface; and so long as that defect continued, it appeared to him they must abandon all attempts at wall decoration by any kind of painting on vitrified surfaces. There was also a second defect, that the painter had always been painting on separate pieces, which could never be put together without betraying the junction. There was a slight shade of difference in the different tints, arising from various causes, which could hardly be detected, but which produced such a divergence as to give the character of failure rather than success to the work as a whole. What, therefore, he ventured to say to Mr. Campbell was, that these two defects must be surmounted if success in mural decorations was to be attained, and he also ventured to suggest two or three modes by which the difficulty might be got over. One was that the plaque should be made of a number of hexagons of convenient dimensions, the principle being that, as there would be no joint in a continuous right line, the effect would be to give a general uniformity of appearance, although there might be a great number of minute divisions. In so doing, however, he accepted no responsibility of any kind, telling Mr. Campbell that whatever he did would be at his own expense, and for his own benefit, not at the expense of the nation; for it was astonishing what a number of people there were connected with all kinds of art who were ready to do anything in the way of experiment, provided the nation bore all the loss, and that they were at liberty, if they succeeded, to retain all the profit. He, therefore, was bound to lay down an invariable rule that if anyone thought he could do what was desired he must have sufficient confidence in his invention to work it out at his own expense. Mr. Campbell, therefore, had taken up the idea, and produced what they had seen, and certainly when he first saw the result he shared in the astonishment which had been expressed by more than one gentleman, and hoped that if there were still any difficulties in the way they might be surmounted. Mr. Campbell had certainly done what had never been done before, namely, prepared for the artist a continuous surface on which he could paint his entire work, no matter how large. The tesseræ could be put together to any required extent, and the artist could perform his work just the same as if he were painting on canvas. And this relieved him of one of the difficulties which had hitherto stood in the way of painting on plaque. Of course, it was a matter of experiment how the colours would work, but they were told that they flowed freely from the brush, and, if this were so, it removed the great restraint under which any artist must labour who was compelled to paint, not according to the free scope of his own genius, but under the conditions of some mechanical contrivance. If Mr. Campbell had accomplished this, he had rendered a great service in the direction in which they were all looking, a combination of the mechanical arts, and their great development in this country, with the higher branches of art as practised by men of genius. Hitherto there seemed to be a complete separation between the two. No doubt pictures had been painted which had afterwards been rendered in mosaic, but after all a mosaic was but a mechanical copying, under very great disadvantages, of an original, and if an ordinary copy of a painting was not esteemed of much value, what could be the value of a copy made by putting together little bits of glass or stone? It was quite clear that the merit of the copy was not in the beauty of the painting, but was only a measure of value of the labour that had been bestowed upon it. This had been beautifully illustrated by the example spoken of by Mr. Cole, viz., that portrait of George IV. which, with the greatest respect for the exhibition at Kensington, he held no artist would like to own as a painting, and nevertheless they were told that the labour of putting together the little bits of stone had actually made the portrait cost no less than £4,000. Comparing this with what they knew were the sums paid to the most eminent artists in this country for painting portraits, it would be seen what was the value of the mechanical process; and the estimate which must be formed by a person of a painting who would give £4,000 for a mere mechanical copy. He believed it was peculiarly his duty to avoid falling into some of those errors which he believed were often committed by the patrons of art. There were two things which he was particularly desirous of seeing kept distinct, viz., the real beauty of a thing, and its accidental circumstance. If you showed some persons a painting by a living artist, which everybody who saw it, whether a connoisseur or an ignorant person, pronounced at once to be of a most beautiful character, there would yet be an indisposition to give the artist an adequate price for such a work. Whereas, if you could only show a certain picture on some old piece of canvas, which had perhaps an unfinished subject upon it, and attached to it a story that it had been an unfinished work of somebody who lived 300 or 400 years ago—if you could only persuade him of that, there was hardly any limit to the price that he would be prepared to pay for it; whereas, if you put it before him simply, and asked him what he would give for it, he would say, "I will not give you £5 for such a piece of rubbish." This was a specimen of the fancies indulged by individual patrons of art, but it was his peculiar duty to avoid all such fanciful ideas. He felt himself bound to look at the real merit of a work of art, and to give its value for it, whether it were newly painted, or whether it had been in existence hundreds of years, in short, to avoid giving value for things which were not intrinsically beautiful, merely because they happened to be curiosities in art. No doubt a curiosity might be very instructive for many purposes, but, at the same time, it might have no pretensions whatever to be beautiful. He desired, therefore, always to avoid falling into the antiquarian point of view, which could see no beauty in anything except through the false medium of age. Sometimes they were accused of going backward in art; but it must be remembered that painting in oil-colour was the result of all other efforts, and was adopted because all mechanical processes previously in use were found so imperfect. The starting point appeared to be from Byzantine glass-mosaic, and it would therefore be a very curious mode of progress to go backward from the most perfect mode of painting, oils, to that which was most imperfect, and which had been abandoned as most unsatisfactory. It could hardly be called going backwards, however, if they used fresco instead of oil, because fresco was available for certain purposes, and produced certain effects which men of the greatest experience and genius did not think could be obtained by oil-painting. He was not quite prepared to admit that himself, because only a short time ago he saw two works of art in a large hall, one a fresco and the other oil, one on each side of the room, and he was bound to say that, in his opinion, the oil looked much better than the fresco. There was this one difficulty about it, however, as a mode of decoration for public places which were sometimes thronged with people, and this would be understood by anyone who had taken a tour through the Houses of Parliament on a public day, and noticed the odour which prevailed, no oil painting, if left unglazed or unvarnished, could possibly stand the treatment to which it would be exposed in such a situation. And, on the other hand, if it were constantly cleaned, the process would, sooner or later, very much deteriorate the picture. If that were so they must fall back upon fresco painting as fulfilling the conditions which could not be obtained from oil. In the same way he thought the method which had been brought before them that evening was not to be put in competition with fresco, but had a nature and character of its own, and he had no doubt there was ample room for both. In conclusion, he need only say that when men of art had settled amongst themselves what was the best mode, and when public opinion had recognised the conclusions at which they had arrived, then, and not until then, should he think it his duty to recommend the expenditure of public money for promoting any particular mode of developing art in the decoration of public buildings in this country.

The vote of thanks to Mr. Alan Cole was carried unanimously.

ANNOUNCEMENTS BY THE COUNCIL.

CANTOR LECTURES.

The fourth lecture of the course "On Artists' Colours and Pigments," by Frederick S. Barff, Esq., M.A., F.C.S., and Fellow of the Cambridge Philosophical Society, was delivered on Monday evening last, the 12th inst. The subject of the lecture was, the "Vehicles and Media used in Painting, and Fresco and Silicious Painting." The last lecture will be delivered on Monday evening next, the 19th inst., and will treat on "Fresco and Silicious Painting (continued); Destructive Influences on Colours, &c." The Lecture commences at eight o'clock.

NEW AGRICULTURAL PROCESS.

In *Journal* No. 913, of 20th May last, an announcement was made that a number of boxes of seeds, each embedded in manure, according to a process belonging to Mr. Wm. Rée, of Hamburgh, were for distribution. Some of these were applied for by members, and the Council will be glad to hear of any results that have been obtained.

Some boxes of seeds are still left, and may be had for testing the process on application to the Secretary.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions: —

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

The Sample Post.—A meeting of representatives of the seed trade was held on Wednesday evening, at Anderton's Hotel, Fleet-street, Mr. Barr in the chair, to further consider the new arrangements of the sample post, in so far as they affect the transmission of seeds by post. A meeting of the representatives of the nursery and seed trades was held last month, when it was agreed that an application should be made to the Post-office authorities to alter the new arrangements of the sample post, and that if the reply was unfavourable another meeting should be called to consider what steps should be taken in the matter. The chairman said the meeting was called to ascertain if they could not influence the Postmaster-General to alter the present arrangements regarding the sample post. Mr. Richard Dean, the honorary secretary, referred to the course taken since the last meeting, the communications with the Post-office having resulted in a manner unsatisfactory to the seed trade. The answer received from the Post-office was, that the question had been submitted to the solicitor to the department, and he was opinion that "the Postmaster-General has no power, under the new Post-office Act, to permit the transmission of any other articles than *bona-fide* trade patterns, or samples of merchandise, at the same rate of postage." He (the secretary) read a letter from the Royal Horticultural Society, stating that the society was deeply interested in the success of the application to the government on the question of the sample post, "not only as affecting the direct interests of the society, but horticulture generally, as the present prohibitory rates must militate against the development of the object for which the Royal Horticultural Society was incorporated. On the direct effect on the fellows of this society, it may be sufficient to state that they send out annually about 1,000 packets each of flowers and vegetable seeds, each packet containing 24 varieties. Under the present arrangements these will cost on the average ounce 1s., against 3d. under the old sample rate." Mr. Wm. Bull, F.L.S., of Chelsea, moved, and Mr. Chas. Turner, of Slough, seconded the following resolution:—"That seedsmen fail to understand the difference between sending a given quantity of seed as a sample, or in execution of an order; that having been permitted by the Post-office authorities to send small quantities of seed by sample post, its withdrawal of that privilege will occasion them serious loss, and be a great disappointment to their customers, especially to those abroad, who do not know of the said withdrawal; that it is desirable to use every endeavour to bring the matter before the House of Commons on an early occasion." The resolution, having been supported by several speakers, was carried unanimously. A committee was formed to take action in the matter, and the meeting separated.

Messrs. Cox and Son, of the church furniture manufactory, 28 and 29, Southampton-street, Strand, write thus:—"The present action of the Post-office, with respect to the sample post, is not only extremely inconvenient, but will, we anticipate, entail a serious loss upon us. We were among the first to avail ourselves of the facilities that were afforded; and in the new editions of our catalogues we gave quotations for a great variety of small articles, including the cost of transmission by post. There is a vast number of these catalogues in circulation, and we have some thousands on hand, which are all now comparatively valueless. The cost of conveyance by rail is out of proportion to the value of the small articles, and the consequence is, that we have a restricted sale, after our arrangements had been made, and we had provided ourselves with goods in anticipation of the usual demand. This, which a longer notice would have prevented, is what we have the more especially to complain of as a grievance, in addition to the loss entailed upon as by the comparative uselessness of our catalogues."

Pills.—Messrs. Arthur Fox, Son, and Co., of the Tasteless Pill Manufactory, Brighton, write as follows:—"Our business has been seriously injured by the late silly regulations. Some time after the sample-post had been in operation, we wrote to the Postmaster-General stating that we supplied surgeons in nearly every town in the kingdom with pills, rendered tasteless by a process for which we had obtained a patent; that our first order was generally for a small quantity, and really a sample, but we could not say they were without "intrinsic value," and we wished to know whether, under the circumstances, we could send our goods by sample-post. In reply, we were told the words "intrinsic value" were omitted from the regulations just published, sanctioning, in fact, what we required. We directly sent circulars to all the surgeons in England, offering to send our goods free of carriage, and on that basis our trade has been conducted. When the October regulations were published, in reply to a letter we addressed to the authorities, we received the following:—'I am directed by the Postmaster-General to inform you, in reply to your letter of the 23rd ultimo, that although parcels of pills may have passed unchallenged, the pattern and sample-post has always been that which its title indicates, and was never intended to extend to goods sent in execution of an order. In strictness, therefore, there is no new regulation.' So that not only was our business almost destroyed, but we were charged with fraud, although we previously obtained the sanction of the authorities for the course pursued."

SIR,—In 1649, the House of Commons resolved that "the office of postmaster is and ought to be in the sole power and disposal of Parliament;" and the reason assigned is declared, at a later date, viz., 1657, in the preamble to an ordinance, in which it is stated as a recommendation in favour of the institution of government posts, "that they will be the best means to discover and prevent many dangerous and wicked designs against the commonwealth."

At this date the revenue derived from the Post-office was settled on the Duke of York, who, when he became James the Second, lost no time in ensuring it to himself personally, by an Act passed in the first year of his reign, with the additional proviso "that the revenue of it should hereafter be to him, his heirs, and successors one independent and indefeasible estate in fee-simple, and therefore that its revenues were not to be accounted for to Parliament." Letters, irrespective of their weight, appear to have been charged a postage rate in proportion to the distance they were carried, till 1735, and the members of the House of Commons had the privilege of franking their letters; but in that year, owing to the abuses which had grown up, it was determined that the weight of the letters to be franked by by them should in future not exceed two ounces, and the privilege of franking was confined to the period during which Parliament was sitting, or within forty days before or after. The system of franking letters still prevails in many departments of the government service, and is, as the writer has good reason to know, still greatly abused.

In 1732, it was enacted that bills of exchange were not to be sent with a letter upon the same piece of paper; and still further, that persons were not to write different notes upon the same sheet, double letters, or letters on two pieces of paper, were then charged double postage.

In 1795, patterns were allowed to be sent by post, under covers open at the ends, and containing no writing but the price, name and address of the sender, and were charged a single postage; so that that which the public is now permitted to do was then allowed, although the privilege was subsequently withdrawn or its use greatly restricted.

The history of the Post-office shows that, from the earliest times, its rulers have aimed rather at obtaining high rates, and a restricted use of its agencies, than a free use of its facilities, and have offered continued resistance to improvement, however and by whoever it may have been suggested, for rendering the post-office more readily available by the public, at the same time that the monopoly of its right to be the sole agents for the carriage and transmission of letters has been more and more strongly upheld.

The efforts of Mr. Palmer, by whom the mail-coach system was introduced (the first mail-coach left London on the 2nd August, 1784), were resisted by the Post-office authorities from the beginning to the end, and ultimately his plans were reported against, even after their success had been established, and the Post-office revenues had been doubled, trebled, and quadrupled; he finally failed to obtain the reward of his labours upon the base originally agreed to. Mr. Palmer was a man who saw the deficiency of the existing postal system, and by his own energy amended it, to the great advantage of the public. He would, doubtless, have carried his reforms much further than he did, but the times and authorities were against him. "Postage," observed Mr. Palmer, "is really no tax, but a just and reasonable price for so much labour, which government, by its monopoly, is enabled to do cheaper than an individual, and should do with greater expedition and safety, or submit to the loss of the public employing other carriers in preference."

Till Sir Rowland Hill's penny post system was introduced, postage was practically a heavy system of taxation, amounting to several hundred per cent. upon the cost of the work done, a tax that, in the main, fell upon the industries of the country, which should, it is now admitted, be left as free and unfettered as possible.

Sir Rowland Hill's plan involved the principle of charging postage upon weight and not for distance.

The Post-office ought to be a great mechanical agency for promoting and advancing the social and industrial position of the people.

What the establishment of mail coaches did for Mr. Palmer's plan, in extending and expediting the delivery of letters, the railway system, which was inaugurated on the opening of the railway between Manchester and Liverpool in 1836, and which principle has since extended throughout every part of the world, was destined to do for the much bolder system of a penny post, and will, we hope, ultimately do for a small parcels post.

While coaches of limited capability as to stowage were the only means at the disposal of the Postmaster-General, for the despatch of letters, parcels and newspapers, it was perhaps necessary to restrict, to a certain extent, the nature of the letter or parcel that should be forwarded; but now that railways, worked by steam-engines of gigantic power, exist throughout the length and breadth of the land, and afford facilities for carrying any amount of letters or parcels which the public may desire to send, it is unreasonable on the part of the Post-office authorities to refuse to throw open its doors to the widest possible extent to receive them. To refuse to convey a small parcel of merchandise except at a prohibitory letter rate, is to do, in reference to trade, industry, and commerce, what was done, in reference to correspondence generally, under the old letter postal system, when, two pieces of paper were ordered to be used, and then charged double postage, thereby debarring the public from a free use of the system which the government have thought it right to monopolise, upon the ground that they can do the work better for the public than the public can do it for itself.

The work demanded to be done by the Post-office at the present time is the carriage of small parcels, as their delivery, in the majority of cases, in remote districts, would impose but little extra work upon its servants; while, in centres of industry, where parcels would probably be numerous, their doing so would merely necessitate the employment of an additional number of men, who would be only too glad to find occupation.

The work of the Post-office is, in the main, a purely routine duty, necessitating little more than honest, sober industry; and the question of what agency is required to do the work is easily ascertained. If one man can deliver 1,000 letters in a given time, how many men will it take to deliver 1,000,000? and it will affect the answer but slightly if *small* parcels be, in some cases, added to the letters. At present, we have advanced but slightly upon the position we had attained to in 1795, when a penny post existed in London, and patterns were permitted to be sent through the post-office at a single postal charge. For a time we retrograded, but now the public is permitted to send a single glove, in an open wrapper, for one halfpenny, provided it does not weigh more than two ounces, but a pair of gloves or stockings is prohibited, or can only be sent at the cost of double postage, and against Post-office regulations. This acting up to the strict interpretation of the word sample involves the Post-office executive in an additional amount of work, without, in many cases, bringing the extra payment of postage, and leads to evasion, as did the old postal system.

It is the same spirit of doing what the law says the postmasters are to do as was shown in reference to the penny stamp as formerly issued. It was then, as it is now, the duty of every postmaster to supply stamps to the public on demand, and the following fact illustrates the spirit in which the duty was performed.

A person applied for a shilling's worth of stamps at a certain post-office in Plymouth. The stamps at that time were not perforated, and therefore had to be cut apart. The person who had bought his 12 stamps asked the postmaster if he could lend him a pair of scissors to cut them with, and wa brusquely told that he did not keep scissors for public use, so the purchaser had to saw them asunder with a blunt knife against the door post. A second person coming in while this was going on, and witnessing what was taking place, demanded of the postmaster a stamp, which he had to cut off separately. When supplied, he demanded another, and another, till the purchaser had obtained what he thought sufficient, and then left, laughing at the labour which had been performed because the law prescribed it, and which might have been saved had the postmaster acted in anything like a liberal spirit.

The spirit of the New Post-office Act did not aim at restricting the use of the post-office by the public, but an extension of the privileges which it had enjoyed for years past; and it is unjust and absurd on the part of the Postmaster-General to put an interpretation upon the meaning of the word sample, which it has not hitherto been allowed to bear.

In a future letter I will endeavour to point out what are the terms and conditions under which foreign governments perform their parcels post duties for the public, and what it is desirable the public of this country should do in order to regain the services of the Post-office which they have lost.—I am &c.,

H. G. H.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel. Scott, R.E., secretary.

Official Catalogue.—The Commissioners are about to ask for tenders for printing the official catalogue, and for the insertion of advertisements in it.

The First Consignment of Foreign Goods to the International Exhibition of 1871 has arrived. It consists of a parcel of native cloths from Bavaria.

Albert Hall.—On page 64 is a representation of the interior of the hall, which gives a fair idea of the appearance it will assume when completed. In the galleries, which are described as picture galleries, will be held the exhibition of educational works and appliances.

Woollen and Worsted Fabrics.—In order to render the illustration of these manufactures complete, the various animals from which the raw material used is obtained will be exhibited. The Zoological Society have co-operated with the Commissioners, and have promised to lend guanacos, alpacas, cashmere goats, Asiatic sheep (from Singapore), and other animals. The Royal Agricultural Society will also give their advice in the selection of specimens of the best breeds of woolly animals.

EDUCATIONAL NOTES.

London School Board.—The first meeting was held yesterday (Thursday), at Guildhall, Alderman Cotton in the chair. Professor Huxley moved, and Mr. Lucraft seconded a motion that no salary be paid to the chairman. This was adopted by 32 "ayes" against 14 "noes." The Right Hon. Lord Lawrence, late Governor-General of India, and one of the members for Chelsea, was then elected chairman of the Board, at a final ballot, by 29 votes, against 17 in favour of Mr. Charles Reed, member for Hackney. The other candidates were Mr. W. T. M. Torrens, M.P., and Professor Huxley.

Voluntary Schools.—Among the meetings held in support of the voluntary system may be mentioned the following:—One at Berkhampstead, at which Earl Brownlow presided, and there were also present the Bishop of Rochester and a large number of the clergy and laity of the district. The Bishop moved a resolution affirming the expediency of making an effort to carry on existing schools under clause 7 of the Elementary Education Act. This was carried, though not without some opposition from those who held that "the present system had proved a mockery and a delusion." One at Derby, presided over by the Mayor, for the purpose of giving effect to the appeal recently issued by the Bishop of Lichfield, for raising funds towards the building and improvement of Church schools in the diocese. Great efforts are being made throughout the county of Dorset to supply the accommodation in schools to meet the requirements of the new Act, and so to avoid the necessity of electing school boards. Sub-committees have been formed in the various deaneries of the diocese of Salisbury, in pursuance of a recommendation from the Bishop, and already important results have been achieved. In several towns of the West meetings have been held during the past week. At Exeter the school managers held a conference at the Guildhall, under the presidency of the Mayor, when there were present the leading clergy. Sir John Bowring also attended. It was resolved to defer further proceedings till the beginning of the new year—a motion for the calling of a public meeting to consider the expediency of forming a school board being negatived. There prevails a pretty strong feeling in the city that a school board must come. The ratepayers of Weston-super-Mare have met, and it seems that the school accommodation in the town is equal to the requirements of the Act. At Tiverton every effort is being made to secure a school of the first grade, as well as schools of the second and third grades. At Bideford, the Vicar of Northam in the chair, the meeting was divided between a school board and the voluntary system, and ultimately it was resolved to take a poll as to whether a school board or the voluntary system should be adopted. At Teignmouth, the voluntary system has been decided upon as the best. In all probability there will be no school rate made in Torquay, as it is believed that the existing school accommodation, together with what is in progress, will be more than sufficient. At West Monckton, it has been resolved to support the present schools by voluntary contributions. At Torrington, it has been decided to form a committee for carrying out the voluntary system. A conference has been held at Abergwili, county of Carmarthen, for the purpose of devising measures for supplying the existing school deficiencies in the archdeaconry of Carmarthen by voluntary means. About 200 clergymen and influential laymen responded to the invitation of Bishop Thirlwall, who called the meeting. The proceedings were most enthusiastic, and the meeting altogether was very successful. Numerously-attended public meetings at Truro, Redruth, and Camborne have decided in favour of the voluntary principle.

Proposed School Boards.—The inhabitants of Barnsley, in Yorkshire, have held a meeting at their town-hall, at which it was resolved, by an overwhelming majority, that it was desirable to appoint a school board without delay. It appears from the speeches made upon the occasion that, after all that is possible has been done under the denominational system, there must still be a residue of nearly 800 children for whom no educational provision can be made. At another similar meeting, held at Wath, a like resolution was proposed and carried. It was also resolved to levy a rate for the purpose of building a new school-house and master's residence, at a cost of £1,200. The Pembroke Town Council has decided, at a special meeting, to apply for a school board. At Longton and at Worcester the town councils have also unanimously come to a similar decision. A very numerously-attended conference of delegates from the various Nonconformist churches and schools in Bath and its vicinity has just pronounced in favour of a school board. The Bath Working Men's Reform Association has also been moving in the same direction. The Bristol City Council has held a special meeting, when Mr. Wait, ex-mayor moved a resolution in favour of making application for a school board. This was supported by many members of the corporation of both sides in politics, and carried unanimously.

Middle-class Schools.—An influential meeting has been held at Stoke Newington, for promoting middle-class schools, in connexion with the Church of England, in the northern suburbs of the metropolis. Mr. M'Cullagh Torrens, M.P., occupied the chair, and was supported by the leading clergy and inhabitants of the district. Resolutions in support of the object were passed, and a liberal subscription was entered into for its promotion.

Technical Instruction.—On Tuesday last, the Lord Mayor presided at a meeting of the General Committee formed to establish in London a national university for industrial and technical training. It will be remembered that the scheme in question was started in July last, and that it eventually received the sanction of the late Lord Mayor, who suggested that a conference should be held in the City. The Executive Committee have now presented a report, and in it they make arrangements for adopting the suggestion, and propose that the intended conference should, if possible, be held in February next. The proposed national university (says the report) would stand alone, and would not admit classical studies, nor adopt the statutes of ancient institutions, but would aim at training natural philosophers, artists, chemists, engineers, and mechanics, and would bestow its honours and rewards upon those who obtained distinction in the arts and sciences. A Royal charter would be applied for as soon as possible, and decrees and diplomas would be granted in the several branches of study pursued. Steps would also be taken to form local technical schools or colleges in connexion with the university. The cost would, of course, be great, and this the Committee propose to meet by applying for State grants, for endowments, and for donations, and they also suggest that the trustees of the various obsolete charities might be asked to assist them in carrying out their object.

Free Education.—A very long and interesting letter on this subject has appeared in the *Times* from Mrs. Fawcett, sister to Miss Garrett, recently so triumphantly elected to the London School Board. The object of this communication is to explain why she thinks the stigma of pauperism may fairly attach to parents who are too poor to pay for the primary education of their children, and why, consequently, she differs from the views of the leaders of the working classes on free education. Mrs. Fawcett's principal objections may be shortly stated as follows—1. Compulsion is justifiable only on the assumption that primary education is as necessary to a child's mental welfare as food and clothing are to its bodily welfare. The assumption affords no ground for making education free. 2. What is called "free education" is not really free. It is, in reality, an extravagant mode of paying for education, the operation of which is unjust, and tends to discourage providence with regard to marriage. 3. The incidence of the education rate would most probably be borne chiefly by the working classes; it would, therefore, be more to their interest to pay for their children's education directly than indirectly. 4. Free education would be an immense extension of the system of out-door relief. In reference to the last point, Mrs. Fawcett says:—"The discouragement of self-restraint, which is one of the most striking results of the Poor-law, would, by a system of universal free education, operate in a minor degree on every section of the working classes. The demoralisation caused by the Poor-law does not act upon the best and most independent of the working classes; these provide, by means of benefit societies, trades' unions, and clubs, against times of sickness and loss of employment; but by removing the stigma of pauperism from free education, and extending it indiscriminately to all, no section of the working classes will escape from the pernicious influence of this new kind of out-door relief. With a Poor-law which gives a right of maintenance to everyone, extended by an educational system which provides free education for everyone, pauperism and intemperance will continue to flourish."

Female Education.—Lord Lyttelton, chairman of the Endowed Schools Commission, recently presided over a public meeting in the St. Pancras Vestry-hall, to establish an institution to supply good and cheap education for girls of the lower middle-classes in the district of Camden-town. His Lordship, in the course of his speech, said he doubted whether the mental capacity for all branches of intellectual occupation was the same in both sexes. At the same time he could not resist the appeal that an experiment should be fairly made to see whether, with the advantages of early training similar in all but physical respects to boys, girls would prove themselves as well fitted as the opposite sex for the various intellectual branches of occupation in this country. He confessed that the remarkable result which had attended the recent elections for the London School Board showed a tendency in the public mind to that opinion.

CORRESPONDENCE.

MR. TOMLINE, M.P., AND THE CHANCELLOR OF THE EXCHEQUER.

Sir,—In what has been published elsewhere I fail to discover a popular exposition of the point at issue.

Mr. Tomline asks that the Mint shall coin his sterling silver bullion on the same footing as that on which sterling gold bullion is coined, that is, for all comers gratis. Now gold is the basis of our monetary system, and nobody is obliged to take in payment gold coin sensibly depreciated by wear and tear. It is obligatory to call-in such pieces, and subject the last holder to the loss thereon. But our silver coinage is merely subsidiary. In sums not exceeding forty shillings nobody can refuse to accept it in payment, unless it has become so worn in fair usage, that the legends have become illegible. The Bank of England receives worn-out silver coin at its nominal value, then "garbles" it, *i.e.*, separates the over-worn coin, and receives new, full-weight coin from the Mint in exchange. The loss so incurred is borne by the State, and the State is only in part recouped that loss by the privilege to mint 5½ shillings out of every ounce of sterling silver, notwithstanding that the market price of that commodity fluctuates sometimes below 5s. 6d. per ounce. The brassage, *i.e.*, cost of fabricating the coin, somewhat reduces the margin available towards recouping the loss consequent upon the replacement of old by new ones.

A responsible minister of the Crown determines the limits within which the balance of such loss needs to be incurred, so that there should be no scarcity of silver coinage in circulation. The granting of Mr. Tomline's demand might either enable him to force the nation to purchase from him, at 5s. 6d. per ounce silver bullion, glutting the market at a lower price, or else tempt his labourers to sweat their bran new shillings before passing them again.

His object, as a statesman and as a philanthropist, is avowedly to supply productive employment on safe economical principles to labourers who, for lack of such employment, must become either paupers or exiles. Rather than witness the failure of such an object, I hereby undertake to provide for payment in silver coin to labourers above described, the wages which Mr. Tomline shall contract to give them, subject, of course, to his prior deposit of legal tender money in an approved bank.

My excuse for interfering in this controversy is the part which I have been accustomed to take in discussions upon the natural place of silver token-coinage in our monetary system, *vide* papers of mine read before this Society from 1852 to 1870, published in its *Journal.* From another point of view, the proposal of Mr. Tomline interests me deeply, inasmuch as he claims to be able to furnish employment to pauper labour, profitable in result, without undue competition with free labour. For such employments always to be available, and on a sufficient scale, a prize was offered, at my instance, at Manchester, having special reference to the cotton famine, which prize has not yet been claimed.—I am, &c.,

Jacob A. Franklin.

Dec. 12th, 1870.

P.S.—This morning's *Times* contains an admirable letter by "Vigilans," which prompts me to send these few lines after my own letter of the 12th inst., lest its offer to provide paymasters to Mr. Tomline's labourers seem less ingenuous than his own proposal. I had overlooked the probability of my being able to make profit out of his acceptance of my engagement, after this fashion:—The shopkeepers, from whom his labourers must make their purchases, will be unable to get rid of their silver coin in wholesale payments exceeding 40s., and will be obliged to exchange it for gold, and submitting to a charge for the accommodation. This discount is commonly submitted to by proprietors of public entertainments, by suburban railway companies, by re-importers of English silver coin worn away by circulation abroad, and the like. The loss thus entailed upon Mr. Tomline's shopkeepers must of necessity be compensated by increase of price charged to his labourers, notwithstanding that they enrich the country by redemption of waste lands without depressing wages in the market.

J. A. F.

Dec. 14.

COMPETITIVE EXAMINATIONS.

Sir,—May I request that you will give insertion to the following letter, addressed to Lord Lyttelton, on the origin of competitive examinations?—I am, &c.,

James Booth, Vicar of Stone.

"*To the Right Hon. the Lord Lyttelton.*

"My Lord,—In the account published in the *Standard* of the 5th inst., of the distribution of prizes to the successful candidates at the Oxford Local Examinations, your Lordship is reported to have said in your address on that occasion—'These examinations ought not to be mentioned without giving credit to their real originator, the present Bishop of Exeter, to Mr. Acland, and to certain enlightened friends of education in Birmingham.'

"Will your Lordship permit me, with the utmost respect for your high character and varied attainments, to state in a very few words, appealing only to recorded facts, the true origin of those competitive examinations which have now become one of the established institutions of the country.

"In the year 1847, I published a pamphlet, in the form of a letter to Lord Landsowne, under the title 'Examination the Province of the State,' in which I developed at considerable length the principle of competitive examination, as an instrument that might be used with great power and success to promote national education, taken in its widest sense. In this letter will be found most, if not all, of the arguments which have been advanced to uphold and recommend this system. Of this letter, some years after its publication, your Lordship was pleased to say, in your 'Thoughts on National Education,' p. 10,—'The first suggestion of this system (*i.e.* competitive examinations) seems to have been in an able pamphlet published by the Rev. Dr. Booth, addressed to the Marquis of Lansdowne.' About the same time the *Daily News*, in a leading article on the promotion of education, asserted—'Dr. Booth, in his pamphlet, "Examination the Province of the State," published some years ago, laid down the general outlines of the system of promoting education by means of examinations, which now meets with such general acceptance.'

"In 1853, shortly after I became a member of the Council of the Society of Arts, a committee was appointed, on my motion, to collect information on the subject of industrial instruction. This committee, of which I was chairman and reporter, strongly advocated in their report the establishment of a system of competitive examinations for the improvement of the Mechanics' Institutions in union with the Society.

"Two years having elapsed, in which nothing further was done in the matter beyond an abortive attempt to establish these examinations, on my appointment as chairman of the Council of the Society of Arts, I proceeded to devote my time and energies to realise in actual working efficiency the system I had developed in theory. Accordingly, in February, 1856, the Council established a Board of Examiners, of which Dr. Temple, now Bishop of Exeter, was appointed a member.

"In June, 1856, the first examinations were held at the house of the Society of Arts, in the Adelphi, when 52 candidates were examined. The general interest these examinations excited, the expressions of warm sympathy they elicited from many influential friends of education, and the numerous offers of pecuniary support that were made, proclaimed them a signal success. Measures were immediately taken by the Council to enlarge the sphere of the Society's operations, and to extend the system over the whole country. As a preliminary tentative experiment, it was arranged that the next year's examinations should be held in London and at Huddersfield. At the Society's house 80 candidates were examined, 140 at Huddersfield; at the latter place Earl Granville presided at the distribution of prizes.

"The examinations of the Society of Arts having now obtained considerable notoriety, it occurred to Dr. Temple, who, as an examiner employed by the Council of the Society of Arts, had become familiar with the whole system of their organisation in all its details, that it would be a judicious move if the University of Oxford would appropriate the system that had thus been elaborated and perfected, and apply it to the examination of schoolboys of middle-class schools. Accordingly, on the 17th of April, 1867, Dr. Temple submitted an outline of the plan to Dr. Jeune, then master of Pembroke College, for his approval and support. The original plan of the Society of Arts and that adopted by the University of Oxford were identically the same; but while the Society of Arts widely departed in subsequent years from its original scheme, Oxford adhered to it in all its integrity—with the single exception—the suppression of *viva voce* examinations.

"In conclusion, I may be permitted to express my opinion, as that of one who had once gained some experience in this matter of examinations, that the excessive multiplication of examinations, now so common, is much to be deplored. The principle is of vast importance, considered as a test of results, and an incitement to sustained exertion. But it is misapplied—nay, perverted—when it leads to cramming instead of learning, and thus becomes a hindrance instead of a stimulus to education.

"The processes of the acquisition of knowledge retard the current of thought, while those of examination accelerate it. Repeated examinations tend to dwarf the growth of knowledge. When the knowledge becomes actually incorporated with the mind, the case is different. An impatient gardener, who would be always pulling up his carrots or parsnips to see how they were growing, would have but a poor crop when the time came to gather them up.

"Such, my lord, is the true origin of the Oxford Middle-class Examinations. It may be thought scarcely worth while to correct an inaccurate statement at such length, but no one who even slightly values the *Esuriens pisæ ramus olivæ*, poor though the reward may be, would willingly see it shrivelled up without some effort on his part to arrest its decay, and assert the truth.—I have the honour to be, my Lord, &c., "James Booth.

"The Vicarage, Stone, December 6th."

MR. JENKINS' PAPER ON CHEESEMAKING.

Sir,—I beg to be allowed to make a few remarks on the paper upon "Cheese-making and Co-operative Farming," read by Mr. H. M. Jenkins, F.G.S., on Wednesday evening last, before the Society of Arts.

Much credit is due to Mr. Jenkins for his able paper, and I venture to express a hope that this matter will be again before the members at no very distant date.

It is to be regretted that the discussion which followed the reading did not take a more practical form. I have had several interviews with large dairy farmers in Cheshire, as to the desirability of adopting the factory system, but, except in a very few cases, I cannot find that they are in the least disposed to give up their old-established custom of cheesemaking in favour of the new system; in fact they maintain that they are not in possession of sufficient data to justify them in making so radical a change.

When Mr. Jenkins' paper was announced, I had a hope that the entire subject, in all its bearings, would be treated upon in the paper or in the after discussion, and that I should be then in possession of information and facts the better to enable me to re-open its discussion, with stronger and more convincing arguments as to the utility and profit likely to accrue from the adoption of the factory system in this county. However, in this I have been disappointed, for the very ground the farmers cannot see their way clear upon was not touched in the paper, and only just alluded to by Mr. Frask and Mr. Rigby in the after discussion.

Upon the cold, hungry, clay soils of Cheshire, a large quantity of manure is required, to keep the land in anything like proper condition to grow remunerative crops, and in every well managed dairy-farm a large number of pigs are kept, in the first place, to consume the whey, and in the second place, to produce and make as large a quantity of manure as possible. The making of this manure is of essential importance to the Cheshire farmer.

Again, the whey and its productions, like butter-milk, are very important articles in the consumption of his household, for his servant-men, &c. These things should all be taken into consideration, and properly dealt with, each in its proper place, before there is a good case to convince the dairy-farmer that a system, whereby he can obtain 6½d. per gallon for his new milk, whilst, at the same time, he must necessarily sacrifice certain other advantages, is more, or even as much to to his interest as that system he has followed for so long a time, and which he so well understands.

It is wonderful how soon the work in a well-regulated dairy is daily performed, and how easily by a good system of management the farmer's wife or daughter, as the case may be, gets through her daily task of cheese-making. There are, of course, exceptions to this rule, but I speak in a general way.

The largest amount of concentrated labour required at a given time is for milking purposes. Now, this is an important part of the subject, for although by joining a factory the in-door work and the cheese-making—the latter of which is usually performed by the farmer's wife or daughter—is materially reduced, still a staff of servants will be required for milking purposes, and one with a horse and cart, daily to convey the milk to the factory.

There are also sundry other circumstances well worthy of consideration, in connection with the adoption of the factory system, some of which are of great value in the internal economy of the farmer's household, but which will have to be dispensed with if the new system is adopted.

I observe that Lord Lichfield has kindly offered to lay before the public a statement, showing the entire history of the cheese-factory movement in Derbyshire. This would be a great boon to the Cheshire farmer, and will, perhaps, tend in a great measure to dispel his prejudices against the factory system.

Mr. Jackson, of Tattenhall-hall, whom I know to be a gentleman of enterprise and intelligence, gives, in the paper read by Mr. Jenkins, three reasons why he established his factory. Each of these reasons are good, but I cannot see how reason No. 3, and which deals with the moral aspect, will materially alter under the proposed new system, unless female servants are entirely dispensed with in the matter of milking. But, if this is done, and so do away with the mixing of young persons of both sexes in the shippons in the early mornings, one of the most prominent vices of the labouring population in the rural districts of Cheshire will be materially lessened. This is worthy the consideration of landlords and tenants in connection with the cheese-factory movement, for if you can bring about a higher moral standard, or remove the temptations connected with the existing system out of the way of farm servants, a vast lever will be set at work, which will exert an influence for good throughout the homesteads of Cheshire.

The description which Mr. Jenkins gives of the operations in a private dairy does not apply with much force to Cheshire, for, in the locality in which I reside, and it is generally so over the country, the most improved mills for dividing and grinding the curd into a proper state, as well as the foot-presses for pressing it, and instruments for ascertaining the proper temperature of the milk, are in general use, and the old "rule of thumb" is the exception. I think, also, that it will be found that the best quality of Cheshire cheese is in greater demand than the American, and realises a better price. The rinderpest decimated the dairy stocks of Cheshire about four years ago, and this has had a depressing influence up to this time upon cheese-making.
—I am, &c.,

A Member of the Cheshire Chamber of Commerce.

Chester, 12th December, 1870.

THE CONVERSION OF PEAT INTO BALL FUEL.

Sir,—Having heard Mr. Alloway read his paper on the 30th ult., on "Peat and its Profitable Utilisation," I had hoped I should have been allowed to convey to the meeting a right and true impression of my method of "peat working" into ball fuel, and eventually into peat charcoal for iron and steel manufactures. I was prepared to prove that peat charcoal is far superior in all ways to wood charcoal, and I certainly did not mean to say that I was ready to sell ball peat at eight shillings per ton, its cost price, without carriage, transfer, or profit. All I wished to assert and prove, was simply that I could and did produce specimens of condensed peat balls, by the aid of combined and powerful machinery, at eight shillings per ton at the works, of a much better and denser quality than that produced at eight shillings per ton (on his works) by Mr. Alloway. By his mode of hand labour, "the fuel," he asserts, "is so reduced in bulk (from common turf stowage) that it is ten times less in bulk," and he asserts that 50,000 tons of peat coal will be produced annually from 100 acres of bog, for 40 or 50 years in succession. I respectfully beg to correct his statement "that I had acknowledged my machines were too costly to pay." What I did say was, that it was Messrs. Gwynne's machines were too costly, and that I had successfully reduced the cost to working bounds, producing dense peat balls, 50 per cent. heavier than coal of the same size and form, and possessing enduring powers, three to one when compared with coals, weight for weight.

I trust ere long to be able to prove beyond all doubt that machinery, properly constructed and carefully attended to, will, in the production of peat fuel, prove its superiority to hand labour.—I am, &c.,

W. Austin, C.E.

13, South-terrace, Hatcham-park, New-cross,
London, Dec. 6, 1780.

PATENT LAWS.

Sir,—Would not the remark of the honest Lowlander when he first saw a railway train sweeping along—"Hey mon! gin they would only tak awa' that heavy, lumbering thing from afore'd, would'nt it gang a-head"—be well worth the consideration of those who would abolish entirely the system of patents. The countryman wanted, and rightly, too, that the train should go faster; and he thought, in his simplicity, if they would only take away that "heavy, lumbering-looking thing" in front (the engine), that the train would then be certain to shoot a-head. But we all know that he was wrong; that that "heavy, lumbering-looking thing" was the motive power by which mainly the train was enabled to speed its way at the wondrous rate it did. Do not those who advocate the abolition of all patents occupy much the same position as did the countryman referred to. The progress of industrial art at the present day is undoubtedly far beyond what it was before the era of patent right. These abolitionists wish, and rightly, too, that it should be even faster; but, to accomplish this, they would adopt a course much the same as that proposed by the countryman, their language being virtually identical with his. "Take away," they say, "that heavy, lumbering thing (patent law) in front, and then you will see how industrial art will advance."

Now, there can scarcely be a doubt but that the present system of patents, heavy and lumbering though it be, is the motive power by which mainly industrial art is enabled to make the rapid progress it does. Undoubtedly, the hope of reward which the system of patents enables every man to cherish lies at the root of all the inventive talent which has been, and is now at work improving and advancing industrial art, and as unquestionably is the present rate of progress largely due to such. Destroy the hope of reward, the incentive to all this, and, like the countryman, you destroy the motive power to which the present rate of advance is mainly due. If this is carried out, we shall shortly see both trains and art jogging along at the good old pace they did some 200 years ago. Besides, is there not something suggestive in the fact that, both in the case of industrial art and the train, it is only since this "heavy, lumbering thing" was tacked a-head that both have made the wondrous progress they have.

It is to be hoped that those who have the system of patents under consideration will follow the example of Stephenson and others, and, instead of throwing aside this "heavy, lumbering thing," will set about and improve it.—I am, &c.,

H. F. Alexander.

Edinburgh, December 2nd, 1870.

OBITUARY.

Thomas Brassey died suddenly on Thursday, the 8th inst., at St. Leonard's-on-Sea, where he had recently been staying for the benefit of his health. He was born in 1805, at Boughton, in Cheshire, where his yeoman father occupied land which had been held by his ancestors during a couple of centuries. Articled to a local land agent and surveyor, Mr. Brassey learnt the principles of commercial economy, and made his first independent start by contracting for the making of a road in North Wales. The first railway contract signed by Mr. Brassey was in 1836, when he took ten miles on the Grand Junction line between Birmingham and Liverpool, now incorporated with the London and North-Western Railway. The Penkridge-viaduct, on the same line, was his next great work, and at this date Mr. Brassey accompanied the late Mr. Locke, the eminent engineer, into the southern districts of England, where he executed large portions of the main South-Western line, and many of its branches. From the south-west district of England, Mr. Brassey was led by the same engineer to the Continent, where, in the early days of improved locomotion, he constructed a large portion of the Western of France and the Paris and Rouen Railways, which in turn led to his contracting for important works in Belgium, Holland, Denmark, Norway, Spain, Savoy, Italy, and Austria, with all of which countries his name will ever be intimately associated. Many of these works—notably, among others, the flying railway over Mont Cenis—proved in a pecuniary point of view disastrous speculations. The gigantic foreign and colonial operations in which Mr. Brassey was engaged for many years did not exhaust his energy, and while they were in progress a section of his large staff were always busy in the United Kingdom—at one time upon the Caledonian Railway, a remarkably difficult work; at another constructing the Welwyn-viaduct, upon the Great Northern Railway; then the West London Extension line, including a bridge across the Thames at Battersea; then the Northern mid-level sewer, and, more recently, Mr. Baker's great bridge across the Mersey at Runcorn, near Liverpool. A fair idea of the magnitude of Mr. Brassey's operations may be gathered from the fact that, in the 13 years from 1848 to 1861 inclusive, he made, either by himself or in an association with others, 2,374 miles of railway, at a contract price of £27,998,224. Mr. Brassey is stated to have suffered during the panic of 1866 to the extent of more than a million of money, but it is, perhaps, quite as extraordinary that, in 1869, he is understood to have been a richer man than during any former period of his career. Mr. Brassey married early in life Miss Harrison, of Birkenhead, who survives him, and by whom he leaves three sons, Mr. Thomas Brassey, M.P. for Hastings, Mr. Harry Brassey, M.P. for Deal and Sandwich, and Mr. Albert Brassey, of Heythrop, in Oxfordshire. Mr. Brassey became a member of the Society of Arts in 1856.

GENERAL NOTES.

Science in Liverpool.—A conference of gentlemen interested in scientific education was held in the Royal Institution, Liverpool, on Tuesday, the 6th inst., and passed unanimously a resolution declaring the advisability of establishing a Science College in that town, the cost of which was estimated at about £50,000. A committee was appointed to take steps with the view of carrying out the object.

Improvements in Fire-grates.—A patent has been taken out by Mr. John Milne, of St. Andrews, for a fire-grate, which heats air introduced by a pipe, either from the outside or from the room, as desired, and discharges it, when heated, into the room, instead of allowing so much to escape, as in ordinary cases, up the chimney. Such a purpose has often been the subject of patents—*e.g.*, Welch's patent and various others, though the means adopted differ.

Defensive Warfare.—The siege of Paris is producing new appliances for defence in great number. An armour-plated locomotive, armed with two powerful mitrailleurs; the Marekderberg mitrailleur, firing 200 balls a minute; the Montigny, firing 480; the Durant steam mitrailleur, discharging 4,500 balls per minute; the Faucheuse, or mower, costing only 35f., for all the means of throwing 300,000 balls 500 or 600 yards, and without smoke, noise, or fire; bombs emitting suffocating vapours; and a rocket so terrible that the French are said to hesitate committing the wholesale slaughter of the Germans its use must result in.

Cold Galvanisation of Iron.—The metal is first cleaned by being placed in a bath, made up of water, 1,000 litres; hydrochloric acid, 550 litres; sulphuric acid, 50 litres; glycerine, 20 litres. On being removed from that bath, the metal is placed in a bath containing 10 per cent. of carbonate of potassa, and is next transferred to a metallising bath, consisting of water, 1,000 litres; chloride of tin, 5 kilos.; chloride of zinc, 4 kilos.; bitartrate of potassa, 8 kilos.; acid sulphate of alumina, 4 kilos.; chloride of alumina, 10 kilos. The metal is left in this mixture for from three to twelve hours, according to the thickness of the layer of zinc to be desired.

Facts about New South Wales.—The area of New South Wales is 323,437 square miles, or nearly three times the size of the United Kingdom. The population is about half a million. The average attendance at public worship is 156,659 persons, of whom 45,322 belong to the Church of England, 47,685 to the Church of Rome, and the rest to various denominations. There are 48,081 scholars in Sunday schools. There are about 40 municipalities, about 550 post towns, postal villages, and postal stations, and 85 telegraph stations. The total extent of holdings of land is 7,857,469 acres—482,324 acres under cultivation, 3,693,213 acres enclosed but not in cultivation, and 3,681,932 acres unenclosed. Last year, there were 189,452 acres under wheat, which yielded 3,200,959 bushels, or nearly 17 bushels per acre. The acreage under the vine in the year ending March 31, 1870, was 3,907 acres, and the produce 460,321 gallons of wine, and 1,687 gallons of brandy, besides 955 tons of table fruit. There is abundance of land suitable for the vine, and the crop is growing in favour. The sugar cane had 3,915 acres, and the produce was 3,563,704 lb., and should have been much greater but for the want of machinery. In the tropics the sugar cane must be replanted whenever it arrows or flowers; in New South Wales it never flowers, and therefore is pretty nearly perennial. The product is thought likely to average 2½ tons per acre. This is better than grain growing. Horse-breeding is not found profitable in New South Wales, and the horse deteriorates in quality. There are now (1870) 280,304 horses in the colony. The number of horned stock is 1,795,904; of sheep, 14,989,933; of pigs, 175,294. The great staple of the colony is wool. A fat sheep, weighing 60 lb., fetches from 6s. to 8s.; the wool does not average 2 lb. per fleece. In consequence of the low price of inferior wool, great attention is now being paid to the production of better quality. In 1869, the quantity of coal raised was 919,773 tons, of the value of £346,146. The search for diamonds has not hitherto proved a very successful avocation, the cost of the labour not being covered by the value of the gems found. These have been about 5,500, but the average weight has been but a grain; the largest was 5¾ carats. Within the year ending December 31 there were imported into New South Wales goods to the value of £8,392,758, of which £3,544,285 was for imports from the United Kingdom, £1,076,014 from Victoria (£581,159 being in overland trade); £523,344 from South Australia, £1,473,008 from Queensland, and sundry shipments from other British colonies swelled the amount to £3,919,092. From foreign States the imports were £929,376. In exchange for these, there was exported to Great Britain produce, &c., valued at £3,267,019; to Victoria, £2,825,393; South Australia, £286,868; other British possessions, £3,245,290; foreign States, £308,827, making a total of £9,933,442. Among the exports wool assumes the highest place. 63,000,000 lbs. were exported; but as about 12,000,000 lbs. was the produce of Queensland, credit is only taken for £51,269,672 lbs.; of this 29,938,837 lbs., valued at £1,762,912, was shipped from Sydney, and 21,330,835 lbs., worth £399,610, left the colony overland, chiefly for Victoria. The total export of gold consisted of coin to the amount of £2,184,612; bars, £416,570; dust, 161,690; total, £2,762,672; towards which New South Wales contributed £2,489,145.

Large Refracting Telescope.—A magnificent refracting telescope, with an object-glass of twenty-five inches in diameter, is being constructed at the manufactory of Messrs. Clarke and Sons, Massachusetts, for the national observatory at Washington. The money for this valuable instrument was voted by Congress last session, and amounts to 50,000 dollars (about £10,000).

The Indelible Diary of Messrs. De la Rue, for 1871, is edited by Mr. Goddard and Mr. Thelwall, M.A., and is illustrated with engravings showing the changes in solar prominences, which are explained by an interesting article written by Mr. Norman Lockyer, who, with Dr. Frankland, has been enabled to locate the solar atmosphere and determine its pressure. The diary, with its useful scientific details of measurements and tables of all kinds, is a model of artistic taste.

Science Besieged.—We learn from *Nature* that the French Académie des Sciences has held its sittings regularly since the commencement of the siege, and the *Comptes Rendus* has been published regularly every week. Every sitting is reported fully, and several numbers have had even more than the average number of pages. A large part of them is devoted to military science and to ballooning. The scheme put forward by M. Dupuy de l'Ome was fully discussed and illustrated by copperplates; an article contributed to the *Presse*, by M. Giffard, the celebrated engineer, when reporting upon his aërial experiments as much as twenty years ago, has been reprinted. It was shown that Dupuy de l'Orme's experiment was almost of the same nature, and the Académie des Sciences has apologised for not publishing it in proper time. M. Dumas and M. Elie de Beaumont, although members of the former senate, now act in their capacity of *sécretaires perpetuels* of the Academy. M. Leverrier has not appeared at any of the sittings. M. Chasles is most punctual in his attendance. Lectures are given at the Conservatoire des Arts et Métiers, and are to be given at the Collége de France. No lectures have been given this session at the Sorbonne. Since the commencement of the siege, a few numbers only have been issued of the *Révue des Cours Scientifiques; Les Mondes* and *Cosmos* have been entirely suspended.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

December 21.—"On a Method of Lighting Towns, Factories, or Private Houses by means of Vegetable or Mineral Oils." By Albert Silber, Esq.

MEETINGS FOR THE ENSUING WEEK.

Mon. ....SOCIETY OF ARTS 8. Cantor Lectures. Mr. F. S. Barff, "On Artists' Colours and Pigments." Lecture V. "Fresco and Silicious Painting (continued)—Destructive Influences on Colours, &c."
London Institution, 4. Prof. Odling, "On Chemical Action" (Educational Course).
British Architects, 8.
Actuaries, 7. Mr. T. A. Welton, "On the Movement of Population."
Medical, 8.
Tues. ...Civil Engineers, 8. Annual General Meeting.
Statistical, 7¾.
Pathological, 8.
Anthropological, 8.
Wed. ....SOCIETY OF ARTS, 8. Mr. A. M. Silber, "On a Method of Lighting Towns, Factories, or Private Houses, by means of Vegetable or Mineral Oils."
Geological, 8. 1. Mr. T. F. Jamieson, "On the older Metamorphic Rocks and Granite of Banffshire." 2. Mr. C. J. A. Meyer, "On Lower Tertiary Deposits recently exposed at Portsmouth." 3. "Mr. W. Whitaker, "On the Chalk of the Cliffs from Seaford to Eastbourne, Sussex. 4. Mr. W. Whitaker, "On the Chalk of the Southern Part of Dorset and Devon."
Royal Society of Literature, 8½ 1. Dr C. M. Ingleby, "On a passage in 'Othello '" (by the late Rev. W. W. Berry). 2. Mr Walter De Gray Birch, "On the Great Seals of William the Conqueror."
Thurs...Royal, 8½.
Philosophical Club, 6.
Fri.......Quekett Club, 8.

Journal of the Society of Arts.

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FRIDAY, DECEMBER 23, 1870.

PROCEEDINGS OF THE SOCIETY.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The Musical Education Committee, to whom the arrangement of the details for carrying out this object is entrusted, met on Monday, the 19th instant. Present—The Right Hon. Sir John Pakington, Bart., M.P., in the chair; Lord Gerald Fitzgerald; Sir John Harington, Bart; Lieut.-Col. Scott, R.E.; Capt. Donelly, R.E.; Messrs. H. Cole, C.B.; A. S. Cole; C. Wren Hoskyns, M.P.; J. F. Puttick; and Seymour Teulon. Sir Michael Costa attended the Committee by invitation.

The following report from the Musical Committee has been laid before the Council and adopted:—

1. In order to carry on the work already begun by the Society of Arts, with the view of establishing a National Training School for Music, the Committee recommend the Council to make music—as one of the Fine Arts—an object of the Society's attention.

2. For promoting this purpose, the Committee recommend that a musical section of the Society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall.

3. These concerts to consist of performances of vocal and instrumental music of the highest character.

4. After paying the expenses of the concerts, the profits to be applied to the establishment of a National Training School for Music.

5. Members of the Society, for every subscription of one guinea paid to the musical fund, to have the privilege of obtaining a transferable ticket for six evening concerts in the arena and balcony (see woodcut on next page) without further payment, provided that no member as such shall have the privilege of receiving more than five tickets on these terms. Each seat will be numbered and reserved.

6. Persons not members of the Society shall have the liberty to purchase tickets on such terms as the Council may from time to time determine.

7. That the Musical Committee of this Society, consisting of:—

The Lord Henry G. Lennox, M.P., Chairman of the Council, or the Chairman of Council for the time being, and
S. Redgrave, Esq.,* and Seymour Teulon, Esq., Vice-Chairmen of the Council, or Vice-Chairmen of Council for the time being
Lord Gerald FitzGerald *
The Right Hon. Sir J. Pakington, Bart., M.P.*
Sir John E. Harington, Bart.*
Sir Francis Sandford *
E. A. Bowring, Esq., C.B., M.P.*
Henry Cole, C.B.
A. S. Cole, Esq.
Capt. Donnelly, R.E.*
The Honourable Seymour Egerton
W. Hawes, Esq.*
C. Wren Hoskyns, Esq.
Frank Morrison, Esq.
J. Puttick, Esq.*
Lieutenant-Colonel Scott, R.E.*
E. C. Tufnell, Esq.

be authorised to carry out the arrangements for the six concerts, as soon as a guarantee fund for not less than two thousand pounds has been obtained, and one thousand subscriptions of one guinea.

That Sir Michael Costa be asked to meet the Committee, to discuss the necessary details.

A guarantee fund for assuring the Society against loss has been commenced, and the following gentlemen have guaranteed the amount set opposite their names respectively:—

	£	s.
F. A. Abel, F.R.S.	10	0
G. C. T. Bartley ..	20	0
William Beamish..	10	0
L. Birnstingl	10	0
Sir W. H. Bodkin	10	0
William Botly	10	0
E. A. Bowring, M.P.	10	0
J. G. Breach......	10	0
George Brough ..	10	0
Henry Butter	10	0
C. M. Campbell ..	100	0
Andrew Cassels ..	10	0
E. Chadwick, C.B.	10	0
W. D. Child......	10	0
Hyde Clarke......	10	0
John Clutton	10	0
Alan S. Cole......	10	0
Henry Cole, C.B...	50	0
Henry Creed	10	0
Earl de Grey and Ripon, K.G.	50	0
Sir C. W. Dilke, Bart., M.P.	20	0
Samuel Dean	10	0
Captain Donnelly, R.E.	20	0
Christopher Dresser	25	0
Major-General F. Eardley-Wilmot, R.A.	10	0
Hon. S. Egerton ..	10	0
John H. Evans ..	10	0
Captain Festing, R.E.	20	0
Lord Gerald Fitzgerald	10	0
G. E. Forrest	25	0
John Fowler	20	0
John Francis	10	0
Jacob A. Franklin	10	0
C. J. Freake......	100	0
Captain D. Galton, C.B., F.R.S.....	20	0
I. Gerstenberg	10	0
George Godwin, F.R.S.	10	10
Frederick Gordon	10	0
Lieut. Grover, R.E.	10	0
Sir John E. Harrington, Bart. ..	10	0
James Heywood, F.R.S.	20	0
Dr. Hogg	20	0
Bartlett Hooper ..	10	0
C. Wren Hoskyns, M.P.	10	0
Henry Howell	10	0
Walter Hughes ..	10	0
Henry Hunt	50	0
T. O. Hutton	10	0
Professor Huxley, F.R.S.	10	0
J. M. Johnson and Sons	10	0
John Kelk	100	0
Right Hon. A. H. Layard	10	0
Lord Henry Lennox, M.P.......	50	0
Samuel Lovegrove	10	0
Messrs. Lucas Bros.	250	0
T. A. Masey......	10	0
H. Maynard......	25	0
J. Maynard	50	0
Admiral E. Ommanney, F.R.S.	10	0
Right Hon. Sir J. S. Pakington, Bart., M.P.	25	0
John Penn, F.R.S.	100	0
J. Pollen	10	0
J. F. Puttick	10	0
H. Ravenscroft....	21	0
Samuel Redgrave..	10	0
Sir Francis Sandford	10	0
Edwin Saunders ..	20	0
Lieut.-Col. Scott, R.E.	50	0
George Smith & Co.	150	0
G. A. Spottiswoode	10	0
Seymour Teulon ..	10	0
Henry Thring	20	0
E. C. Tufnell	10	0
Henry Vaughan ..	10	0

List of Subscribers for Tickets.

T. W. Baggallay	3
R. W. Bartram	2
W. Beamish..........	2
L. Birnstingl	2
Sir W. H. Bodkin	2
William Botly	2
J. G. Breach	2
George Brough	2
Henry Butter	2
Andrew Cassels	4
W. D. Child	2
John Clutton	3
Henry Cole, C.B.	5
Henry Creed	2
Major-Gen. Daubeney, C.B.	2
S. T. Davenport	3
Samuel Dean	2
P. F. Debary	1
Christopher Dresser ..	2
Charles Downes	2
John H. Evans	2
Freeland Filliter	1
P. Le Neve Foster	2
John Francis	2
I. Gerstenberg	1
Frederick Gordon	2
Lieut. Grover, R.E. ..	2

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* These signed the Report on Musical Education, 1866.

Arthur Hall	2	H. Maynard	2
Bartlett Hooper	2	J. C. Nickisson	2
C. Wren Hoskyns, M.P.	2	James Noble	2
Henry Howell	3	O. A. Pegram	2
Walter Hugher	2	M. E. Rodocanachi	2
F. W. Hulme	3	H. Ravenscroft	2
T. O. Hutton	5	Edwin Saunders	3
J. M. Johnson and Sons	2	W. F. Simpson	2
Samuel Lahee	4	Capt. Arthur Styan	5
W. G. Larkins	2	Seymour Teulon	2
Samuel Lovegrove	5	W. H. Thomas	2
Messrs. Lucas Bros. (two members)	10	Henry Thring	2
George Macnair	3	R. L. Trollope	2
T. A. Masey	1	E. C. Tufnell	2
		Zachariah Watkins	3

The Council earnestly hope that the members of the Society will support, and co-operate with them in, this important public undertaking, and by joining in the proposed guarantee, and by availing themselves of the privilege of subscribing for tickets at the reduced rate, aid in securing the establishment of a National Training School for Music.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

SIXTH ORDINARY MEETING.

Wednesday, 21st December, 1870; Sir Antonio Brady in the chair.

The following candidates were proposed for election as members of the Society:—

Chester, Frederick J., The Elms, Clapham-common, S.W.
Drummond, the Hon. Edmund, 58, St. George's-sq., S.W.
Green, John A , 34, Clement's-lane, Lombard-street, E.C.
Robinson, Alfred, F.R.G.S., Mountjoy-house, Huddersfield.

The following candidates were ballotted for and duly elected members of the Society:—

Bird, P. Hinckes, 1, Norfolk-square, W.
Bosanquet, Charles B. P., 8, Lansdowne-road, W.
Gamgee, Professor John, 26, Horbury-crescent, Notting-hill-gate, W.
Greene, Benjamin, 102, Piccadilly, W.
Hart, James L., 20, Pembridge-square, W.
Hartley, Dr. Edmund, 31, Warwick-square, S.W.
Hookey, Henry G., 28 Westbourne-park, W.
Hurtzig, Charles, Danford-house, the Grove, Boltons, S.W.
Puxty, W. C., Erdington Orphanage, near Birmingham.
Saunders, James T., 143, Oxford-street, W.
Taylor, William, Great Driffield, Yorkshire.

The Paper read was—

ON A METHOD OF LIGHTING TOWNS, FACTORIES, OR PRIVATE HOUSES, BY MEANS OF VEGETABLE OR MINERAL OILS.

By A. M. Silber, Esq.

We are all familiar with gas-light. It meets our sight wherever we turn, on passing any evening through the busy thoroughfares of populous London. Accustomed as we are to the sight of the brightly illuminated shops and streets, we are scarcely able to realise to ourselves how people fared before the introduction of coal-gas; and yet it is barely 60 years since gas was first thought of as a general illuminant, and in this comparatively short time it has almost entirely superseded—at all events, in our large towns—the sources of light known at the beginning of this century, viz., vegetable and animal oils, and fats of various origin, which, for centuries past, formed the exclusive illuminating material of rich and poor.

The eye is occasionally attracted in our business streets by brilliant white lights, displayed in shop windows, burning from lamps of novel construction, which strike the Londoner, accustomed as he is to gas-light, as a vast improvement upon the latter. These are the so-called paraffin lights. Who has not stopped for a moment to muse over the cheerful sight, and has gone his way saying to himself, "This is really a pleasant light; will it ever take the place of gas-light?" In many a humble dwelling in this country, and more so in other countries—in Norway, Sweden, Denmark, Germany, Russia, America, and others—we meet now with the same bright light. The paraffin lamp has in fact pushed aside the old dips, candles and oil-lamps; and the long winter nights of our northern latitudes have been rendered more cheerful since the introduction of these cheap lights. It is well known that the consumption of paraffin and petroleum oil has increased immensely in this and other countries during the last eight or ten years, and that the lamps constructed for the combustion of these mineral oils have now found their way into some of the most out-of-the-way places of country districts. When we remember how slowly people familiarised themselves with gas, and how many misgivings about its practical employment as a source of light had to be overcome, it is astonishing how rapidly this new illuminant has come into use. Why are these lights found more frequently in country districts than in towns—more often in the cottage than in the houses of the well-to-do people? We need not go very far to answer this question. It is on account of their cheapness, and the better light which they produce.

There are many people who strongly object to gas, even in these days of almost general consumption of this lighting material, and many who object more vehemently to the use of mineral oils. Both gas and mineral oils are possessed of a somewhat unsavoury odour; both explode under favourable conditions, *i.e.*, when mixed with air, and when a light is brought into contact with the explosive mixture. But, then, gas can be consumed from properly-constructed burners without giving any smell, and mineral oils, when burned from suitable lamps, burn likewise with little or no odour. Petroleum oil has got into bad repute with people on account of the many shocking accidents by fire, arising from the upsetting of lamps, and the unscrupulous retailing of oils which inflame at low temperatures when they are brought near a light.

If I can show this evening that I have overcome, for the most part, these drawbacks to the use of mineral oils, by employing specially-constructed lamps, and by a perfectly safe and novel mode of conveying the oil to the lamp and wick, you will, I trust, patiently forbear with me if I do not place the subject before you as well as its paramount importance deserves.

How to Convey and Distribute Oils.—It occurred to me that oils might be distributed like water over our houses, by availing ourselves of the law which applies to all fluids, viz., that they flow till they find their level or equilibrium, and that, by providing a small oil-tank in the upper part of the house, with pipes conveying the oil to the lower parts, any liquid illuminating material might be distributed with the same facility as water is now distributed over most modern-built houses.

In the place of plain taps, I regulate the flow of the oil by employing on each floor a little cistern or cisterns, provided with a well-constructed little tap, regulated by a ball-cock or self-acting float, and through which the oil must pass on its way to the lights. It is obvious that the lights must be, as nearly as possible, on a level with the distributing cistern, and that the wicks of the burners which dip into the oil must be adjusted at such a height that they suck up the oil freely, without, however, causing any overflow; in other words, that the oil at the top of the wick is in a state of perfect equilibrium with the oil in the distributing cistern, though the level need not be absolutely the same, owing to the slight friction in the conveying-pipes and the suction exerted by the cotton wick. When the lamp is lighted, the oil must, on the principle of the ball-cock movement, be supplied to the wick as fast as it is consumed, and with the most marvellous regularity. The light itself, in fact, is made to regulate automatically its own supply of oil. Having thus explained, in the briefest possible manner, the principle which guided me in the distribution of the oil to the lights, I will next proceed to explain to you in detail how this may be done practically.

Distributing Apparatus.—A small tank or reservoir is placed in the upper part of the house. It may be made of wood, lined with stout tinned-iron or sheet-tin, and covered in with a lid provided with a small opening for the admission of air, and for filling the reservoir with fresh oil whenever it is required. The capacity of the tank should be made proportionate to the number of lights that have to be fed from it. Its contents need rarely exceed one or two gallons. Over the outlet pipe I fix a cage of fine wire gauze, which keeps back any dirt occasionally found in oil.

A pipe leads from this tank to the lower parts of the house. It may be carried along the waste-pipe, which is to be found in most modern houses. Branch pipes are carried to each floor. It is necessary to avoid lead or composition pipes, on account of the corrosive action which oils, especially vegetable oils, such as linseed, rape oil, and others exert upon lead. Tin pipes are accordingly used for the conveyance of the oil.

The branch pipe which conveys the oil to the little distributing cistern may be fixed, like an ordinary gas-pipe, against the wall either inside or outside the room, in the manner seen in the model before you. The distributing cistern, of which I have here a model, consists of an open oblong box, about 6 to 8 inches long, 3 to 4 inches wide, and about 3 to 4 inches deep, into which the oil is delivered from a well-constructed stop-cock, which is soldered into the narrow side of the oblong box, and against which a somewhat smaller close box or oblong cistern is soldered, into which the oil makes its way from above by means of an inlet pipe connected with the small box by a union joint. At about one-fourth from the top, inside the box, a very fine copper gauze is fixed. The oil, on passing through this sieve, is deprived of any accidental impurities, such as chips of wood, bits of straw, &c., which might otherwise make their way into the stop-cock and cause an obstruction. The hermetically closed box can be readily got at by unscrewing the union joint, which is at the bottom of the auxiliary reservoir, if it should ever become necessary to remove any accumulation of dirt. The stop-cock is large enough to deliver a large stream of oil, whilst at the same time the action of the self-acting float is capable of checking the delivery down to a drop or two every few minutes. The distributing boxes can be made of all sizes, but as they constitute merely temporary resting places for the oil, on its passage from the main tank at the top of the house to the burner or burners, they need not be made larger than is sufficient to hold a few ounces of oil. The china float is fixed to the tap by means of a metal arm or lever. The conical metal plug of the stop-cock may be either fixed by means of a screw button, or simply by means of a metal pin. The float is set so as to shut off the flow of the oil automatically as soon as the box or distributing-cistern is filled to about $1\frac{1}{2}$ inch in depth with oil. The china float is a circular double convex disc, pierced with a hole in the centre. Into this hole is fixed a piece of hard wood, to which the arm or lever is attached by a metal pin. The metal cone of the tap should work smoothly and regularly, and should be well ground in, so as to prevent any leakage whilst it is shut off. For better security, however, I fix a stop-cock just somewhat above the distributing-box, to shut off the supply when no oil is required from each floor. A stop-cock, fixed in the main-supply pipe, just below the oil reservoir in the upper part of the building enables me likewise to shut off the oil from the house as effectively as gas can now be turned off at the meter.

It is obvious that the little distributing apparatus just described can feed one or two lights with the same facility with which it will feed 100 or more burners, provided they are all arranged on the same level, as seen in the model before you, since the tap will discharge the oil only in proportion as it is consumed. Burners placed at different heights must be supplied from distributing cisterns placed at corresponding heights. For single lights, such as street lights, railway lamps, &c., I have also succeeded in perfecting another system of conveying the oil to the wick, which answers most admirably, but which I am not able to submit to you to-night, as the experiments have not been quite completed, and as certain necessary arrangements have yet to be gone through.

Lamps and Burners.—The construction of the lamp or burner differs, of course, according to the kind of oil—vegetable or mineral—which it is proposed to burn. I have until now only used ordinary colza and rape oil as well as petroleum oil, but there can be little or no doubt that any vegetable as well as light or heavy mineral oil can be burnt on the same principle. The consumption of colza oil, rape oil, &c., is rendered so much more easy as the distributing apparatus renders the supply of oil to the wick as regular as clockwork, and gives a light which remains steady for a considerable time, say 24 hours, and which can only be influenced by the gradual charring of the wick. The petroleum oil light possesses in this, as in other respects, an important advantage over the ordinary oil light, in so far as the wick chars much more slowly, and rarely ever gets distressed. No lamp has as yet been constructed which gives the same amount of light during a lengthened period of combustion. Carcel's clock-work lamp gives a light of such uniform brilliancy, remaining unimpaired for several hours after the lamp has been lighted, that, in France, for instance, its light serves as a standard for determining the illuminating power of coal gas. It is known to burn remarkably steady after the first hour, and to preserve this constancy of combustion from six to ten hours. The very slight change observed in the light is owing to the uniform level and superabundant flow of the oil. The increase of brilliancy with the progressive burning during the first hour may possibly be accounted for by the decreasing quantity of heat withdrawn from the flame by the neighbouring parts, in proportion as these become warmer, and also perhaps by the excess of oil being too great at the commencement, and becoming reduced to the proper quantity by the decreasing tension of the spring employed for working the pump.

A perfectly uniform light cannot be obtained from ordinary lamps on account of their construction, and more particularly from the action of the wick; the variations, however, which occur in the intensity of the light are confined within much narrower limits than in the case of candles, where a constant change is occurring. In many less perfectly-constructed lamps the diminution of light during six hours amounts to $\frac{1}{3}$, $\frac{1}{2}$, and even $\frac{4}{5}$ of the original intensity; it is only imperceptible in Carcel's and a few other lamps which produce their light with the least consumption of oil.

Upon what Principles should Lamps be Constructed.—There are four conditions required for a good lamp:—

1. A regular supply of oil to the burning wick.
2. Means for regulating and varying (within certain limits) the height of the flame.
3. The regulation of the current of air, according to the nature of the illuminating material and the quantity thereof which is to be burnt.
4. The oil reservoir should be placed in such a position

as not to throw a disturbing shadow into the illuminated space, without at the same time endangering the steadiness of the lamp.

All lamps may be divided, according to the methods adopted for feeding the wick with oil, into—

(*a*). Lamps in which the capillary action of the wick has to raise the oil from a lower oil level to the upper part of the wick; these are called *suction-lamps*.

(*b*). Lamps which are provided with a mechanical (hydraulic) contrivance for carrying oil in smallest possible proportions and in constant quantities to the wick; these are termed *mechanical* or *pressure-lamps*.

An ordinary light, with a floating burner, constitutes a suction-lamp, in which the distance of the level of the oil from the top of the wick remains always the same. This most rational construction of a lamp cannot, however, be applied to lamps on an increased scale of construction, and is of use only for lamps which have not to be moved, and which have to produce only a weak light. Among the other suction lamps of a most simple yet faulty construction, are the lamps in which the oil vessel is placed sideways (as, for instance, in the ordinary kitchen or study-lamp), or below the burning wick. In both kinds of lamps the wick suffers from an irregular supply, varying with the ever changing level of the oil; they produce therefore a varying light. A more regular supply of oil to the wick can be insured by constructing the oil-vessel upon the principle of the common bird fountain. The lamp requires, in fact, two oil cisterns, an outer one, from which the burner is fed, and an inner or inverted vessel, from which the oil is supplied to the outer vessel, in proportion as it is consumed. When the lamp has been lighted for some time, and the oil in the outer vessel has sunk below the mouth of the vessel, air-bubbles enter, and take the place of an equal bulk of oil, which makes its way into the outer vessel, thereby raising the oil-level until the mouth of the inner vessel becomes again closed. In all lamps of this construction the height of the oil in the burner is subject to slight fluctuations, which produce, however, a perceptible variation in the supply of the burner, and, consequently, in the light produced by the lamps. Of other lamps, such as the so-called hydrostatic lamp, I need not speak, as they are little used now, having been found far too complicated and clumsy.

The ingenious mechanism in the different mechanical or pressure-lamps, in which springs or pumps are made to force up the oil from the oil reservoir below the burner to the top of the wick, deserves to be admired. These lamps, known by the name of pump-lamps, moderator-lamps, Carcel's clock-work or mechanical lamp, convey the oil with almost faultless regularity to the burning wick. The moderator-lamp, on account of its greater simplicity, its greater cheapness, and pleasing shape, has now, for the most part, replaced the Carcel-lamp, in which the oil is raised by a Priest-pump, so called after its inventor, set in motion by a spring which can be wound up. All mechanical lamps convey more oil to the wick than can be burnt, causing a constant overflow of oil—most ample in large lighthouse lamps. The wick can, therefore, be raised considerably above the edge of the burner. Thus, less heat is conducted away from the flame by the metal burner, and the wick does not char so rapidly, whereby a more regular flow of the oil is secured—a condition which is all-important when heavy and less fluid vegetable or animal oils have to be burnt. The principle underlying all mechanical lamps, viz., the plentiful supply of oil to the wick, so as to cause a constant overflow, is inapplicable in lamps which are constructed for the consumption of mineral oils, such as naphtha, camphine, shale oil, photogen, solar oil, and paraffin oil. The principal condition which has to be complied with is a well-regulated and abundant supply of air, in order to consume the very large quantity of carbon which enters into their composition. To prevent smoke, it is also necessary that the wick should receive as little oil at a time as possible, and that this oil should reach the flame as hot as possible.

It is obvious that compliance with this latter condition renders the use of oils all the more accessible, which can only be burnt by a copious supply of air, deflected from both outer and inner air currents into the flame. This is done in various ways. In the so-called paraffin lamps the wick tube is capped with a metal cone, which slightly rises above the level of the burner, and a current of air, as in the case of argand burners, is often thrown into the inner side of the flame by means of a moveable button, the so-called Liverpool button. The air current is further regulated by glass chimnies of varying heights, according to the nature of the oil and the size of the flame. It is impossible to pay too much attention to the chimnies. I have found that one and the same burner produces as much as four times the amount of light when supplied with different chimnies. I also observed that the chimney influences to a very great extent the size or height of the flame, and that the latter is sometimes contracted and squeezed into a pyramidical form by the chimney, whereby the illuminating power of the flame is materially reduced.

To sum up briefly this review of the different systems in use for conveying the oil to the wick, and the various lamps—at all events the more important ones which have been made—it will be clear that the lamps which are constructed on the most correct principles are at the same time of a highly complicated nature, and far too ingenious for every-day use; also, that mineral oils are burnt with greater advantage by a totally different system of constant oil-supply, although I may mention that I have succeeded in constructing a moderator lamp which burns petroleum very nicely. I believe that the new method of feeding lamps with petroleum, proposed by me, has at least the merit of great simplicity, whilst it complies most rigorously with the requirements of a steady and uniform oil supply to the lights.

Improvements in Burners.—I have used both argand and flat burners for the consumption of mineral oils in lamps, and have succeeded in what will probably astonish many gentlemen in the room familiar with lamps, viz., in burning the oil by means of the ordinary argand burner and cotton wick dipping into the oil, without being inconvenienced by any overflow and dropping of oil, the wick projecting but slightly from the burner. This, you will agree with me, can only be done when the oil is supplied to the wick with the greatest possible regularity, and, *vice versâ*, it affords a clear proof that I have succeeded in so supplying it.

The difficulty of employing argand burners for the purpose of burning light mineral oils is considerably increased on account of the more mobile nature of the fluid, and any overflow from the burners can only be prevented by the nicest adjustment of the oil supply.

The argand burner is already such a perfect piece of apparatus that you will not expect to hear from me that I have materially improved upon it. I have been able, however, with the aid of Mr. White, of whose mechanical skill it would be difficult to speak too highly, to introduce several improvements in the construction of argand burners for the consumption of petroleum oil, which enable me to employ burners of considerably larger size than have, I believe, hitherto been employed. By dispensing with the Liverpool button for throwing air into the inner part of the flame, the latter increases considerably in height, giving a proportionately increased illuminating power.

The movement imparted to the wick by means of a worm, whereby the inner tube, or wick-holder, is worked from the outer gallery tube, which supports the glass chimney, by means of a pin fitted into the serpentine groove of the inner tube, usually entails a very unsightly breaking up of the flame into as many distinct divisions as there are brass stays, or rods, for connecting the outer with the inner tube, owing to the splitting-up of the air draught into several distinct currents. A perceptible loss of illuminating power is known to result from these defects; the burners are more liable to be influenced by air-currents, which often cause them to smoke most disagreeably. I have substituted fine connecting-pins between the outer and inner closely-fitting tubes, and thereby entirely obviate these drawbacks to a pleasing and steady flame. This improvement applies equally to argand burners used for burning colza or mineral oils.

The movement for raising or lowering the wick, known as the rack-and-pinion movement, which depends upon turning a key that works the pinion, was found to be defective, as the expansion of the metal tubes by the heat, and the contraction on cooling, played havoc with the most perfect fittings, and caused frequently a slight leakage through the hole in which the key works. In order to overcome this defect, I have placed the key above the level of the oil in the wick tube, and have since found that no leakage need be dreaded from this cause.

I employ argand burners of different sizes, burning wicks varying in diameter from $\frac{7}{8}$ to $1\frac{3}{4}$ inch. It has, however, been found that the larger argands give proportionally less light than the smaller sized burners, a ratio which is the reverse of that observed in the case of argand gas-burners. This applies to the earlier experimental photometrical testings. I hope to overcome this loss of illuminating power, however, by employing central tubes, which deflect the current of air into the flame, whilst, at the same time, the quantity of air to the inner part of the argand flame can be brought under thorough control. The proper conditions for any alteration of this kind can only be studied by patiently watching the effect produced, and I must therefore abstain from going further into this question, beyond mentioning that I am hopeful of constructing burners larger in diameter, with every prospect of success.

Theoretical Consideration of the Nature of Luminous Flames.—I found that the illuminating power of argand burners, as well as flat lights, is considerably increased by an appropriate and well-adjusted supply of the illuminating material. It may be readily conceived that, with a mobile liquid like petroleum oil, which is easily vaporised, it is a matter of great importance to place the supply of oil to the wick at such a height as to allow the wick not only to suck up the oil freely, and to convey it without hindrance and with the utmost regularity to the wick, but to utilise also the heat engendered by the combustion of the oil, and which is communicated, to some extent, by conduction and radiation to the metal tubes in which the wick is encased, and in which the oil is supplied to the latter, in order to vaporise a portion—perhaps not an inconsiderable portion —of the oil before it comes in contact with the air supplied to the burner from the outside and inside of the flame. That this is actually the case may be seen when a light is allowed to burn for some time, until the wick-case has become heated to its maximum temperature, and is then suddenly blown out and rekindled after a few moments. The vapour of the oil is seen to burn above the burner, leaving a non-luminous dark space between the wick and the flame. Cold petroleum oil does not inflame, even when a light is held closely over the surface of the oil. It is, in fact, by this very test that the value of different samples of petroleum is determined. The point of ignition is observed by a thermometer, and no oil, the vapour of which inflames below a temperature of 90 deg. F., is now allowed to be sold, according to an Act of Parliament passed in the year 1868. It will strike you, as it struck me, that we arrive at the right condition for the burning of easily volatilisable oils, when they are vapourised previous to their introduction into the flame, and that a higher illuminating power is obtainable from the same illuminating material when conveyed to the flame in the form of vapour heated nearly to the point of ignition. Petroleum oil is, after all, not separated from coal gas by such an insuperable line of demarcation. The latter is a vapour at the ordinary temperature, and the petroleum oil which I use becomes converted into a vapour at the temperature of about 340° Fah.

Moreover, gas engineers have shown us that the temperature at which coal gas is consumed materially influences its illuminating power; that, for instance, gas which is conveyed through several miles length of gas-mains loses in illuminating power, on account of the condensation of the less volatile hydrocarbon vapours, such as benzol, naphthaline, and others, contained in the gas; that during cold weather the illuminating power of the gas recedes and that the exhaustion of the coal in the retort-house cannot be carried so far as during warm weather. They are likewise aware of the fact that during the warm season of the year the gas remains more thoroughly charged with hydrocarbon vapours, rich in illuminating power, and that, consequently, a more thorough exhaustion of the coal is possible.

I may also remind you of the numerous ingenious devices resorted to by various inventors, from the late Mansfield, who was, I believe, the first to distil benzol on a manufacturing scale, down to the more recent enthusiasts in the cause of improving coal gas by charging it with hydrocarbon vapours, viz., the various so-called naphthalising processes, with which most of you, gentlemen, are no doubt acquainted. We all know of the surprising effect which can be produced by passing coal gas through benzol, or some other more volatile hydrocarbon, and we also know how coal gas dislikes to be improved in this apparently simple manner. Attempts made on a large scale in the City of London, and in other places, have failed, owing to the difficulty of keeping the more condensible vapour in suspension in the gas. It is even possible—and a most ingenious lighthouse lamp has been actually constructed on this principle—to procure a beautiful light by merely passing air through very light mineral oils, slightly heated, and to burn the mixture of air and gas with splendid effect from a close argand burner—if this name may still be applied to such an illuminating apparatus, by making use of the precautions observed in a Hemming's oxy-hydrogen jet. This shows, more than anything else, how closely coal-gas and light hydrocarbon vapours are allied to each other, and how the same thing holds good for the one and the other under different conditions of temperature.

Every practical gas-burner maker is familiar with the influence which the temperature possessed by the gas when it issues from the burners, exerts upon its illuminating power. One rule, I believe, is to allow the gas to issue under as low a pressure as possible, and a most ingeniously devised argand burner has been constructed by an eminent gas engineer at the West-end, which burns the gas to the greatest advantage, but which hitherto has not passed out of the region of the gas-testing room (where I believe it is doing good service) into general practice, because the least draught of air causes it to smoke most inconveniently. Burners have been constructed also, in which the flow of the gas is checked by wire gauze, cotton wool, &c., placed as near as possible to the point of issue of the gas. Metal burners get hot, and the longer the gas is retained in the heated part of the burner, before it issues the greater the illuminating power it produces. You are also, no doubt, familiar with the contrivance of placing a small piece of platinum into the flame of ordinary gas-burners, and we are informed, on the authority of Dr. Letheby, that the illuminating power of gas is increased 63 per cent. by this simple contrivance.

If, then, the illuminating power of coal gas can be improved by consuming the vapour at a higher temperature, or by charging it with easily vaporised hydrocarbons, it deserves certainly the serious attention of every practical lamp-maker, to study carefully how the same condition can be best complied with in the burning of mineral and other oils.

Now, I think that the burners which I have the pleasure of exhibiting to you, comply pre-eminently with these conditions. I may mention that I found this out only by carefully watching the influence which a lower or higher supply of oil had upon the flame. I was partly led to it also by endeavouring to realise a most necessary condition with which I felt that the new lights should comply, viz., that the burners should not discharge any oil. This is really not so easily attainable as may be thought at first sight, and I had no little trouble before I arrived at the right conditions. I found, however, that on lowering the supply pipe to the argand burner an inch or more, so as to lower the level of the oil in the wick case to the same extent, the illuminating power of the same burner was increased as much as 30 to 50 per cent, without entailing a corresponding increase in the consumption of petroleum. The fact was, that in one burner (the large size one) I discovered, on closely watching one day, that some vapour was issuing from a very fine hole just below the key, and that this vapour burnt when I brought a light near it. This observation proved that the petroleum vaporises, to a great extent, before it gets to the top of the wick.

The theoretical explanation for this fact I found in an admirable lecture, delivered by Dr. Frankland, at the Royal Institution, June 12, 1868, from which I quote somewhat fully, as the evidence which Dr. Frankland brings to bear upon this interesting subject quite coincides with my own observation.

Dr. Frankland states that the source of light in a luminous gas or candle flame has been held by different chemists and physicists to be derived from "the ignition of solid matter in the intense heat developed by the chemical changes attendant on combustion."* It was thought that whenever hydrocarbons are imperfectly burnt "there is a deposition of carbon, and this temporary deposition of carbon was said to be an essential condition for the production of the whole light required in an ordinary flame."† Another authority tells us "that the illuminating power of the gas is due to carbon particles, which are afterwards burned nearer the border of the flame."‡

Again we read: "That the brightness, or illuminating power of a flame, depends not only on the degree of heat, but likewise on the presence or absence of solid particles, which may act as radiant points. A flame containing no such particles is said to emit but a feeble light, even if its temperature is the highest possible."§

Now this view, commonly held by scientific men, based upon Sir Humphrey Davy's researches, has been exploded by Dr. Frankland, who showed that there are many flames possessing a high degree of luminosity which cannot possibly contain solid particles. The flame of metallic arsenic burning in oxygen, for instance, emits a remarkably intense white light. Phosphorus burning in oxygen emits a dazzling light, surpassed by few other burning bodies, and is converted into phosphoric anhydride, a body which is volatile at a red heat, and it is therefore manifestly impossible that this substance should exist in the solid form at the temperature of the phosphorus flame, which far transcends the melting point of platinum.

For this and other reasons, to which I need not refer, Dr. Frankland considers that incandescent particles of carbon are not the source of light in gas and candle flames, but that the luminosity of these flames is due to radiations from dense but transparent hydrocarbon vapours, and it is to the behaviour of hydrocarbons under the influence of heat that we must look for the source of luminosity in a flame. These gradually lose hydrogen, whilst their carbon atoms coalesce to form compounds of greater complexity, and consequently of greater vapour-density. Thus, olefiant gas (C_2H_4) the chief illuminant in coal-gas, forms naphthaline ($C_{10}H_8$), when the vapour-density augments from 14 to 64. These and others are some of the dense hydrocarbons which are known to exist in a gas flame, but there are, doubtless, others still more dense; pitch, for instance, must consist of the condensed vapours of such heavy hydrocarbons, for it distils over from the retorts in the process of gas-making.

Candle flames are similarly constituted. Dr. Frankland has also shown that a candle burns with feebly-luminous light, under a low atmospheric pressure (on the top of Mont Blanc, for instance), and that jets of hydrogen and carbonic oxide, two gases which at the ordinary atmospheric pressure burn with little luminosity, burn with a markedly augmented light when burnt in oxygen under a pressure gradually increasing to twenty atmospheres. If it be true, then, that dense gases emit more light than rare ones when ignited, as Dr. Frankland has conclusively shown, it follows that the vapour of hydrocarbons, such as those contained in petroleum oils (mostly homologues of marsh gas and olefiant gas, two of the chief constituents of coal gas), and which are much denser than these simpler hydrocarbons, fully account for the greater intensity of the light which these oils produce when burned in properly constructed lamps. That these oils can be burnt without soot, which after all is not elementary carbon, but always contains hydrogen, and that great luminosity is attainable without the presence of solid particles of carbon in the flame, is amply illustrated by the lights which I am able to exhibit before you. The difficulty to contend with is not so much how to burn the vapour of mineral oils, but how to prevent their volatilisation in a more or less unburnt or partially burnt condition. Everybody is familiar with the unpleasant odour which so-called paraffin lamps do occasionally emit. This no doubt arises from imperfect combustion, for on first testing photometrically the light produced by the different size burners it was found, in fact, that the larger size argand burners, giving the light of as much as forty sperm candles, consumed proportionately more petroleum than the smaller size burners. This was evidently owing to the passing of some portion of the oil in the form of unburnt or incompletely burnt vapour through the mantle of the flame, and as it was contrary to the well-established fact of gas producing a considerably increased illuminating effect when burnt in larger quantities than it produces when burnt in small quantities, I endeavoured to account for it by the theory so ingeniously advanced by Dr. Frankland.

Petroleum.—Since the years 1858 and 1859, extensive borings, for the purpose of obtaining petroleum or rock oil, were made in Pennsylvania and Ohio. In the former State, the most extensive and successful sinkings have been made between the Allegheny River and the western limit of the state. Along that river native springs of petroleum have existed, which, oozing through the superficial clay, have now formed a tenacious, pasty mass. In the vicinity of these springs, the artificial wells have been made by sinking a bore deep enough to reach the thin layer of bitumen flowing between the strata. As the whole of this oil region is underlaid by what is known to geologists as the coal measures, the petroleum is probably derived from the natural separation of the bitumen from the carbonaceous portion of the coal, which, oozing upward from faults or fissures in the coal seam, drains off between the strata, and follows the inclination of the latter until it reaches the surface in some denuded portion of the coal bed. This gradual oozing over extensive surfaces yields a large supply of liquid oil, which has been extensively brought into the market, and has almost entirely superseded the mineral oils formerly distilled from bituminous deposits, liquid or solid, found in various parts of the world, among which the Burmese naphtha or Rangoon petroleum deserves special mention.

The neutral oils distilled from bitumen, bituminous schists, coal, rock oil, &c., are composed of liquids having their specific gravity and boiling points so close to each other, that it is a matter of great difficulty to isolate them so as to examine their properties. But, although the photogenic oils derived from these sources are not always the same when viewed chemically, their photometric value may yet be precisely the same. According to the proportion of carbon contained in the oils, they require a more or less plentiful supply of air for their proper combustion, and the cotton-wick would probably be affected differently by heavier than by lighter oils. The oil which I usually burn is American petroleum of specific gravity, ·795. It boils at about 340° F. I have not had time as yet to test both lighter or heavier oils, but have no doubt that they can be burnt with equal facility by the apparatus before you. The wholesale price of the oil is 1s. 6d. per gallon. It is not difficult now to procure properly purified petroleum, and I have no doubt, if the demand for well purified petroleum were to increase, that the distillers would find means and ways to thoroughly purify the oil used for burning in lamps.

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* Prof. W. A. Miller.
† Prof. Williamson.
‡ Balfour Stewart.
§ "Watts's Dictionary of Chemistry."

Cost of Production of the Petroleum Light.—In determining the illuminating power of the different lights which it is my pleasure to exhibit to you this evening, I was fortunate in securing the help of Mr. W. Valentin, principal assistant in the Royal College of Chemistry, a gentleman who has had much experience in testing gas, and who gave me much valuable advice in elaborating the new system of lighting. I submitted two lamps for burning colza oil, and four lamps constructed for the consumption of petroleum, to that gentleman, together with the experimental model which you see here. The experiments were made at the Royal College of Chemistry. The illuminating power was taken by means of the well known Bunsen photometer, and is expressed, as is usual in this country, in sperm candles, consuming 120 grains of sperm per hour. Each experiment extended over at least three hours, so as to counteract any slight error arising from the drawing off of the oil. The amount of oil consumed was carefully ascertained by weighing before and after each experiment. Petroleum oil of specific gravity, ·795, was employed, one gallon of oil weighing 55,650 grains. The oil distilled between 340° to 350° F. It can be obtained wholesale at 1s. 6d. per gallon.

Mr. Valentin has tabulated the results, and has, for better comparison, given in column 1 the number of sperm candles; in column 2 the number of cubic feet of common coal gas, price 3s. 9d. per 1,000 cubic feet; in column 3 is given the hourly consumption of oil in grains; in column 4, the cost of oil consumed per week; in column 5, the cost of a corresponding amount of coal-gas per week; and lastly, in column 6, the proportional cost of gas and oil.

The illuminating power of common London coal gas has been taken at 15 sperm candles for every five cubic feet of gas burnt, although it is a well-known fact that the consumers' gas burners probably never burn the gas to equal advantage, and that 12 sperm candles may be said to represent the consumers' light more truly than 15; and that consequently my petroleum lights are 20 per cent. cheaper, in addition to the per-centage shown in the tables. It is also a well-established fact that gas-burners consuming less than five cubic feet of gas per hour, such as the ordinary fish-tail burners most generally in use, do not produce a proportionate illuminating power, whilst on the other hand, gas-burners consuming more than five cubic feet of gas give a proportionately better light. The pressure under which gas issues from the burners likewise affects its illuminating power most seriously.

For these and other reasons, to which I need not refer, such as differences in the burners themselves, &c., I have abstained from comparing with coal gas the smaller lights, giving less than 15 candles, and likewise the larger lights, giving considerably more than an ordinary 5-feet jet-burner, and I prefer to rely, for the comparative numbers which I beg to submit to you, upon the petroleum lights which give a light equal to about 12 to 20 sperm candles.

I have already stated that the earlier experiments revealed certain defects in my burners, which, fortunately, I was able to rectify, and the Table which embodies Mr. Valentin's experiments shows, therefore, a somewhat greater cost on the side of petroleum compared with that of gas (say from 10 to 20 per cent.), which I think would, however, be fully neutralised by the 20 per cent. loss of illuminating power which the consumer suffers on account of having to employ less perfect gas burners, so that even these earlier experiments, set forth in the accompanying Table, exhibited most encouraging results:—

TABLE I.—Showing Illuminating Power of Original Argand Burners, Consuming Colza and Petroleum Oil.

DESCRIPTION OF LAMP, (Argand Burners)	Illuminating power expressed in sperm candles.	Illuminating power expressed in cubic feet of common coal gas= 15 candles.	Hourly consumption of oil in grains	Cost of oil for one week's consumption of 42 hours	Cost of gas at 3s. 9d. per 1,000 cubic feet, for one week's consumption of 42 hours.	Proportional cost of gas and oil
Colza Oil Lights.				s. d.	d.	
Lamp 1, consuming colza oil from an Argand burner, wick $\frac{7}{8}$ to $\frac{15}{16}$ of an inch..	11·81	..	1,203	2 $9\frac{1}{5}$	..	..
Lamp 2, with imperfect chimney, wick $1\frac{1}{4}$..	3·98	..	532	1 $2\frac{2}{3}$	..	..
Do., with differently constructed chimney..	15·01	5	1,775	4 1	9·45	1 : 5·2
Petroleum Oil Lights, as originally constructed.						
No. 1 Burner, size of wick $\frac{7}{8}$ to $\frac{15}{16}$ of an inch	15·67	5.22	864	0 11·8	9·86	1 : 1·21
Do do do	15·47	5·15	787	0 10·7	9·73	1 : 1·11
No. 2 Burner, size of wick same (of French construction)	14·93	4·98	818	0 11·1	9·4	1 : 1·18
No. 3 Burner, size of wick $1\frac{1}{4}$ of an inch ..	17·01	5·67	818	0 11·1	10·7	1 : 1·04
No. 4 Burner, size of wick $1\frac{1}{2}$ of an inch ..	33·85	..	2,145	2 5	..	..
No. 5 Burner, size of wick $1\frac{3}{4}$ of an inch ..	38·32	..	3,433	3 $10\frac{2}{3}$	..	..

Lights ranging from 15 to 38 sperm candles, of greater ntensity than any other lights, promised sufficiently well to induce me to pursue the subject with every prospect of success, and when I again tested the lights, altered as the burners were in the meantime, I had the gratification to find that the illuminating power produced by the same burner was 40 to 50 per cent. greater than before. The accompanying Table gives the results, before and after the alteration, of the burners:—

TABLE II.—Showing Illuminating Power of Altered Argand Burners, consuming Petroleum Oil, as Compared with Original Burners.

DESCRIPTION OF LAMP. (Argand Burners.)	Illuminating power expressed in sperm candles.	Illuminating power expressed in cubic feet of common coal gas = 15 candles.	Hourly consumption of oil in grains.	Cost of oil for one week's consumption of 42 hours.	Cost of gas at 3s. 9d. per 1,000 cubic feet for one week's consumption of 42 hours.	Proportional cost of gas and oil.
				s. d.	s. d.	
No. 1A Burner, wick	14	4·66	602	0 8·18	0 8·8	1 : 0·93
No. 1 Burner (original), wick ⅞ to 1 5/16	15·67	5·22	864	0 11·8	0 9·86	1 : 1·21
Do. 2nd experiment	15·47	5·15	787	0 10·7	0 9·73	1 : 1·11
Do. (altered)	23·24	7·74	795	2 10·8	1 2·63	1 : 0·738*
.2 Burner (original), same size as No. 1 (of French construction)	14·93	4·98	818	0 11·1	0 9·4	1 : 1·18
Do. (altered)	21·52	7·17	788	0 10·7	1 1·55	1 : 0·79†
No. 3 Burner (original) wick 1¼..........	17·01	5·67	818	0 11·1	0 10·7	1 : 1·04
Do. (altered)	28·0	9·33	1,102	1 3	1 5·6	1 : ·85
No. 4 Burner (original) wick 1½..........	33·85	..	2,145	..	..	..
Do. (altered)	46·5	..	2,008	..	..	..
No. 5 Burner (original) wick 1¾..........	38·32	..	3,433	..	..	..
Do. (altered)	50	..	1,965	..	..	..

* 35 per cent. cheaper than gas. † 27 per cent. cheaper than gas.

I have already explained that the alterations in the burners consisted mainly in the lowering of the oil level in the wick tube. The same lights which hitherto had produced 15 candles gave now 21·5 to 23 sperm candles, without any increased consumption of oil, so that an increased illuminating power, to the extent of 40 to 50 per cent., was secured by this simple alteration, whereby the new petroleum lights compare now much more favourably with gas-light, rendering them in fact 20 to 30 per cent. cheaper than common coal gas, and if we take into account that at least 20 per cent. less illuminating power is produced from the consumers' burners than what can be produced in the gas-testing room, I may say that the lights are 40 to 50 per cent. cheaper than coal gas.

Hitherto, I had only experimented with argand burners. I next directed my attention to flat light, which can be trimmed so much more readily. I felt that it would be desirable to obtain small lights, giving about 4 to 10 candles illuminating power. I burnt the same petroleum oil in four different lamps, which you see before you, and determined the illuminating power of the light they produced. I next placed the same flat wick burners in a wick case, which could be screwed to my model, and determined the light again, when an increased illuminating power of 15 to 20 per cent. was obtained. The following table contains the photometrical results:—

TABLE III.—Showing Illuminating Power of Flat-wick Burners, placed in ordinary Stand Lamps or screwed to the Model.

DESCRIPTION OF LAMP. (Flat burner).	Illuminating power expressed in standard sperm candles.	Illuminating power expressed in cubic feet of common coal gas = 15 sperm candles.	Hourly consumption of oil in grains.	Cost of oil for one week's consumption of 42 hours.	Cost of gas at 3s. 9d. per 1000 cubic feet, for one week's consumption of 42 hours.	Proportional cost of gas and oil.
				d.	s. d.	
No. 1. Flat wick, in lamp................	3·56	..	..	..	..	..
Do.	4	..	215	2·92	..	..
Do. screwed into model	4·4	..	208	2·83	0 2·77	1 : 1·02
No. 2. Flat wick, in lamp................	8·5	..	409	..	..	..
Do. screwed into model	11	3·66	426·6	5·8	0 6·91	1 : 0·84
Do. second experiment	11·2	3·73	448·5	6·09	0 7·05	1 : 0·86
No. 3. Flat wick, in lamp................	10·1	..	528	..	..	..
Do. screwed into model	15·26	5·08	598	7·8	6 9·6	1 : 0.812
Do. second experiment	16	5·33	748	10·16	0 10·07	1 : 1·009
No. 4. Flat wick, in stand lamp of Bohemian glass	17·27	..	..	..	..	..
Do. burner, screwed into model	20·06	..	..	..	..	..
Do. second experiment	21·1	7·0	822	11·17	1 1·23	1 : 0·844

There can be no doubt that flat lights possess certain advantages over round or argand lights, especially on account of the greater facility with which they can be trimmed; but it is impossible to obtain from them the same intense light, owing no doubt to imperfections in the chimneys. I therefore give the preference to argand burners.

The cost of a flat light, taking Table No. III. for comparison, giving about 16 candles, is about the same, or slightly less than that produced by coal gas.

There remains now for me only to show you an ordinary table or study-lamp of novel and perfectly safe construction, which gives a remarkably good light. I have not had time to ascertain photometrically what amount of light it gives, nor what its cost of consumption will be, compared with gas-light; but as I use the same size burner and same wick as in No. 1 burner, described in Table II., giving the light of 23·24 candles, it promises to give a light which is cheaper than gas. This lamp promises also to become a useful adjunct to the microscope and spectroscope, as Mr. Highley, of No. 10A, Great Portland-street, assures me.

I have constructed, with the assistance of Mr. White, a railway lamp, which you see before you, both for rape and petroleum oil, giving the light of eight candles for rape oil, and six and a-half candles for petroleum, and the lights of which can be decreased or increased at will. I am not aware that petroleum has ever been burnt in railway lamps, although repeated efforts have been made. This lamp is a perfect success. It may be swung about in all directions without discharging any oil, and can be made to burn for twenty or more hours without requiring any attention. It also offers the advantage that the oil is placed in that part of the lamp which is above the outside roof of the carriage. The Board of Directors of the Great Western Railway, who warmly received my propositions for lighting up railway carriages, gave me every facility of practically testing the new lamp. It was placed in the guard's van of a night express train, and travelled all the way to Chester and back again, giving a perfectly steady light. The inspector testified to the above in a memorandum to me. I am also in treaty now with other companies.

I have not been able to ascertain the consumption of petroleum, but it is not difficult to foresee a considerable saving upon the railway lights, which consume vegetable oils, such as rape or linseed, if we glance at the relative proportion of the cost of colza oil and petroleum, when consumed from my new argand burners, as set forth in Table I. Colza oil costs four to five times as much as gas, consequently there would be a saving of from 500 to 600 per cent. with the new lamp, whilst double or treble the amount of light can be obtained if it be desired, which, I believe, will be hailed as a great boon by all night travellers on our great railway lines.

I may mention that the new burner can be readily placed in the railway lamps now in use without any material alterations, and that it requires very little trimming. I have burnt it for 22 consecutive hours without ever touching it. It can be turned off like a street lamp.

You see before you a street lamp, which is constructed on a similar principle to the railway lamp, and in which small or large lights may be burned with equal success. The mode of conveying the petroleum or rape oil to the burner from the oil reservoir round the upper rim of the lamp ensures a perfectly steady supply, and the oil is consumed in the most economical manner possible. I am this evening burning No. 4 flat burner, which gives the light of about 21 candles. It will, of course, be necessary to await the results of further practical testings in the open before it can be said with certainty how it will turn out.

To show the practicability of my novel mode of conveying oils to burners, I have had constructed a chandelier, burning from one arm colza oil, from the other petroleum, and from the third coal gas, and have had it burning for weeks in my office with perfect success.

I may also mention that Sir Frederick Arrow, accompanied by the elder brethren of the Trinity-house, came to my office to examine the new lights, at the instance of Dr. Tyndall, who was highly pleased with them, and who would no doubt have been here this evening if he had not been called away to the shores of Northern Africa, to study the grand phenomenon of a total eclipse of the sun, and that I am commissioned to prepare burners for lighthouse purposes, for which I believe these lights of great intensity are specially adapted.

Now, gentlemen, the lights which I have had an opportunity of exhibiting to you this evening are merely in their infancy; many shortcomings, of which I am even now aware, I have been unable to remedy as yet, especially those connected with chimneys. I have not been able either to test various kinds of oil, either vegetable, animal, or mineral. What the infant will become when it grows into manhood I am unable to predict. This much I may say, however, even now, that the child promises well, and that it has already distanced its elder brethren, candles, lamps, and gas-light.

I may claim for the lights—

1. A perfectly regular supply of oil to the wick.

2. A pure and white light, superior in brilliancy to any light now in use.

3. Great steadiness of flame, which will cause them to become a boon to many engaged in the various manufacturing branches requiring a steady light. I believe them well adapted for counting-houses, type-setting rooms, &c.

4. Perfect safety from risks of explosion, as no air can possibly mix with the vapour of petroleum before it issues from the wick case. I may mention that I had the inspectors of the principal insurance offices at my place of business in Wood-street to investigate the matter, and that they endorsed my insurance policies most readily, declaring the proposed conveyance of petroleum as safe as that of gas.

5. Great adaptibility for all purposes of illumination where gas is now employed in private houses, public buildings, factories, railway stations, signal lights, and street lights.

6. Saving in cost of 500 to 600 per cent. upon colza oil, and 40 to 50 per cent. upon that of common coal gas, reckoned at 3s. 9d.

From all these considerations, I am inclined to think that the new light will be especially adapted for country districts where no gas can be had, and to places where gas is much dearer than in London. The supply of mineral oils may be said to be plentiful, and a new source of illumination is, therefore, provided, which will become a formidable rival to coal gas.

I am painfully aware, gentlemen, that I have scarcely done justice to the all-important subject of burning mineral oils—the liquid gas which nature has provided for us. To-morrow, some of our most eminent men of science will be engaged in investigating the nature of the universal source of light—the sun—with all the appliances of modern science. Now, when we come to think how little we know about this great source of light and heat, you will forbear with me if I have but imperfectly brought before you the nature of the artificial light, the light which mineral and other oils are capable of producing when properly burned.

DISCUSSION.

Mr. Silber, in answer to a question, explained that the table-lamp exhibited was constructed on the theory propounded by Dr. Frankland, viz., that oil which was burnt at a certain degree of heat produced a more brilliant light than it would if simply brought up to the top of the wick by suction in the ordinary way. There were two principal points to be aimed at, to insure perfect combustion in a lamp with petroleum oil; first, that the mass of oil should remain cool; and, secondly, that a small portion of it just below the wick should be nearly, if not quite at boiling point. He had effected this in the lamp before him, and in fact some of the oil was consumed

FIG. 1.

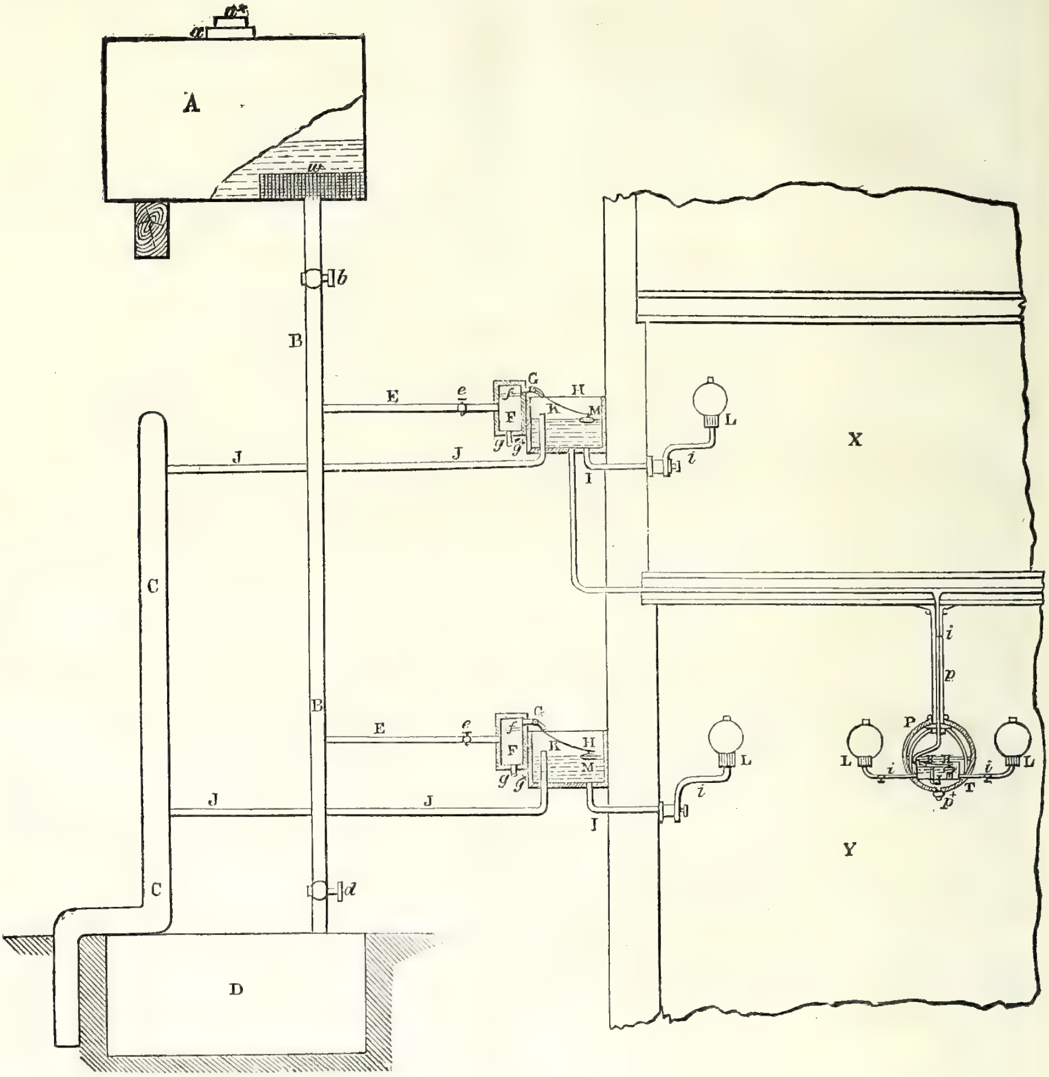


Fig. 1 is a vertical section of the apparatus applied to a house.

Fig. 2 is a section of the receiving box, H.

Fig. 3 is a plan of chamber, H.

Fig. 4 is a plan of the float.

A is a tank or reservoir (placed outside the house, if possible), for holding the oil. *a* is a screw neck, with caps for filtering the oil. B is a main service pipe, with a tap, *b*, to the floors X and Y. C is a waste-pipe, communicating with a reserve tank, D, sunk in the ground, closed by a tap, *d*, used in case of fire. *w* is a filter. H is a receiving box. E is a supply box, widening out into F, a box, and terminating at G, a tap, into receiving-box H. *e* is a tap shutting off the supply into F. *f* is a wire partition. *g* is a nut for the removal of deposit. I is a pipe leading to the burners through *i i*. J is an overflow-pipe. K M is a float-apparatus which regulates the flow of oil from the reservoir. L is the burner. P is a spherical chamber for the pendant lamp.

FIG. 2.

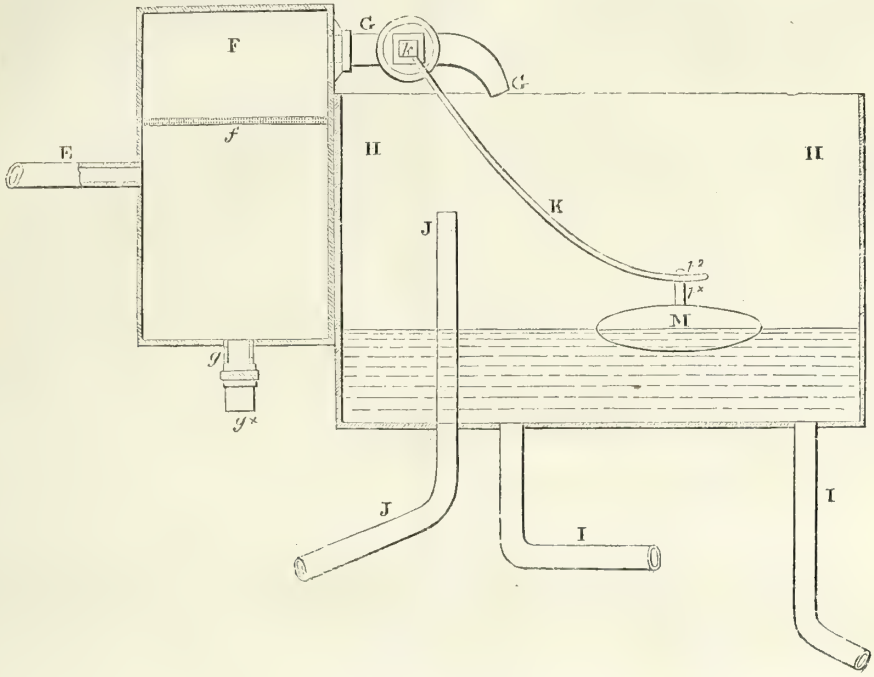
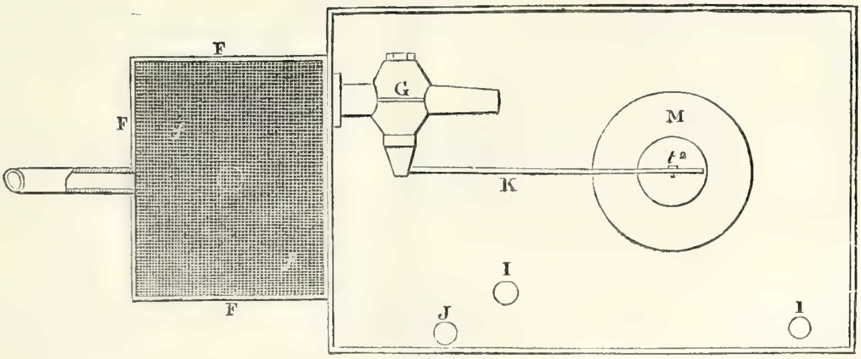


FIG. 3.



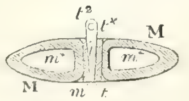


FIG. 4.

almost, if not quite, in the shape of vapour. The wick went down nearly to the bottom. The arrangement referred to prevented the oil flowing out of the lamp, even if upset; the lamp being of metal throughout, would also not break.

Dr. Wylde said he believed that petroleum oil lamps had been tried for some time in railway carriages, but it was found they were subject to the objection that suddenly slamming the door of the carriage would extinguish the light, and also that the lamp-men complained that they took three times as long cleaning as ordinary lamps, and he would like to know whether this objection had been met.

Mr. Silber said, speaking from the limited experience which had yet been obtained, neither of the evils alluded to had been found to arise from his new lamp.

Mr. Hartley said it had been stated that the use of these oils would effect a saving of from thirty to forty per cent. as compared with the use of gas, but he supposed this was calculated on the present price of petroleum, and apprehended that if it came into common use instead of gas, the increased demand would occasion an increased cost. A comparision was also drawn between the lights obtained from burners used by the public generally and the burners used for testing, and it had been stated that the light obtained was considerably in excess of that required by the public. That might be so when measured by such lamps as were now exhibited; but he believed that what the public really wanted was a light of from eight to twelve candles. Much as he admired the ingenuity displayed by Mr. Silber in the construction of his lamps, and in the apparatus for supplying houses, he could not think it was a system which would recommend itself to the public who could get gas. In the first place, cisterns must be provided, which would necessitate keeping a large stock of inflammable oil on the premises, which was open to considerable objection, while in the case of gas, you had simply to turn it on or off as required. Then, again, with oil lamps, of whatever character, there was not only the trouble of attending to the lamps, adjusting them at proper times, but of trimming the wick, and in any estimate of the relative value of a particular mode of lighting, this time and trouble ought to be taken into account, which did not seem to have been done in the present case. Although he was interested in gas lighting, he had no wish to disparage any new system, knowing that improvements must be likely to arise in the mode of lighting; but some little difficulty seemed to be attached to the regularity of supply by means of these cisterns, and he thought anyone who had had experience of ball-taps, and there were few who had not, must at some time or other have found them to fail, very often by having their houses flooded with water. In these cases, moreover, they were acted upon by a much greater pressure than would be necessary in the small supply cisterns referred to by Mr. Silber. He saw by the diagram on the board that provision was made for an overflow, but in such a case, of course, there would be waste and expense.

Mr. Silber said there would be no waste, as the overflow pipe went into a safety-box at the bottom of the house. In reply to another gentleman, he said that the oil would flow through the smallest pipes that might be required in colder weather than had been known in this country for the last fifty years.

Dr. Dresser said when he first entered the room he perceived the unpleasant odour which was always noticed when any kind of mineral oil was being burnt. To him it was very offensive, as it always gave him a headache, and for that reason he objected to sit in a room which was lighted with petroleum. There was another thing, which was the standing difficulty with all the lamps he had yet seen which were lighted by any fluid, and that was the attention required in keeping them in order. His servants might, perhaps, be inferior in capacity to those of other persons, but, at any rate, they seemed to lack the power of regulating the wick in moderator or any other lamps, and, when this devolved upon himself, it became very tiresome. If anything in the shape of an incombustible wick, made of asbestos, or any substance of that kind could be devised, it would remove one great objection. Gas had a great number of advantages, one especially being the power of turning it on and off at a moment's notice. It certainly did not give so good a light as that afforded by mineral oil, as he had proved in his own experience. He had procured an experimental lamp, which he used in his own study, and which was so constructed that he could introduce a carburetting material such as coal-tar naphtha; and when the gas passed over this carburetting substance and became surcharged with carbon, a very great brilliancy was added to the light, in fact, a very similar class of light was produced to that shown in some of Mr. Silber's lamps. There was also this advantage in such a lamp, that the supply needed renewing but very seldom, the vapour only being consumed; indeed, half-a-pint of this carbonising material would last probably three months, or even longer. One disadvantage of this method, however, was that the more carbon that was introduced into the flame the more was the smoke that was produced, and as he was concerned specially in fine arts, and a great deal in decorated rooms, he was strongly opposed to smoky lights of any description, because they damaged decorated ceilings, walls, and valuable paintings. He noticed that if he carbonised his light he got an increase of smoke, and also that offensive odour which he had previously spoken of, and for that reason he was obliged to discontinue even the carbonising of common gas. Of course a leakage of gas was attended with an unpleasant odour, and it would be the same with mineral oil, and in each case there would be the danger of explosion, which, probably, would be equal, but there would be the additional disadvantage in the case of mineral oil, that it being of a greasy nature, the walls and carpet might become seriously injured. It appeared to him that this plan was best adapted for railway lamps, if draughts did not affect them, and he also thought it might advantageously be applied to small towns and villages, where gas-works were almost out of the question.

Mr. Highley said that, on hearing of this improved lamp, he had called on Mr. Silber, who was entirely unknown to him, and expressed a desire to try how far it would be applicable to scientific purposes, especially for the microscope, for the opthalmoscope, and for the magic-lantern. Mr. Silber very kindly placed at his disposal a lamp similar to the one on the table, and for the last two or three weeks he had been using it constantly every night. He was happy, therefore, to give his testimony to the fact that there was no unpleasant smell whatever arising from it when properly used. On the second night of trying it, when using it in his bedroom, he found an unpleasant odour, but it arose from its being turned down too low; but, if properly adjusted, there was neither smell nor smoke. He had had considerable experience of paraffin lamps, naphthalised gas-burners, and, indeed, he had tried nearly every form of lamp in the market, and his opinion was that this was the most perfect he had yet seen, and admirably adapted for lighting fine art galleries, from the purity of the flame. If a silver spoon were held over it it was not discoloured, as would be the case with gas. The magic lantern was every year coming into more general use for educational purposes, and it was a matter of great importance to obtain a pure and brilliant light, which could readily be brought into play for such purposes. Originally oil lamps were used, but they did not give so good a light as could be desired, and of late years paraffin had been tried; this gave a beautiful light, but there was this great disadvantage that it gave off a vapour which affected everything with which it came in contact; the lantern itself became saturated with a kind of greasy fluid; and whenever it was re-lighted the peculiar odour belonging to paraffin oil, which was by no means agreeable, was strongly apparent. In consequence of this he had tried paraffin wax, which gave a very brilliant light, and was also free from smell and grease, but there was this drawback that it required to be melted before use, and in the case of a lamp of considerable size, where there was a large mass of the material, this took a great deal more time than was always convenient. He had also used naphthalised gas, which gave a very brilliant light; and ordinary gas used with what was called the "London burner," which had an adjustable cone, also answered very well; but after trying Mr. Silber's lamp for three weeks, he gave it the preference over anything he had tried. The light was peculiarly white, resembling in character the lime light, although of course not so penetrating, and it was certainly the purest light he had met with. With regard to the trimming of the wick, he could only say that, during the whole of the time he had been trying the lamp, he had not had occasion to change the wick at all. It burned very slowly, and there was still enough left for more than three weeks longer. Therefore, for scientific purposes, he thought this lamp was just the thing which had been long desired, and as a household lamp it was certainly the best he had seen, giving a peculiarly soft light, which was very pleasing; in fact, his wife was perfectly delighted with it.

Mr. David Chadwick, M.P., congratulated the Society on the valuable and interesting paper which Mr. Silber had read. He said the lamps exhibited told their own tale, and clearly showed what a vast improvement had been made in the mode of dealing with mineral oils for lighting purposes. With regard to the paper itself, however, he said he should have regarded it as more perfect had the author given a little more detailed information with regard to what had been done by previous inventors, in order to show in what state the subject was when he took it up, and what were the specific improvements he had made. He (Mr. Chadwick) had had some twenty years experience in the management of gas works, and had also had opportunities of seeing all the ingenious American contrivances for burning petroleum oil, and had brought over some years ago from that country a small lamp, costing about 6d. which appeared to him to give as brilliant a light as those now exhibited, although no doubt it had many defects. He did not question the estimate made by Mr. Silber of the relative value of his lamps as compared with lamps burning colza oil, or with gas burners, but he would venture, as one having had some experience in the matter, to recommend him not to trouble himself too much about working out a comparison, with gas, for, wherever gas could be supplied, he was quite sure that no improvements in any lamps for burning oil would ever supersede it. There were, he might almost say, hundreds of advantages in the use of gas beyond those already mentioned, and this he said with the most perfect independence, as he had now no connection in any way, direct or indirect, with gas manufacture. On the other hand, there were thousands of villages, not only in England, but throughout the world, where light was wanted, and if they could only see their way to getting it at a cheap rate there would be plenty of occupation for any amount of ingenuity in supplying them. He must venture to question what had been said by Mr. Hartley about the public only requiring a light equal to eight or ten candles. He had been connected with a gas works which invariably gave twenty to twenty-two candle gas, and if their customers had a less illuminating power, he knew they would very soon complain. His experience was that the public required the best light they could get, and, were it not for the extra cost of cannel coal, they would insist upon having a better article than was now supplied to them. At any rate, he was quite certain that eight or ten-candle gas would not be tolerated in London. Most gentlemen present probably had felt the inconvenience of the miserable light afforded by railway-carriage lamps, and, as he travelled on the average about 200 miles per week, a great deal of which was after dark, he could speak feelingly on the subject, for he was constantly annoyed by the abominable state of the lighting in railway-carriages of almost every line in the kingdom, which was a disgrace to every railway engineer. You might spoil your eyes by attempting to read, but it was to little purpose, for the light was so arranged that it hardly illuminated anything but the top of the carriage. Indeed, he had been in the habit for years of carrying a railway candle-lamp, but that was an inconvenience which passengers ought not to be subjected to. He ventured to say, therefore, that a large fortune was within the reach of anyone who would bring forward a thoroughly good lamp which the railways would adopt, and which would answer railway purposes as well as those now exhibited, for shareholders and the travelling public would soon force directors and slow-coach engineers to adopt it. He did not apprehend there was much danger in burning petroleum, but even in ordinary lamps there was sometimes a danger little thought of. Only in January last he was returning from America, and had in his cabin an ordinary spring candle-lamp. On one occasion he left it burning, and on returning in the course of an hour he found that the spring had forced the candle out, and deposited it on his bed, so that it was almost a miracle that the whole ship was not set on fire. An objection had been raised by a previous speaker that the price of petroleum would probably rise in case of a greatly increased demand, but he did not apprehend this would be the case by any means. He knew something about the quantity of shale in this country capable of producing mineral oil, had personally visited nearly all the oil wells in Oil-city, in Pennsylvania, and had seen the sources of supply both in Canada and the United States, and it was a curious fact that the price within the last six months had been about half what it was some few years ago, notwithstanding the enormously increased consumption. There was no fear, therefore, of the price being so increased, and no one need be deterred from prosecuting any improvements which would lead to its more general adoption for lighting purposes. In villages, houses, shops, and railway cariages there were a thousand ways in which such an invention would be found of enormous benefit to the public, and if so, then of course to the inventor, without interfering with gas, which he did not think would ever be superseded by any such arrangement as that proposed.

Mr. Peters said the principal merit of Mr. Silber's invention seemed to consist in his obtaining more perfect combustion; and if this could be ensured, all the unpleasant odour which was so objectionable in the case of mineral oils would be removed. There could be no doubt that a vast amount of petroleum was being consumed in very badly-constructed lamps; this, probably, was the cause of the complaints which were made of the smell, for he had not noticed anything of the sort in connexion with the lamps exhibited by Mr. Silber. Petroleum had been applied to manufacturing purposes in connexion with steam, but its cost stood in the way of its extensive application for such purposes. In the present case, however, as far as he understood it, the lamp itself, while burning, effected the vaporisation of the oil, the wick-case being so arranged that only as much oil was admitted as could be totally consumed. This seemed the principal merit of the invention, the rest being mere manufacturing detail.

The Editor of the "Ironmonger" asked how Mr Silber proposed to construct his reservoirs, so as to avoid any danger of explosion, in case of a house catching fire. He also asked to know if there were any improved method of trimming lamps for domestic purposes, for all persons knew that this was a delicate matter, especially in the hands of careless servants. If railway carriages were supplied with petroleum lamps, he feared there would be very lamentable results in case of accident, which in these days ought to be considered. He also asked if any means were adopted to ensure the flow of vegetable oil through the narrow pipes in frosty weather?

Mr. Fordred said he had noticed the specific gravity mentioned as that of the oil used in the experiments referred to was ·795, which was exceedingly light, even for the best American petroleum, the average being ·800, whilst the majority of oils made from shale had a specific gravity of ·810 to ·820. Now, as the gravity rose so did the tendency in the oil to carbonise the wick, and the necessity for frequently renewing it. If only the lighter oils were used, of course the difficulty would be obviated, but he had hoped to have seen some lamp exhibited which could burn what was known in the trade as "intermediate" oil. In distilling both petroleum and paraffin oils, the lighter portion could be readily burned in the the ordinary lamps, and the heavier was used for lubricating purposes, but between the two there was generally about 20 per cent. of what was known as "intermediate," which the distiller had great difficulty in utilising. He must say that the system of laying on oil for lighting purposes in houses was not a new one, as it had been practised for many years in America, especially in the Southern States. Some years ago, he was visited by a gentleman from New Orleans, who told him that it was a common practice for houses to be fitted throughout with pipes for supplying illuminating material to lamps; this was before the discovery of petroleum, the fluid used being a mixture of turpentine and spirits of wine. There was always, however, a difficulty in such cases in keeping the joints tight, because a tap which would be perfectly secure under the pressure of gas would not remain tight with liquids. It would have been very useful if a comparison had been made of the results obtained by burning oil in these improved lamps and in those in ordinary use in the trade, the comparison with gas being of very little use, as the two could never compete.

Mr. Seymour Teulon said the railway lamp exhibited by Mr. Silber certainly gave a better light than those in ordinary use in railway carriages, though not equal to the gas-light on the Metropolitan Railway Company's line. It must, however, be borne in mind, in considering the use of hydrocarbon oils in railway lamps, that railway accidents unfortunately happened, and as there would be a separate supply of oil in each lamp in the train, there would be so many sources of additional mischief. That appeared to him a great objection, which must on no account be lost sight of.

The Chairman, in proposing a cordial vote of thanks to Mr. Silber, said he would not detain the meeting by any remarks beyond saying this—that he thought the inventor of these new lamps would do well to follow Mr. Chadwick's advice, and confine himself to those openings where gas could not easily be introduced. He had travelled in many parts of Europe, and there were thousands of places, not only in England but on the Continent, where an improved mode of burning these hydrocarbons would be of the greatest possible public benefit, and of course equally to the benefit of the inventor and patentee if he introduced it.

The vote of thanks was carried unanimously.

Mr. Silber, in reply to the various observations which had been made, said he felt deeply grateful for the patient hearing which had been afforded him, and for the opportunity which he had had of listening, for the first time to all the objections which could be made by various minds to his system of lighting. Many of these objections, however, had been answered by other gentlemen. For instance, Mr. Hartley feared that petroleum would rise in price if the demand were much increased, while another speaker of great experience at once threw over the idea. Another gentleman had expressed a doubt with regard to the safety of keeping a stock of petroleum in the reservoir, but as he had stated in the paper there would be no occasion for more than two gallons at a time to be kept in the house; and he believed that if this system ever came into active use, the oil would be brought to the door as regularly as other necessaries. The ordinary ball-cock in water tanks had also been alluded to, and difficulties sometimes arose from its irregular action; but he invited inspection of the float and stop-cock he had introduced, which, he believed, would work for a number of years, in fact, as long as the metal lasted, without derangement; and he thought this was one of the principal merits of his invention. Other gentlemen had referred to the offensive odour given off by petroleum in the ordinary lamps, but as he had shown that, by the improvement of the burner, a greater light was produced with less quantity of oil, using the same oil, the same wick, and the same sized burner, it would be evident that there must be more complete combustion of the petroleum, and therefore the offensive smell would be got rid of. This had been effected simply by lowering the level of the oil, so that only the necessary quantity of oil came to the wick instead of its being saturated in excess, which was the cause of the offensive vapour being thrown into the room instead of being consumed. By this means he had produced with the same burner, oil, and wick, a light equal to twenty-three candles, whereas before it had only been equal to fifteen. If he had read the figures from the tables, which he had omitted to do for the sake of brevity, every one must have admitted that they were the figures of a man of business. And with regard to the correctness of these figures, he would only say that Mr. Foster, the Secretary, had given the name of Dr. Frankland as the best authority in England on such subjects, and on applying to that gentleman, he had introduced him to Mr. Vallentin, who had made the experiments and made the calculations, the results of which were shown in the tables. No higher testimonial could be given by one scientific man of another than that given by Dr. Tyndall to Mr. Vallentin, for, after expressing his real satisfaction with the lamp, he said that if Mr. Vallentin had prepared the figures they were sure to be correct, and might be thoroughly depended upon. With regard to ill effects on ceilings, pictures, &c., he need not refer to any other authority than his own observation, for he had had these lamps giving more than 300 candle lights in his own warehouse from nine in the morning until eight at night, and had not yet discovered the slightest trace of black deposits on white bodies, consequently they did not damage the ceiling. From conversations he had had with scientific gentlemen, he believed they were under the impression, although he would not state it as a fact, that pictures would suffer little or no damage from the use of these lamps. With regard to the trimming of the wick, the fact of having the fluid always at the same level prevented any pressure upon the wick, and he had burned one wick for 72 consecutive hours without trimming, using mineral oil. Any danger from fire was obviated by having a stop-cock, which would shut off the entire supply, and any waste from overflow was avoided by having the waste-pipe connected with a receptacle twelve feet below the bottom of the house, or in the garden, where also in case of fire the whole of the oil could be transferred in two minutes or less. In the case of railway lamps, the reservoir of oil was placed outside the carriage, which would prevent danger, and his lamps were also constructed for rape oil (which was in fact being burned in one of the specimens exhibited), which would prevent any explosion. The system of burning the oil and the burners in the railway, street, and house lamps were each and all constructed on different principles, and were under different patents. He believed that full statistics would be found in the printed tables, and concluded by expressing his acknowledgments for the vote of thanks which had been passed.

Mr. Hyde Clarke writes, that there being no time for addressing the meeting, he wishes to concur with Mr. David Chadwick as to the supply of petroleum, and the prospect of Mr. Silber's invention being largely adapted in its own sphere of operation, without fear of greatly increasing the price of petroleum. At present many inferior kinds of petroleum are not fully utilized for want of good means for refining, but such will shortly be obtained. With regard to another objection—the use of wicks—it appeared to be within compass that petroleum will be burnt without wicks. It may be observed that many of the objectors appeared to contemplate a still greater application of the invention than the inventor himself, for he, after all, only claims for it a limited application. The objectors, too, appear to have overlooked the positive advantages that have been proved, and to have addresed themselves to speculative disadvantages, which, if they existed, would still leave a very wide field for the productive development of the invention. The cost of petroleum is compared with gas at 3s. 9d. per thousand, but there are many places where gas cannot be applied at so low a rate.

ANNOUNCEMENTS BY THE COUNCIL.

CANTOR LECTURES.

The last lecture of the course "On Artists' Colours and Pigments," by Frederick S. Barff, Esq., M.A., F.C.S., and Fellow of the Cambridge Philosophical Society, was delivered on Monday evening last, the 19th inst. The subject of the lecture was "Fresco and Silicious Painting (continued); Destructive Influences on Colours, &c." The publication of these lectures will commence in next week's *Journal*.

THE LIBRARY.

The following works have been presented to the Library :—

Minutes of the Institution of Civil Engineers, vols. xxix. and xxx. Presented by the Institution.

Monthly Notices of the Royal Astronomical Society, vols. xxviii., xxix., xxx. Presented by the Society.

Journal of the Royal Agricultural Society of England, No. 6. Presented by the Society.

Memoirs of the Royal Astronomical Society, vols. xxxvii. and xxxviii. Presented by the Society.

Our Effective Artillery.

The Moabite Stone. By C. D. Guisburg, LL.D. Presented by Dr. Inman.

South Africa and its Resources.

On the Fulgurator. By J. N. Hearder. On the Degeneration of Our Sea Fisheries. By J. N. Hearder. Both presented by the Devonshire Association for the Advancement of Science, Literature, and Art.

On the Solar Eclipse of August 18th, 1868. By Warren de la Rue, Ph. D. Presented by the Royal Astronomical Society.

Report of the Registrar-General of Victoria, on Patents for the Preservation of Food.

Quarterly Weather Report of the Meteorological Society.

American Journal of Science and Arts. Presented by the editors, Professors B. Silliman and James D. Dana.

Report of the Council of the Art-Union of London. Presented by the Art-Union.

Dietrichsen and Hannay's Royal Almanack for 1871.

Life Assurance made Easy. By F. A. C. Hare. Presented by the author.

The Connection between Science and Religion. Sermon by Rev. A. Hulme, D.C.L. Presented by the writer.

A Park and a Palace. By J. Welsh. Presented by the author.

NEW AGRICULTURAL PROCESS.

In *Journal* No. 913, of 20th May last, an announcement was made that a number of boxes of seeds, each embedded in manure, according to a process belonging to Mr. Wm. Rée, of Hamburgh, were for distribution. Some of these were applied for by members, and the Council will be glad to hear of any results that have been obtained. Some boxes of seeds are still left, and may be had for testing the process on application to the Secretary.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions : —

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

Samples.—Mr. Thomas Stevens, of Coventry, writing to the *Times*, says:—"Mr. Tilley's letter, in reply to your article, is leading many persons to believe that the sample post is not suppressed, and may still be used for patterns only. But the Manchester memorialists state a case in which a *boná-fide* pattern, sent out by a Manchester house, was charged 1s. 8d., being 1s. 7d. in excess of the pattern post rate, and on remonstrance, the Post-office authorities replied that they intended so to treat everything that could become an article of sale. The full rate has accordingly been charged in hundreds of instances, on the express ground that the samples were transmittted in a saleable form. The new rule operates most oppressively, and is a serious restriction on trade, entirely out of keeping with the spirit of the age. Many deserving persons are thrown out of employment who were formerly engaged in making light fancy articles to be transmitted by sample post, and no advantage accrues to any one, for even the railway interest does not benefit, because the goods have ceased to pay the cost of production (including the increased rate of carriage), while the general public is made to suffer."

Shortcomings of the Post-office.—The *City Press* says:—"The Post-office is probably indebted to the war for the forbearance shown it. Unless the department mends its ways ere the intense interest taken in the war subsides, public opinion will take such forms of expression on the shortcomings of the office as to demand its reconstruction from head to foot, with a pretty extensive revision of the list of high officials concurrently. Everybody has some reason for complaint; telegraph messages go wrong, or do not go at all; letters are delayed delivery beyond the proper time; book parcels properly packed are charged as letters for some inscrutable reason, and no one in the office or out of it can tell what, according to the prescriptions of red tape, constitutes a sample that may be carried as such. Certain traders, smarting under the new restrictions imposed on the carriage of small parcels, meet the case by a cunning device, which completely checkmates the authorities, and proves how sound is our theory, that the office must be beaten if it undertakes to determine what is and what is not a sample. Small parcels of goods ordered in the usual way are sent through the post as samples, by attaching to them labels which indicate the prices of larger quantities. Let us suppose that a customer orders a dozen skeins of silk, having no idea of ever purchasing any more. They are sent as samples, with a ticket attached naming the price for a hundred. If the same customer had ordered a hundred, the trader would have attached the price per thousand. At some point or other, no doubt, the office will step in between the parties, but it would be better if it had never engaged to determine the exact material and moral boundaries of a sample."

Home Trades.—A meeting was held on Friday, the 16th inst., at the Westminster Palace Hotel, at two o'clock, composed of representatives from most of the great commercial associations, to consider what means should be adopted for bringing the present vexatious system of the Post-office, with respect to the pattern post, under the consideration of the Postmaster-General, with a view of obtaining a reversion to the system which had been in force before the 1st of October last. The chair was taken by Mr. Francis Taylor, President of the Home Trades Association, who stated to the meeting the object for which they had been called together. A discussion ensued, from which it appeared that since the recent Post-office changes, many unnecessary restrictions had been placed upon sending sample or pattern parcels by post, as instances of which it was stated that a traveller, who had a yard of calico forwarded to him by his employer through the post, to serve as a sample, had to pay upon its delivery 1s. 8d. for postage. Another case of hardship was cited in which the postal authorities charged 6s. 8d. for a parcel of seeds valued at scarcely half that amount. The Post-office stated, in reply to a remonstrance, that their intention was to treat everything in the same manner that could, by any possibility be made an article of sale. It was the custom of most of the firms in the cotton and jewellery trades to supply their travellers with width patterns and perfect samples; but the practice at present resorted to on the part of the Post-office was vexatious in the extreme, and calculated to do most of the trades a serious pecuniary injury. Several letters were read from influential firms censuring the Post-office authorities. The following resolutions were then put in and carried unanimously:—First—"That this meeting heartily concurs with the Manchester Home Trades Association in condemning the recent Post-office regulations respecting the 'pattern post,' and it calls upon the various commercial associations throughout the country to unite in endeavouring to obtain the abrogation of the Act passed on the 1st October last, and, for that purpose, to address a memorial to the Postmaster-General. In the event of that being of no avail, to agitate the question in the House of Commons." Second—"That the Manchester Home Trades Association be requested to make arrangements with the Postmaster-General, and also to convene a general meeting immediately this arrangement is completed." The meeting then terminated with a vote of thanks to the chairman.

The German Feld-Post.—The *Times* correspondent at Versailles says that the German soldiers in France can have a Christmas dinner or a suit of clothes sent to any head-quarters in a letter from Berlin or Dresden, at a postage of a few groschen.

Foreign Newspapers.—The following memorial is in course of circulation:—

"*To the Right Honourable the Marquis of Hartington, Her Majesty's Postmaster-General, &c., &c.*

"The Memorial of the undersigned bankers, merchants, brokers, newspaper proprietors, and others engaged in the trade of India, China, Japan, and Australia, respectfully showeth—

"1. That your memorialists have learnt with great surprise that the reduction decided on in the postage of letters to India, China, and Australia, *via* Brindisi, has not been accompanied by a reduction in the charge of 4d. on newspapers for every $\frac{1}{4}$lb.

"2. That your memorialists beg to inform your Lordship that by far the greatest part of the commercial correspondence of manufacturers and brokers is carried on by periodical publications or prices current, and that a charge of 4d. on such is a grevious tax on their business.

"3. That the increased cost of transmission of the mails to Brindisi by Germany and Brenner pass, should be more than covered by a reduction in the cost of the sea transit from Brindisi to Alexandria, a passage of three days only, while the passage from Marseilles occupied six days.

"4. That it is an anomaly that a newspaper like the *Times* should be carried throughout the United Kingdom for one halfpenny, while the same paper costs, according to the present tariff, eightpence for transmission to India, China, or Australia, which is virtually a prohibition. Your memorialists would call your Lordship's attention to the fact that the postage on letters to San Francisco—a distance of over 6,000 miles—is only 3d., and newspapers 1d.

"Your memorialists therefore pray that your Lordship will be induced to reduce the present excessive tax of 4d. on each newspaper."

What a Parcels Post Should Be.

Sir,—How exceedingly uncertain must be the tenure of office on the part of Post-office officials, if those high in authority in the present day act in the same spirit, in reference to the carriage of parcels, as did their predecessors in 1700, and follow the precedent then set in discharging the Comptroller-General of the Penny Post for refusing to receive and deliver all parcels sent to his office.

The following facts, in reference to parcels postage, are of peculiar interest at the present time, and are extracted from the ninth report and appendix of the commissioners appointed to inquire into the management of the Post-office Department:—

In 1697, William Dockwray had been appointed Comptroller of the Penny Post, and in 1702, in a report of the Postmasters-General to the Treasury, they say: "In obedience to your Lordships' orders of reference of Mr. William Dockwray's petition, we have considered of the allegations therein contained, and do humbly acquaint your Lordship that *we are informed your petitioner was the person who did first set up a penny post*, and that it being thought to interfere with the power granted by Parliament to the Postmasters-General, a suit was commenced against him by the late King James, then Duke of York, whereupon there was a trial at the King's Bench bar, and a verdict was given against him, and damages found, and that soon after the revolution the petitioner did apply himself to the House of Commons for some consideration of his case, and after examination thereof, the House came to the resolution that the petition and case of Mr. William Dockwray, merchant, in relation to the penny post office, be humbly represented and commended to his Majesty from this House to relieve him therein, as to his great wisdom and justice shall be meet."

It would appear that Dockwray's enterprise in starting a penny post was better than his management, for he was dismissed in 1700, in consequence of complaints against him. The complaints set forth that "Hee hath removed the general penny post from Cornhill, a place most proper, being near the Change, and in the heart of the Citty, to a more remote place altogether improper . . . . so that letters are thereby delayed for hours, to the great hindrance of business and fatigue to the poor messengers, and £100 charges to His Majesty to fit his house to his own convenience. *He forbids the taking of any bandboxes* (except very small) *and all parcels above a pound, which when they were taken did bring in considerable advantage to the office*, they being now at great charge sent by porters in the Citty, and coaches and watermen into the country, *which formerly went by penny post messengers much cheaper and more satisfactorily.* Hee stops under specious pretences, most parcels that are taken in, which is great damage to tradesmen by losing their customers or spoiling their goods, *and many times hazzard the life of the patient when physic sent by a docter or an apothecary.*" The commissioners say that no limit appears to have been assigned to the weight of the parcels and packets, although it was required that they should not exceed £10 in value. The conveyance of parcels continued down to 1765, when it was enacted by the 5th George III., c. 25, that no packet exceeding the weight of four ounces should be carried by the penny post, unless it had first passed or was intended to pass by the General Post-office, which meant that it was to pay a high rate of postage.

This brings us to the consideration of what are the conditions on which the parcels post system is conducted in foreign countries, and might fairly be permitted in our own. We have seen by the comparative statement of the postal systems of France, Belgium, Switzerland, and North Germany, which has already appeared in the *Journal*, that in France postage is charged upon two classes of parcels packets, viz., small parcels not exceeding 2½lbs. in weight, and parcels containing small objects of value, which are required to be registered, must not exceed 10 oz. in weight, or 1,000 francs (or £40) in value, and are charged with a 20 cent. stamp for registration, in addition to the postal rate. Similar principles are acted upon in Belgium, Switzerland and Germany. In England our letter post is based upon a like system. Money is not allowed to be sent in a letter, and if a letter is found to contain such or other article of value, it is registered by the post-office authorities, and charged a proportionate rate of postage.

What, then, is to prevent the same principle being applied to the carriage of parcels which has been applied to letters in this country, and is applied to parcels in other countries? It is not necessary, nor is it desirable, that the Post-office should deliver bottles of medicine or nitro-glycerine; but if it was found convenient to the public in 1697 to have parcels carried by the Post-office, and was profitable to its revenues then, it cannot be doubted that the greatly increased and vastly cheaper facilities of transport existing at the present time, added to the greatly extended demand which would be made upon it by the people in general, would add a vastly increased revenue to that already obtained from the carriage of letters, samples, newspapers and book packages. In order, however, to an efficient working of a parcels post system, it is essential that the rules and regulations issued by the Postmaster-General should be few and simple, and such as may be readily understood by the public. Such was the case when Sir Rowland Hill instituted the penny post for letter carriage; but rule has now been added to rule, and regulation to regulation, and in our sample post regulations so much is left to the judgment of ignorant postmasters in deciding what is or what is not a sample, that the public is deprived, to a large extent, of the power of using the Post-office as in times past, and as it did again in more recent times, before the new rules were issued. The regulations have been made much clearer in reference to the letter post, and what constitutes a letter and what a circular; the latter, if lithographed, now comes under the designation of printed matter; and it cannot be beyond the reach of human ingenuity to eliminate such classes of objects as it is desirable for their nature should be prohibited from postal privileges, and by limiting the weight and measurement of other parcels, allowing them to pass as such unchallenged, except so far as relates to the value of the goods or articles they contain.

It is not desirable that our postmen should be lumbered up with all the hat or band-boxes sold in London daily, as they would be cumbrous, though the weight of such articles might not be an objection. Every parcel sent through the post should be firm, light, and compact, and not liable to injury from rough handling, a blow, or a fall; and if articles sent were injured from such causes, the loss should be borne by the sender, unless registered as articles of value and paid for at a proportionate rate.

The question then arises, what should be the limit of the weight, and what the rate at which an ordinary parcel should be charged, and what the registration fee for articles of value. With reference to weight, such a limit should be placed upon it as would prevent the postman being converted into a railway porter in post-office attire. A parcels post should mean a small parcel of such weight as the post-office authorities have by experience proved not to be inconvenient. The length and bulk of parcels found convenient for carriage and transmission has already been determined, but packets of 14 lbs. weight, as at present permitted under the book-post regulations, appear to the writer to be more suited for railway and delivery company transit than for postal distribution. Having determined the weight of a parcel, what would be a fair rate of postal charge to put upon its transmission is the next consideration, and there is ample evidence to guide the Postmaster-General in arriving at a conclusion upon that point; but it may be well to consider what letter rate means when applied to the carriage of parcels. This I propose to do in another letter.—I am, &c.,

H. G. H.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel. Scott, R.E., secretary.

Sweden.—Prince Oscar has been appointed President of the Commission, which consists of 22 members, and of which Baron A. H. Fock is the Acting Commissioner. The Commission has applied for more space.

Belgium also finds that the space she originally applied for will not be sufficient for her purpose. Her exhibits will include a complete representation of the educational works and appliances used in the primary and middle schools, and also in the schools of design and the Academy des Beaux Arts.

Albert Hall.—A number of architects and their friends visited the hall on Wednesday, at the invitation of the Commissioners, when the testing of the acoustic properties of the hall, as before her Majesty the Queen on her recent visit, again took place by the performance of pianoforte, flute, piccolo, and vocal solos. The tests were perfectly successful, and the large number of visitors, about 600, testified their pleasure by frequent applause.

Intending Exhibitors should bear in mind that the Commissioners have given formal notice that the 31st of December is the latest time at which persons proposing to submit objects for exhibition can signify their intention to do so.

Specimens of School Work.—All specimens must be delivered at the House of the Society of Arts, 18, John-street, Adelphi, London, on Wednesday, the 8th, or Thursday, the 9th of February, 1871, conveniently arranged, so as to be ready for immediate inspection by the Committee of Selection. The Commissioners consider it desirable that the rule should be strictly observed by which the number of specimens to be sent from any one school is limited to ten, in each subject of instruction, for every hundred pupils in regular attendance at the school. For any number of pupils less than one hundred, a proportionate number of specimens will be admissible, viz., one specimen, in each subject of instruction, for every ten pupils in attendance.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

THE NEW GENERAL POST-OFFICE.

On Friday, the 16th inst., the chief corner-stone of the New General Post-office, in St. Martin's-le-Grand, was laid by the First Commissioner of Works, the Right Hon. A. S. Ayrton, M.P. The building will be one of four stories, and it will have a frontage of 286 feet in St. Martin's-le-Grand, and another of 144 feet in Newgate-street. It will be constructed of Portland stone throughout, the first two stories being ornamented with Doric, and the others with Corinthian pilasters. The principal entrance will be in St. Martin's-le-Grand, facing the present Post-office. In the centre of the building will be a large public office, in which the usual postal business will be transacted. The floors are to be thus appropriated:—Ground-floor (besides the large office), the Postmaster-General, and Receiver, and Accountant-General's offices; first-floor, Secretary's Department; second-floor, the Savings Bank Department; and third-floor, the Telegraph Department. The basement will be formed into store-rooms and offices. The old Post-office will then only be used for the receipt, sorting, and dispatch of letters. The estimated cost of the structure is £129,700. The stone having been laid, Mr. Ayrton said the building had been designed, as it had been required, to meet the growing wants of the Post-office, and the Commissioners of Works, in its design and construction, had not allowed ideas of fancy or taste to be made paramount to the demands of public utility. On the contrary, it had been designed to supply the constantly increasing requirements of this great city, and, indeed, of the whole kingdom, viz., improved postal communication; and it would, he thought, be a remarkable illustration of the advantages to be derived from the study of economy, combined with utility, in the erection of a public building. No edifice, moreover, had been recently designed in which so much accommodation would be obtained from so small an expenditure of the public money, having at the same time such an amount of ornamentation and elegance as was requisite in so important a building. It would not present what were called "the grand features" that some people might expect to see, but his (Mr. Ayrton's) department was not erecting a Grecian temple, but a place of business, and it had, therefore, sought to subordinate architecture to convenience. However desirous people might be to encourage mere beauty, his department was bound to remember that architecture was not to be regarded as the master of the public, but its servant. It might, indeed, be compared to a handmaid of fair proportions ministering to the wants and luxuries of its mistress, but when worshipped it became an inexorable thing, compelling every one to submit to its dictates. The present General Post-office offered a remarkable illustration of that, for it had not only a Grecian portico, but a stately hall resembling a Grecian temple. It would, no doubt, have been a very appropriate thing if all the newsvendors in the City had been expected to go there at stated times and present votive offerings at the shrine of Mercury, but with the Commissioners of Works it had become necessary in this instance to consider whether the people of this country should forthwith be put in the enjoyment of the great advantages to be derived from the halfpenny post, or should continue to preserve a Grecian temple in St. Martin's-le-Grand; and he hoped that men of sense would ratify the conclusion at which the Commissioners had arrived in this matter, in rendering beauty and art subservient to public convenience and utility. They were, therefore, under the necessity of foregoing a Grecian hall, in order to afford facilities for doing the greatest amount of public business in connection with the halfpenny post, especially with regard to the distribution of newspapers. That being so, he hoped the community would not be sorry at the change that had been introduced. The building had been designed by Mr. Williams, an excellent officer of his department, and he hoped that with all the convenience and accommodation which it would afford, the Post-office authorities would show themselves equal to the public necessities and expectations, by carrying on their business with energy and zeal for the benefit of the citizens of London, and, indeed, of the whole kingdom.

PETROLEUM, AND ITS PRODUCTION IN NORTH AMERICA.

During the last few years, the working, purifying, and transit of petroleum in North America has employed nearly as many hands as coal-mining and the working of iron, and the increased production of this mineral oil has gained great importance, not only in the particular districts of its occurrence, but also in all Europe, since its uses here have received great extension.

Pennsylvania, West Virginia, and Ohio in the United States, as also West Canada, must be regarded as the chief localities of its production, although it occurs over a large part, and is made use of in numerous places of North America, whilst the greater part of the oil sent to Europe is produced in County Venango, in Pennsylvania, in the neighbourhood of Oil-city, Titusville, Petroleum, Cherry Run, &c.

According to C. H. Hitchcock (the *Geological Magazine*, 1867, vol. iv., p. 36), the petroleum of North America is frequently found in trough-like basins, in the same way as underground water, which is brought to the surface by means of artesian wells, as, for example, in West Pennsylvania, where the petroleum occurs in three sandstone zones, closed in by beds of clay. Petroleum is generally found with carburetted hydrogen, and often weak saline waters, in hollows, clefts, and cracks of beds bent up into anticlynal and synclynal curves. Hitchcock mentions fourteen different geological formations from the tertiary rocks of California down to the equivalent of the Utica slate, and the lower Silurian Trenton limestone, in Kentucky and Tennessee, which carry petroleum over an area of several thousand square miles, and present an inexhaustible well of this oil. However, according to researches made up to the present time, the richest settlements of petroleum are to be found in the Silurian, Devonian, and carboniferous formations.

Petroleum is worked by means of boreholes, from three to four inches in diameter, and frequently five or six hundred feet deep, sometimes eight hundred feet. The oil at first overflows out of these, but later on has to be pumped out. Practice has taught that often, in boring into a strata of petroleum, a strong escape of gas takes place, and sometimes with such force that the boring rods are shot out of the borehole high into the air. An outstreaming of gas and petroleum follows the escape of gas, after which petroleum alone comes forth, and is also driven up to a considerable height, but in the course of time gradually sinks, until at last it does not reach the surface, and has to be got out by pumping.

Often when the strata is pierced, petroleum, and often water, comes forth instead of gas, and the mixture of gas and petroleum escapes later on, and the escape of gas, petroleum, and water often occurs at regular intervals.

These phenomena have led to the conclusion that petroleum occurs chiefly in cracks, clefts, and hollows of the rock, and in these spaces the water is undermost, swimming on this comes the petroleum, and uppermost is the gas.

At the oil creek in Pennsylvania, the petroleum occurs in a very porous layer of sandstone, which is like a honey-comb, containing numerous cells and cracks. When in this sandstone petroleum is bored, the gas gradually forces it up till it reaches the surface, over which it often rises from forty to fifty feet in an uninterrupted stream, yet at regular intervals changing its height, at one time rising with greater, at another with less force. This phenomena may also be explained in the same way as the last, since it may be assumed that the gas, petroleum, and water in the sandstone occur in three zones, one above the other, in the same way as in the clefts, cracks, and hollows of rocks, and in consequence of the escape of petroleum out of the cells and hollows into the borehole from the pressure of the gas. The expansive power of the latter diminishes, then, however, from the overflow of gas into the neighboring cells and hollows; it again increases until an equal expansive power is produced in all connected cells and hollows, and thereby the flow of petroleum continues with its original force, which only decreases in the course of time. Boreholes of this kind give often, for many years, a large quantity of petroleum.

The quantity and quality of the petroleum obtained is often in direct proportion to the depth of the borehole. Shallow boreholes produce only a small quantity of heavy oil of superior quality, while deep ones yield, for the most part, only light oils. In the Cherry Run district (Pennsylvania) the boreholes in the valley go to the depth of about 550 feet, that of Pit-hole is 620 feet deep.

In Pennsylvania the working of petroleum, which there is always got by means of boreholes, has nearly as great importance as the very extensive production of iron. At the commencement of working petroleum in those parts, enormous sums were spent in fruitless boring, but after a time a better system of research and method of sinking boreholes was introduced. It is now possible, in the space of one month, with the ordinary number of hands, to sink a borehole nearly 900 feet, and to prepare to pump out the petroleum. One of these boreholes costs 4,000 to 5,000 dollars, but it ensures a considerable profit, as for example in the case of the Niagara farm, out of which daily more than 300 barrels of petroleum are obtained from ten boreholes, the value of which are five dollars the barrel. Taking from this 500 dollars per day for working cost, as the gas from the boreholes is sufficient to drive the necessary steam-engines without other fuel, and there remains a clear profit of 1,000 dollars daily. In the course of time, important improvements and simplifications have been introduced in the purification of petroleum.

The *Titusville Herald*, a Pennsylvanian journal, gives the following statistics:—"In Pennsylvania, in the beginning of 1868, there were altogether 182 boreholes at work; at the beginning of the following year there were 373, showing an increase of 191 on the previous year, an increase which was necessary from the decreasing production of the existing single boreholes, and from the escape of large quantities of gas from the petroleum-bearing sandstone. From this it will be seen that, in order to keep up the same production of petroleum for the future, a further increase of boreholes is necessary. Since the beginning of October, 1869, a large number of boreholes have been made. Of the new boreholes at the beginning of October, this year, about sixty yielded enough petroleum to cover the working cost. At Cherrytree Run both boreholes south of the earlier ones produced petroleum at the time mentioned, the one forty and the other fifty barrels* per day, and gave signs of great extension of the workable tract. Also between Charley and Shaffer Run, as also west of Oil-creek, a larger workable tract was discovered.

The methods of working and treating petroleum has, in all essential points, remained unaltered, but it has, in the Pensylvanian and other districts, received many improvements which have made the trade safer, increased the value of the petroleum-bearing tracts, and also the profit on the capital employed. The most important improvements are in the purification and preparation of odourless petroleum. It is chiefly in Canada that the improvement in the purification process, which made the oil there produced, on account of its extremely nauseous odour, appear for several years nearly worthless, has been crowned with a favourable result, and has, consequently, produced an entire change in the trade in the produce of that country.

In Canada, the stock of petroleum in the beginning of 1869 of 400,000 barrels from previous years, was taken to market, together with that obtained during 1869, which amounted to 200,000 barrels. The purified oil produced in Canada in the same year was also taken to Europe, and found equally as good as other petroleums. In the United States, the purification and treating of petroleum, as also the form and size of the retorts, has been essentially changed, and thereby the produce of oil greatly increased.

In 1869, the price of petroleum was greater than in any previous year, and a greater gain was obtained on the capital employed than ever before. The gain in the purification of petroleum, and the trade in the same was good, yet it was less than that of the producers. In 1869, in consequence of the continually-varying price, speculations of enormous extent in petroleum were made, but less bankruptcies than usual occurred, and among these none of any consequence.

During last year, in Pennsylvania, the best yielding boreholes gave each more than 250 to 300 barrels daily. Of this kind, there were only four working, and at the end of the year there was only one bore-hole which produced 200 barrels, whilst there were thirty yielding only from 50 to 100 barrels per day.

The following is the daily average produce of the boreholes of the Pennsylvanian petroleum district for each month of the last three years:—

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* The barrel generally contains 45 gallons of 4·54245 litres, but according to the *Titusville Herald* petroleum is reckoned in barrels of 43 gallons.

Month.	1867.	1868.	1869.
	barrels.	barrels.	barrels.
January	..	9,700	10,192
February	..	9,200	9,767
March	..	8,621	9,791
April	..	8,837	11,067
May	..	9,700	10,153
June	..	10,102	11,334
July	..	10,698	11,697
August	..	11,981	12,157
September	9,700	11,033	12,645
October	9,600	10,133	13,071
November	9,800	10,275	13,317
December	10,400	9,737	12,843

The results for the year 1867 is from estimation, but the others by calculation of the shipments and the stock of petroleum in the districts.

Since the year 1859, in which year the first petroleum was obtained by boring, the following has been the yearly produce:—

	Barrels.
1859	82,000
1860	500,000
1861	2,113,600
1862	3,056,600
1863	2,611,300
1864	2,116,100
1865	2,497,700
1866	3,597,700
1867	3,347,300
1868	3,715,700
1869	4,215,100
Total	27,853,100

The produce of the year 1869 was the greatest for any single year since the commencement, and the total production for the eleven years working amounts to nearly 28,000,000 barrels.

In the districts of West Virginia and Ohio, in 1869, the daily produce of burning oil averaged 1,000 barrels, and consequently, for the whole year, 365,000 barrels, of which about two-thirds came from West Virginia, besides which about 1,000 barrels of lubricating oil were also produced from the same district.

In the Kentucky district, about 75 barrels are produced daily, and the Canadian district yielded 4,000 barrels weekly; thus, for the whole year of 1869, 210,000 barrels were obtained from the latter, and 27,000 barrels from the former district.

The following is the total produce of all the districts of North America for the last two years, with the exception of California and Montana, where petroleum has also been worked, but which, in comparison with the other districts, was unimportant:—

	1868. Barrels.		1869. Barrels.
Pennsylvania	3,715,000	..	4,215,000
West Virginia and Ohio	125,000	..	365,000
Kentucky	25,000	..	27,000
Canada	100,000	..	210,000
Total	3,965,000		4,817,000

In 1868, the entire produce of North America was somewhat over 4,000,000 barrels, whilst in New York alone, in 1867, 1,533,200 barrels, and in 1868, 2,250,400 barrels were shipped. The stock of raw petroleum in the United States, in 1870, was 880,000 barrels, or 180,000 barrels more than on the 1st July, 1869, and 90,000 more than on the 1st January, 1869, but 200,000 barrels less than on the 1st January, 1868.

The price of oil varies, and differs according to the demand, the stock, and the district from whence it was obtained. At the beginning of 1869 it was, on an average, from 4 dols. 50 cents to 4 dols. 60 cents the barrel, but towards the end of the year from 5 dols. 45 cents to 5 dols. 55 cents at the Lower, and from 5 dols. 25 cents to 5 dols. 35 cents at the Upper Oil Creek, Pennsylvania.

AUSTRALIAN WINES.

The committee appointed by the Board of Agriculture of Victoria, for the purpose of testing the wines exhibited in the Intercolonial Wine Exhibition, recently held, have issued their report, in which they have pleasure in recording their opinion that the exhibition has been the most successful of the kind yet held in the colony. They trust that it will be still further utilised by information being obtained from the different successful exhibitors on many points of culture and manufacture, for the use of the vignerons of the colony. With regard to the disposal of the samples of wine now on hand, the committee very strongly urge upon the council that, if the exhibitors respond to the invitation of the council as passed at its last meeting, and leave their exhibits to be further dealt with, measures should be taken to forward them to Europe, for the purpose of being reported on by competent judges there. It is certain that such a report would be of very great advantage in showing colonists what is thought of our wines in a country where there is an unlimited demand for wine. If the report were unfavourable, it would be a still further incentive to find out the direction in which change in our wine-growing is necessary.

The exhibition consisted of 272 exhibits, contributed by 37 Victorian, 5 New South Wales, and 12 South Australian exhibitors, divided into two classes. Section 1. Full-bodied red wines, any vintage, 14 exhibits. Section 2. Full-bodied red wines, not older than 1868, 20 exhibits. Section 3. Light red wines, any vintage, 10 exhibits. Section 4. Light red wines, not older than 1868, 13 exhibits. Section 5. Full-bodied white wine, any vintage, 13 exhibits. Section 6. Full-bodied white wine, not older than 1868, 15 exhibits. Section 7. Light white wine, any age, 11 exhibits. Section 8. Light white wines, not older than 1868, 17 exhibits. Section 9. Red, sweet, or liqueur wine, 16 exhibits. Section 10. White, sweet, or liqueur wine, 6 exhibits. Section 11. Full-bodied red wine, 38 exhibits. Victoria, 7 exhibitors, 9 exhibits; South Australia, 11 exhibitors, 17 exhibits; New South Wales, 4 exhibitors, 12 exhibits. Section 12. Full-bodied white wine, 43 exhibits—New South Wales, 5 exhibitors, 14 exhibits; South Australia, 8 exhibitors, 18 exhibits; Victoria, 7 exhibitors, 11 exhibits. Section 13. Light red wine, 27 exhibits—New South Wales, 2 exhibitors, 5 exhibits; South Australia, 5 exhibitors, 11 exhibits; Victoria, 8 exhibitors, 11 exhibits. Section 14. Light white wines: 24 exhibits—New South Wales, 3 exhibitors, 4 exhibits; South Australia, 7 exhibitors, 14 exhibits; Victoria, 5 exhibitors, 6 exhibits. Section 15. Sweet or liqueur wines: 18 exhibits—New South Wales, 2 exhibitors, 6 exhibits; South Australia, 4 exhibitors, 7 exhibits; Victoria, 5 exhibitors, 5 exhibits. For the sample of wine which, in the opinion of the judges, had the greatest number of points of merit, we selected from the wines which had taken first prizes in the 15 preceding sections, No. 15 of Section 8, a Shepherd and German Reisling (1868), exhibited by Mr. C. Maplestone, of Heidelburg, being a light mellow wine, with fine bouquet, and all the character of a Rhenish wine, and most suitable for our climate. It is, therefore, to be recommended to the attention of all our vignerons. On the whole, the Victorian vignerons must be complimented on the decided progress they have made since their last competition with the older colonies, as shown by this exhibition. In red wines they can hold their own; while in the white their exhibits, in many instances, come close to the prizes. On the average, the wines were well made, and nearly all were in good condition, the bottles clean, and the corks good and sound. It will thus be seen that the hermitage, mataro, reisling, and chasselas stand most prominent; but it is evident that the wines of the same name had changed their character in each district, thus producing many varieties. This is the most important point in the exhibition to the vignerons; and although it cannot be denied that many of the wines are very fine, this variety is a great drawback, which it is for the vignerons to remedy. To make their wines marketable for foreign countries, the first condition is uniformity, and to attain this, the vignerons should set to work without delay. We would suggest that in each district an association be formed, whose sole object should be to ascertain, by careful examination over two or three years of the wines produced, the most suitable grape for their particular district. Having ascertained this, they should lose no time in re-organising their vineyards, according to their means, by planting no other than the grape selected for their district, and by grafting it, a certain proportion in each year, on to their old vines. By this means, in 10, 12, or even 15 years, each district would excel in its particular kind of wine, as the Rhine produces hock; Bordeaux, claret; Burgundy, burgundy; the Douro, port, &c.; and our wines would then, through the agency of our wine merchants, be introduced into the home markets, which will never be done to advantage unless what we have recommended is carried out.

The Board of Agriculture having adopted the report, passed the following resolution:—"That a sum not exceeding one hundred pounds from the balance in hand be placed at the disposal of the wine committee, to be drawn upon by them to such extent as may be necessary to obtain a report from judges in England, and, if possible, France, on the merits of the various exhibits, and such other samples as may be entrusted to the committee to forward; and that the committee be empowered to take all necessary steps to carry out the intention of this resolution."

EDUCATIONAL NOTES.

Meeting of the London School Board.—The second meeting of the Board was held on Wednesday last. The committee appointed to consider the question of what officers would be required for the Board reported in favour of the appointment of a secretary (or clerk), with a salary of £800, as well as certain subordinate officers. A considerable portion of the sitting was occupied in discussing whether this sum or £1,000 a-year (as proposed by Professor Huxley) should be offered to candidates for this post; ultimately the views of the committee were adopted by a majority of 24. The Board adjourned to the 5th January.

London School Board Election.—On the 15th inst., two deputations waited upon the Vice-President of the Privy Council to complain of irregularities in the late election. Both deputations were from Lambeth, one being composed of Roman Catholics, and the other of the class represented by the Rev. G. Murphy, the temperance advocate. The alleged irregularities complained of were the acceptance of votes of persons said to be workmen of certain candidates' friends, without any proof of their being ratepayers, the refusal of Roman Catholic votes on the statement of an officer that there was no such a candidate as Dr. Kavanagh, and the deception practised on Roman Catholic voters who could not read, by agents who filled up the voting-papers for such ratepayers in favour of other candidates. Mr. Murphy principally complained of touting and undue influence. Mr. Forster, in reply, said that with regard to the 33rd section of the Act, the Privy Council had resolved not to use its powers under this section in respect to London, but to refer all complainants to their legal remedy before the Court of Queen's Bench. With regard to these alleged irregularities, he had looked into the cases in which it was said they had occurred, and had found that in no case could they have affected the final return, even if they had occurred, and he was far from holding that they were proved. He believed that the elections generally had been very well conducted. Mr. George Potter has written to the Education Department complaining of alleged irregularities in Westminster, and has received a similar reply. Dr. Kavanagh has, in a letter to to the daily papers, declared it to be his intention to dispute the validity of the election before the Court of Queen's Bench.

School Boards.—Orders have been issued by the Department for the election of school boards for the boroughs of Beaumaris, Bideford, Blackburn, Burnley, Canterbury, Carmarthen, Chard, Darlington, Dewsbury, Derby, Dudley, Halifax, Hartlepool, Kendal, Leicester, Northampton, Oldham, Portsmouth, Rochester, Rye, Staleybridge, Sunderland, Tynemouth, Wrexham, and Yeovil. In the election for the Hanley School Board, thirteen candidates went to the poll, which resulted in the return of the following:—F. Wragge, J. Bull, R. E. Narramore, G. Bradford (Churchmen), the Rev. W. Molloy (Roman Catholic), C. F. Wedgwood, T. Pidduck, and E. Powell (Dissenters), and W. Wood (working man). The Town Council of Salisbury have decided to make an application for a board; and at Totnes, after a very stormy discussion, the ratepayers came to a similar decision. Similar steps have been taken at Exeter, Stratford (Essex), and Scarborough. An inquiry just made regarding the school accommodation of Preston, shows that full provision will be made for all the children in the town, and that there will be no occasion, at present, at any rate, to make any application for the appointment of a board.

Chairmen of School Boards.—At Liverpool, Mr. Christopher Bushell has been elected chairman, and Mr. J. J. Stitt vice-chairman. At Manchester, Mr. Herbert Birley, Churchman, was elected chairman by eight to six votes against Mr. Oliver Heywood. Mr W. R. Callender, Churchman, was elected vice-chairman. At Birmingham Mr. W. L. Sargant, one of the eight "Scriptural" candidates, but a Liberal in politics, was unanimously elected chairman; and Mr. S. S. Lloyd, another member of the same party, was appointed vice-chairman. At Leeds Sir Andrew Fairbairn, a Churchman, was chosen chairman, and Mr. Jowitt, Nonconformist, vice-chairman. At Bradford Mr. M. W. Thompson, ex-M.P., was elected chairman, and Mr. J. V. Godwin vice-chairman. At Sheffield, Sir John Brown was appointed chairman, and Mr. Mark Firth (ex-Master Cutler) vice-chairman. At Nottingham, upon the motion of Mr. Paget, Unitarian, seconded by Mr. Rothera (Birmingham League), the Rev. Prebendary Morse was voted to the chair by a majority of seven to six. Mr. Gripper (Quaker) was elected vice-chairman. At Coventry Mr. Alderman Gulson was unanimously elected chairman, and Mr. Alderman Lynes vice-chairman. At Wolverhampton Mr. H. H. Fowler, solicitor (Wesleyan), was elected chairman, and Sir John Morris (Churchman) vice-chairman.

Duties of School Boards.—The Education Department has issued a circular letter to the school boards already elected. Speaking of the resolution of the Town Councils calling for a school board, the letter says:—"This resolution, however, and the election of the school board to which it led, do not supersede the necessity for the issue of a requisition from this department, setting forth the amount and description of the public school accommodation required for the district. In order that they may make such requisition, it is essential that my Lords should receive precise information as to—(1) the requirements of the borough in respect of public school accommodation; (2) the amount and character of the existing school provision; and (3) the manner in which those locally interested in the question wish that any ascertained deficiency should be met. The object of the present communication, therefore, is to request that the Board will furnish this department with full and accurate information upon each of these points." The letter then refers to the returns already made at the request of the department, and says that:—"My Lords would be glad to receive from the board, after they have carefully examined these returns, and after such further inquiry as they may find necessary, a report, showing—1. The number of children within the municipal limits for whom means of elementary education should be provided (*a*) between the ages of three and five; and (*b*) between the ages of five and thirteen. 2. The provision to meet the requirements of these children, which the Board considers to be (*a*) already supplied by efficient schools, or (*b*) likely to be supplied by schools either contemplated or in course of erection. 3. The deficiency, if any, in the supply of efficient elementary education for the borough, as shown by comparing 1 and 2. 4. By means of what schools the board would propose to supply this deficiency. 5. The precise localities in which such schools will be needed. This report should be supported by detailed information respecting the individual schools which the board take into account, either as efficient or otherwise." The letter explains the mode in which this should be supplied, and concludes by reminding the board "that while my Lords are anxious to obtain the co-operation of the board, and to have the benefit of their suggestions as to the best means of supplying sufficient school accommodation for the borough, they are unable to divest themselves of the ultimate responsibility of determining, and declaring, the amount (if any) of the deficiency which will have to be met. They must, therefore, reserve to themselves the power of making such further inquiry as, on carefully considering the report and returns now called for, they may deem to be necessary; after which they will issue a requisition to the board, in accordance with the terms of the 12th section of the Act."

Female Inspectors of Schools.—A memorial from "Heads of Houses, Professors, Tutors, Lecturers, and Fellows of Colleges in the University of Cambridge" has just been sent to the Lord President of the Council, praying that women may be appointed to the office of inspector of schools, and pointing out some of their qualifications. The memorial is signed by 72 resident graduates, all of whom are Fellows of Colleges, or hold College or University offices in Cambridge. Among those who sign are the Vice-Chancellor and five other Heads of Houses, including the Masters of Trinity and St. John's, nine University Professors, the senior tutors of every College, with three exceptions; all the tutors, assistant-tutors, and lecturers of Trinity College, with two exceptions; and of the remainder all, except eight, are engaged officially in teaching in the Colleges or or University.

Scientific Teaching in Elementary Schools.—A deputation of the Council of the British Association for the Advancement of Science, consisting of the president, the general secretaries, and the treasurer, Sir Charles Lyell, Bart.; Sir John Lubbock, Bart., M.P.; Dr. Lyon Playfair, M.P.; and Mr. Francis Galton, had an interview with the Vice-President of the Council on Tuesday, the 13th inst. The object is stated in the following document:—"Sir,—The deputation from the Council of the British Association for the Advancement of Science waits upon you for the purpose of urging the advisableness of including elementary natural science among the subjects for which payments are to be made under the authority of the Revised Code. We have asked you to receive us at the present time because we understand that you have announced your intention of making certain modifications in the code. Our reasons for requesting you to give direct encouragement to the teaching of natural science in elementary schools are three. Firstly, we conceive such teaching to be one of the best instruments of education in the sense of intellectual discipline, and in many respects better calculated to awaken intellectual activity than other studies; secondly, we think that a knowledge of the elements of natural science has a high value as information; and, thirdly, we are of opinion that scientific training and teaching in the elementary schools will afford the best possible preparation for that technical education of the working classes which has become indispensably necessary to the industrial progress of the country. We take the liberty of pointing out to you that, in asking for the introduction of scientific teaching into the elementary schools, we are not seeking for the creation of a new system or even of new executive machinery. The Science and Art Department does already provide for elementary scientific instruction; and all that is necessary to fulfil our desire is, that the system of the Science and Art Department and that of the revised code shall be brought into harmonious co-operation. In preferring the request that instruction in the elements of science shall be made part of the regular course of instruction of all elementary schools, we desire carefully to guard against the supposition that we are seeking for such an amount of this kind of instruction as would interfere with the teaching of reading, writing, and arithmetic, and other essential constituents of primary education. On the contrary, we think it very desirable that systematic instruction in elementary science should be given only to those scholars who are able to read and write fairly; that it should be limited to certain well-defined subjects, such, for example, as elementary physical geography, elementary physics and chemistry, elementary botany, and, in consequence of its relation to the public health, elementary human physiology, and that care should be taken to make the instruction, so far as may be, real and practical. Finally, we desire to point out that such scientific instruction in the elementary schools as we pray for would afford a means by which any child of exceptional aptitude for scientific pursuits might obtain the education suited to its capacity in the higher schools, and that in this way advantages similar to those which are offered by the scholarships and exhibitions of grammar-schools to the children of the well-to-do classes of society would be extended to the poor and necessitous. In other countries in which well organized systems of secondary education for the working classes exist, it has been found necessary to give a taste for science in the elementary schools, so that the youth of the country may be induced to take advantage of the more advanced schools. While, therefore, we look with pleasure to the introduction of science into the endowed schools of the country, we still believe that it will be necessary to link them to the elementary schools by commencing instruction in science in the latter."—The address was signed by Professor Huxley, as president.

IMPROVEMENT IN ELEMENTARY EDUCATION.

As there seems little chance of the needed extension of art and science instruction in this country, unless time be gained for it by improving and shortening the time of primary instruction, and the new educational constituences appear to be little aware that any practicable improvements upon the common systems can be made, the testimony collected by the Council on the half-time schools shows that, under proper arrangements, as good results are obtained in three hours of daily instruction, or four hours on alternate days, as by the five and six hours of daily teaching in the common schools; and also that as much instruction as is usually given in them in seven years is given in between three and four, and at less than half the expense, by systematised class teaching. The attention of the Education Committee of the Society was lately called to an improvement upon our system of teaching, in one now extensively practised in Germany, by which reading and writing are better taught together in about one-half the time now occupied in teaching them. It appears that Miss A. J. Clough (a sister of Mr. Clough, the poet), who has recently been engaged in the organisation of a middle-class school for female children in London, was so struck with this method of teaching in the German schools, and with the excellent results attained by it, that at her own expense she brought over a female teacher to try it in teaching English, and the Committee had an opportunity of witnessing the practical working of the method at the National Schools, Christchurch, Marylebone, under the auspices of the incumbent, the Rev. Llewellyn Davies. The principles on which the method is based were brought into notice in Germany twenty years ago, by an eminent and practical teacher, Dr. Vogel, of Leipsic, in his "Child's First Lesson Book."

A primer on this system, prepared by a German teacher, and edited by Miss A. J. Clough, has been produced at the Clarendon Press, Oxford, and is used in the school above referred to, where a German teacher is employed to carry out the system experimentally. As explained in the preface to this primer, the system seeks—"First, to connect the object lessons (which ought to be the beginning of instruction in any well-organised school) with the first exercises in writing. Secondly, to teach the letters by their sounds, not by the names which we have been accustomed to give them, so that the sound of each single letter may be the same sound that it has when pronounced in a word. Thirdly, as a foundation for correct spelling, to accustom the child from the first to take each word as a whole, thus making spelling very much an act of memory. Last, but not least, to provide a pleasant and attractive lesson-book as the school's first gift to a child—one that will not weary him, but will begin by reminding him of the cheerful pastimes of the nursery."

It will be noticed that a main point of the plan is to teach reading, writing, and spelling together. The primer directs that the first lesson should be given as follows, the children being supplied with copies of the primer, which contains wood-cuts of the objects:—"Draw the first object given in the book on the black-board, in outlines, as large and simple as possible. The children should watch how the drawing is done, with the idea that they are to try and imitate it afterwards. If possible, show the real object to excite greater interest; but, if this cannot be done, the picture in the primer must be shown instead. Now begin to talk about the object, show its different parts, its composition, its use, &c.; ask the children what they already know about it, and tell some little story connected with it. Then tell them to draw on their slates the picture which was drawn on the black-board, and allow them perfect freedom in doing this. The child's fancy will recognise the original picture in its own most imperfect attempts at imitation. When this is done, tell the children that, besides drawing, we have another way of putting things down on paper or on a slate; that we can *write* a 'nut' as well as draw one; that as the picture gives everyone the idea of a nut, so the written word gives everyone who can read English the idea of a nut. But *writing* a nut is much quicker than drawing one, and that is why we write and do not always draw things. Now write the word 'nut' in round text-hand on the board under the picture, so that the children may see the drawn 'nut' and the written 'nut' side by side. Then let them find these, first one and then the other, in their primers, and finally tell them to try and write the word, one, two, or three times, on their slates. Next, say that in books we find that words are not written, but printed, so we must learn to know how a printed word looks. Show the word 'nut' in large printed letters on counters, and let the children find the printed word in their primers. Now pronounce very distinctly several words ending with the sound 't,' as—hat, bat, hut, hot, lot, putting the emphasis on 't,' and ask the children what *sound* they hear most distinctly alike in all the words. They will soon answer 'te,' sounded like 'tur,' without pronouncing the 'r,' or, more precisely, like 'te,' with the *e* mute as in French. No child will say 'tee.' Show the counter 't,'' and let them find 't' in the printed nut in their primers, and call it by its sound, 'te' or 'tur.' Follow the same plan in teaching 'u,' sounded as it sounds in 'hut,' 'nut,' but not calling it 'eu.' When the children have thoroughly taken in and understood the printed word as a whole and in the single sounds, they must be made to understand that the written word which they have already seen as a whole, is also composed of three sounds. For this purpose, show counters with the printed sounds, and write the written ones (that is, the letters) one by one on the black-board, and let the children try and copy the written letters. The sounds of the letters may be taught just as they occur in making up the words, not in alphabetical order; and the names of the letters, as in the ordinary alphabet, may be ignored until the child can read."

Other words should be treated in the same manner, till all the sounds employed in the language are learnt. It should be added that the children are first taught to write in the air with out-stretched four-finger and arm, and to describe the strokes as made. Thus '*a*' would be described as "oval—straight-down—up." This part of the system seems to answer well, and to fix the forms of the letters in the children's minds. The plan is explained in further detail in the primer, but the above will serve to give an idea of it.

It may be added that the children who had been taught upon this plan, for about five months, at the school above referred to, appeared to read and write simple words satisfactorily, but the experiment would have been more conclusive had it been made with children of about six years old, previously perfectly ignorant. Happily, however, it was impossible in this school to find such children, and thus the teacher had not an opportunity of working upon perfectly virgin soil.

It appeared that the greater difficulty of teaching spelling in English, as compared with German, in consequence of the frequent representation of the same sounds by different letters in English, would (so long as that difficulty is allowed to remain in children's school books) reduce the gain here from one-half to about one-third. The method has more refinement in it than our common method, and would need a higher order of teaching power than at present exists in our elementary schools.

Dr. Lindo, the distinguished school inspector of Holland, who was recently in London, stated that the method had been lately introduced in the Dutch schools with success. It was considered that their infant school teaching was so far advanced that they had not so much to gain from it in time as in England. But the German method was an improvement, inasmuch as it was more interesting and entertaining to the children, and was a better and less fatiguing exercise of the mind.

EDUCATION IN INDIA.

This subject has been very ably handled in a report just published by the India-office, which contains a *résumé* of the state of education in 1866-67. The returns of the several provinces show the most notable facts of the year, the cost of operations, and the agency in each province by which the operations are supervised. The principles upon which the action of the State is based are referred to as they were laid down in the dispatches of the Home Government of 1854 and 1859. The main object then stated is to divert the efforts from the education of the higher classes, upon whom they had up to that time been too exclusively directed, and to turn them to the wider diffusion of education among all classes of the people, and especially to the provision of primary instruction for the masses, such instruction to be provided by a compulsory rate, which is pointed out as the best means of obtaining funds for that purpose, the system to be extended upwards by the establishment of model schools, to be superseded gradually by others supported on the grant-in-aid principle. Perfect religious neutrality is publicly placed before the natives, from whom the payment of some fee is required, and promotion can be made from the humblest elementary instruction to the highest colleges. To provide masters, normal schools are to be established in each province, and moderate allowances given for the support of those who are willing to devote themselves to the profession of schoolmasters. And by this means it is hoped a supply of masters can be obtained without the necessity of recruiting from England.

The medium of education to be in the vernacular language of India, into which the best elementary treatises in English should be translated; while these languages are not to be neglected, the English may be taught, but not as a substitute for the dialects of the country. Female education is to receive the cordial support of the government, as by it a far greater impulse is imparted to the moral tone of the people than by the education of men. In addition, special institutions for the study of law, medicine, engineering, art, and agriculture are to receive the direct encouragement of the government.

The agency by which this system is to be carried out is a director in each province, assisted by a staff of inspectors. In each presidency a university is to be established, on the model of the London University, such being intended to test the value of the education given elsewhere.

At the time this theory was laid down, there were no universities, and the number of pupils in all the schools was about 14,000, and female education had not been attempted at all by the State. Although a very large annual expenditure has since been incurred, the lower classes do not, in all provinces, receive their proportionate share. During the last ten years, this expenditure has increased from £195,494, in 1856-57, to £763,230 in 1866-67; and the grants for the year under review show a further addition of £72,000 to the charge of the department. The results may be gathered from a table contained in the report, which gives the present condition of educational establishments and the number of pupils. The population is estimated at about 152 millions; the number of universities 3; colleges and schools, 14,990; pupils receiving instruction, both males and females, 622,342. The total expenditure for eleven months, 1866-67, gives 7,602,107 rupees, of which 2,819,065 were from local and private funds, and the remainder from Imperial sources.

The extension of primary education amongst the lower classes, who are incapable of obtaining an education by their own unaided efforts, is dependent upon a system of compulsory local rates. In Bombay, the mode of levying the cess was, that every ryot who pays a rupee of land revenue should pay one anna cess, on the understanding that its continuance should be agreed to by the people. This tax generally is not found unpopular, and in some parts the natives have volunteered to pay the cess, since they can perceive the advantages acquired through the means placed at their disposal. The cess is strictly local, being expended entirely on the district where it is collected, and unexpended funds are not transferable; and it is assessed in various manners, according to the wants of the locality. There has been no cess in British Burmah, the districts of Mysore and Coorg, or in the province of Bengal.

However much the different systems in the various provinces may differ in their development, and in the manner of finding funds for elementary education, it is easy to trace their general accordance with the principles recently adopted in our own Education Act. The gigantic nature of the task imposed upon the government of India is likewise apparent, by the enormous area and the vast population. Notwithstanding the development of the last twelve years, the remark made in 1854 seems almost equally applicable now, "that the efforts of the State have reached but an insignificant number of those who are of a proper age to receive school instruction."

CORRESPONDENCE.

"ASSOCIATED DAIRIES."

Sir,—On opening the discussion on the above subject, I am reported as saying "they must not expect any great profits to result from it." What I did say was, that I recommended all intending to forward the principle to make themselves acquainted with it by a careful study of both parts of the last volume of the *Journal of the Royal Agricultural Society*. I then added, that the co-operative principle must be so in reality, *i.e.*, co-profitable—no directors or managers taking the lion's share to themselves. No class of Englishmen are more averse to jobbery than the agricultural, and I consider it requisite to ensure success, that the following conditions should exist:—Security of tenure, and reimbursement for all unexhausted improvements, or long leases with but few restrictions; then with skill, enterprise, and capital, we may see agriculture rise to the position it ought to occupy—realising the motto of our Royal Agricultural Society—"Practice with Science."—I am, &c., Wm. Botly.

Sir,—"The large dairy-farmers in Cheshire," with whom your correspondent, "A Member of the Cheshire Chamber of Commerce," has conferred, must belong to a section of the agricultural community that is still open to the charge of "not being a reading class." How else can one account for the fact that, after what has been done by dairy-farmers in the United States, Canada, and Sweden, after what has been written about their doings, not only in those countries, but in England and Scotland, Ireland, and Italy, "large dairy-farmers in Cheshire" are still trying to clutch their favourite phantom objection about whey and its products, But, beyond this, it seems very odd that practical men like dairy-farmers should be blind to the obvious fact that the carts and the cans employed to carry the milk from the farm to the factory might be used to carry the whey back from the factory to the farm. However, the following paragraph, extracted from the *Journal of the Royal Agricultural Society* (2nd series, vol. vi., part 1, p. 190) for last February, will prove to your correspondent and his friends that there is no difficulty in the matter:—

"The whey is usually given to swine. Ample pens and yards are provided at the factory. Each farmer or patron is allowed to keep here one pig for every five cows.

"He can have a separate pen if he chooses, or put them in the yard with others. The whey is conducted from the factory into large reservoirs near the pens, and when the hogs are to be fed a faucet is opened, and it runs to the troughs. At some factories the whey is carted home by patrons each day, as they return from delivering milk.

"Quite recently, a process has been invented for taking the butter from whey. The whey is run off, sent from the curds into a large copper vat (600 gallons) placed over an arch. Heat is applied until the mass is raised to a temperature of 180°. Acid (sour whey) is added at the rate of a gallon for every 50 of milk. The oil and albuminous matter rise at once, and are skimmed off and put in a cool place, and next day churned at a temperature of 56° to 68°.

"About 20 lbs. of butter is thus obtained from 500 gallons of whey.

"The butter is of good colour, and a good article for present use. When the process is properly conducted, the fresh butter is not easily distinguished from that ordinarily made from cream, and is sold in the market at the same price.

"At some of the factories the whey is considered a perquisite of the manufacturer, who purchases hogs and feeds them.

"I should have remarked that when the butter is taken from the whey as above, the whey is used for feeding pigs. It is fed sweet, and in practice we find the pigs thrive upon it quite as well as when fed sour (the usual way), with butter retained."

I will only add to this that in some districts it is preferred to feed calves instead of pigs.

The system of associated dairies has succeeded in America, because by its means the standard of cheese produced has been very materially raised, and it will succeed in England, if at all, for the same reason. In Derbyshire this year, for instance, the factory-made cheese has sold at prices varying from 80s. to 85s. Now, it is not pretended that the two or three dairies in the county that have equalled this result will benefit by the factory system; but it is urged that the hundreds of dairy-farmers, whose cheese seldom realises more than from 65s. to 68s., will benefit enormously.—I am, &c.,

H. M. JENKINS.

P.S.—I notice that your correspondent refers to the factory system as "a system whereby he (the dairy-farmer) can obtain 6½d. per gallon for his new milk." No mistake could possibly be greater. The factory system is properly co-operative, as described in my paper; the purchase system is merely the form which the Derbyshire and Cheshire experiments have taken for the first year.

PATENT LAWS.

SIR,—Many thanks are due to Mr. H. W. Reveley, for the able letter on the patent laws, which appeared in your issue of the 25th of November last, both by inventors and those who are engaged, like myself, in their interest. The more ventilation the subject receives the better, for the patent laws must stand or fall on their own merits, and independently of private interests. But the overthrow of a long-established institution can only be the result of undoubted facts and unimpeachable evidence of its being prejudicial or useless, not of partial statements and doubtful statistics.

I think that Mr. Reveley will admit that our patent law, which took its origin in an Act of the reign of James I. (1623) for abolishing letters patent, except for the working or making of any manner of new manufacture, was intended to favour progress in the arts and manufactures, in contradistinction to arbitrary monopolies by way of favoritism, which only shackled trade. That it has answered its object is evidenced by the great strides that have been made in our manufactures under its influence. Its having stood the test of more than two centuries without material change is, I think, the best answer to the opponents of the patent law.

I am far from admitting that the patent laws, as they now stand, are a mass of imperfection, although some defects have crept in during the remodelling process.

Mr. Reveley is labouring under a mistake in supposing that any production of the human mind can be made the subject of a patent right. The required qualifications, as construed by the law courts, are novelty and utility, giving rise to some advantage, such as cheapness, or a new or better quality in the means or make of manufacture. The myriads of ordinary appliances could not, therefore, be the subject of patent monopolies.

The abolitionists evidently take their stand upon the number of patents which turn out unprofitable, without examining into the cause, which is that the implied conditions of the grant, viz., novelty and utility, in many cases are not complied with.

Your correspondent considers it is impracticable to obtain a test of the usefulness of an invention. To a commercial extent this is, no doubt, true, although something might be done in the direction which would render a service by reducing the number of useless patents. But as to novelty, we have the authority of the United States Patent-office for asserting that, by the aid of a staff of well-selected examiners, and a well-stocked library and museum, a great check might be put on the multiplicity of patents complained of, reducing greatly the work for the courts of law.

Mr. Reveley's estimate of what he terms an authorised lottery in patents is much underrated. The Patent Office furnishes evidence that the prizes are numerous, and a rather good trade is done in patents. On looking around him this is amply confirmed, and I might instance many inventors who have reaped rich harvests from their patents. The case of the sewing machine inventor he mentions proves that, unfortunately, the poor inventor does not always reap the full reward for his genius; but would his position have been bettered by taking away the protection under which he was enabled to obtain some recompense, however inadequate? This is rather an argument for removing the difficulties thrown in the poor inventor's way, in the shape of a high government tax.

I believe most of those having experience of the maturing of inventions of great public utility will agree that the course of an inventor is one of trial and difficulty, requiring great sacrifice of time (often his only capital), and long he has often to wait for the fulfilment of his project. If, as Mr. Reveley observes, the patent does not make the invention, and the inducement be fortune or fame, a patent is the means to the end. It is the only tangible mode of recognition, and, in the case of the poor inventor, if you take his patent away you lose his invention, for in his case it may be truly said that necessity is the mother of invention.

The man who invents only for fame requires no less the protection afforded by the patent laws to develop his invention. Without it, he would be debarred from communication with others, and lose their assistance in maturing it, and which is a relief that can safely be extended if coupled with a preliminary investigation under the proposed revision of the patent laws What disputes will such communications give rise to, and how difficult it would be to fix the paternity of an invention. It is necessary, where capital is required to develop an invention, as a guarantee to the capitalist. A good patent law is therefore necessary, independently of the money consideration; for the poor inventor it is indispensable.
—I am, &c.,

L. DE FONTAINEMOREAU.

GENERAL NOTES.

Mineral Statistics of the United Kingdom.—The minerals raised from the earth in the United Kingdom, in 1869, were of the value of no less than £35,252,120. This amount exceeds that of the preceding year by upwards of £1,600,000. The coal produced in 1869 told up to 107,427,557 tons, of the value of £26,856,882, without adding any charges for movement. The returns for 1868 showed only 103,141,157 tons of coal produced, being less than in 1869 by above four million tons. The increase is very marked in the Durham and Northumberland, the Lancashire, the Yorkshire, and the Derbyshire districts. Durham and Northumberland produced 25,765.430 tons of coal in 1869; Cumberland, 1.410.808 tons; Yorkshire, 10.829,827 tons; Derbyshire, 5.460,090 tons; Nottinghamshire, 1,575.450 tons; Leicestershire, 650,700 tons; Warwickshire, 585,630 tons; Staffordshi and Worcestershire, 12,669,107 tons; Lancashire, 13,995,500 tons; Cheshire, 957,150 tons; Shropshire, 1,392,862 tons; Gloucestershire and Somersetshire, 1,979,950 tons; Monmouthshire, 4,275,150 tons; South Wales, 9,179,650 tons; North Wales, 2,155,180 tons; Scotland, 14,417,150 tons; Ireland, 127,923 tons. The export of coal in 1869 does not, however, show an increase; in 1868, it was 10,960,062 tons, and in 1869 only 10,744,945 tons. The advance was in our home consumption, and is attributable chiefly to the renewed activity of our manufactures. It is accounted for to some extent by the increase in the make of pig iron; the production of our blast furnaces in 1867 was 4,761,023 tons; in 1868, 4,970,206 tons; in 1869, 5,445,757 tons. The production of iron ore in 1869 advanced to 11,508,525 tons, of the value of £3,732,560; the quantity is about 1,340,000 tons more than the preceding year. The great increase is in North Staffordshire and in Scotland. The production of iron ore in Yorkshire, in 1869, amounted to 3,325,586 tons; but, large as the quantity is, it was more in the preceding year. In Scotland, the production in 1869 was 1,950,000 tons; in North Staffordshire, 1,287,749 tons; in South Staffordshire, 350,000 tons; in Cumberland, 1,047,819 tons; in Lancashire, 784,507 tons; in South Wales and Monmouthshire, 715,001 tons; in Northamptonshire, 540,259 tons; in Derbyshire, 352,072 tons; in Lincolnshire, 253,024 tons. The other iron-producing counties supplied smaller quantities. The tin ore produced in the United Kingdom, in 1869, amounted to 14,725 tons, of the value of £1,027,805. The copper ore, 129,953 tons, of the value of £519,912. The lead ore, 96,866 tons, of the value of £1,189,030. The zinc ore, 15,533 tons, of the value of £49,366. The iron pyrites, 75,948 tons, of the value of £41,023. Arsenic, 2,561 tons, of the value of £11,464. Gossans, ochres, &c. (estimated), 5,709 tons, of the value of £4,943. Wolfram and tungstate of soda, 25 tons, of the value of £323. Manganese, 1,558 tons, of the value of £7,897. Barytes, 5,987 tons, of the value of £3,415. Clays, fine and fire (estimated), 1,200,000 tons, of the value of £450,000. Various earthy minerals (estimated), £670,000. Salt, 1,250,000 tons, of the value of £687,500, estimated at the value given in the return of the exports. The metals obtained in 1869 from ores above enumerated were of the value of £17,162,767, or £1,400,000 more than in the preceding year, The pig-iron obtained was, in 1868, 4,970,206 tons, of the value of £12,381,280; in 1869, it advanced to 5,445,757 tons, of the value of £13,614,397 at the place of production. The number of iron works active in Great Britain was 174 in 1868, and 199 in 1869; and the furnaces in blast increased from 560 in 1868, to 600 in 1869. In this last year, Yorkshire made 872,175 tons of pig-iron; Staffordshire, 801,475 tons; Durham, 658,506 tons; Lancashire, 436,662 tons; Monmouthshire, 392,387 tons; Glamorganshire, 348,475 tons; Shropshire, 197,443 tons; Derbyshire, 188,353 tons; Cumberland, 129,107 tons. There were 3,456,255 tons made in England, 839,502 tons in Wales, 1,500,000 tons in Scotland. Of the other metals obtained in 1869, lead amounted to 73,259 tons, of the value of £1,397,415; tin, 9,760 tons, of the value of £1,201,456, an advance of only 460 tons over 1868, but of £300,000 in value; copper, 8,291 tons, of the value of £644,065, a decrease compared with 1868; zinc, 4,500 tons, of the value of £92,000, showing an increased quantity; silver, 831,891 ounces, of the value of £207,972; and gold, 18 ounces, of the value of £62. Other metals are estimated at £5,000. Gold and silver both show diminished quantities. The gold was from Sutherland. Of the silver, 315,714 ounces were obtained from Cornwall; 83,398 ounces from Durham and Northumberland; 66,145 ounces from Cardiganshire; 172,839 ounces from the Isle of Man. All these are lead-mining districts. Mr. Robert Hunt, from whose annual volume these statements are obtained, puts the total value of the metals and coal, with other minerals (excepting building stones, lime, slates, and common clays), produced in the United Kingdom in 1869, as follows:—Metals, £17,162,767; coal, £26,856,882; other minerals, not smelted, £1,935,042—total, £45,954,691.

Cotton Growing in the Fiji Islands.—Fiji is especially adapted for the growth of cotton, and the country is gradually becoming the property of British subjects. The export of cotton, during the last five years, has been as follows:—1865, £9,300; 1866, £19,800; 1867, £34,004; 1868, £30,975; 1869, £45,000. It is supposed that the value for this year will be upwards of £100,000. The extent of land planted with cotton is estimated at 5,000 acres. Previous to 1868, the crop consisted chiefly of Egyptian seed; this has been abandoned by the natives, and at present about ninety-five per cent. of the whole produce is Sea Island cotton. The plantations under cultivation vary in size from 80 to 200 acres. On some of these considerable ravages have been made by the grub, against which no remedy appears to have been discovered.

The Overland Route to India via Brindisi.—When the war between France and Germany rendered it impossible, says the *Pall Mall Gazette*, to continue sending the Indian mail *viâ* Marseilles, a convention was effected between England and Belgium, Germany and Italy, to send the overland mail by Brussels, Cologne, Munich, the Brenner Pass, Verona, and Brindisi. In the beginning of last October the first journey by the new route was attempted, and found to answer tolerably well. Since then some improvements have been made, and it is now beyond doubt that the Brenner line can be made the quickest and safest of any. To give an idea of the speed with which the journey can, with even the present arrangements, be performed, we have only to state that, at four o'clock p.m., last Saturday, Captain O'Brien arrived in London with the Indian mail which had left Brindisi at four o'clock p.m. on the preceding Wednesday, having thus performed a journey of 1,800 miles in seventy-two hours. This was the second time that Captain O'Brien had succeeded in getting over the new route with the same remarkable rapidity. To the public the new route to India offers many attractions. Besides being cheap, it passes through some of the most beautiful scenery in Europe. After leaving Cologne, the railway runs for miles along the bank of the Rhine, and three hours after quitting Munich you enter the wild Alpine scenery of the Tyrol. After passing Innspruck the scenery is in places sublime. The change from the savage beauty of high towering rocks, black ravines, and madly rushing mountain floods to the rich, sunny plains of Italy, with vines and orange trees, soft pasture lands, and broad majestic rivers, is startling. The route from Verona is through Padua and Bologna. At Rimini you come upon the shore of the Adriatic, and from thence for nearly the whole way to Brindisi the railway passes over the sands. The South Italian Railway Company have built a commodious hotel at Brindisi, close to the quay where the steamers for Alexandria are moored. On the 20th of this month, the first of the Peninsular and Oriental Company's steamers will leave Brindisi for Alexandria with the Indian mail, and this service will be for the future performed weekly between these two ports. On the first change of route, the postage between England and India was raised, but from the 16th inst. the postage of letters to India and Ceylon will be reduced to 1s. per half-ounce. To China, Japan, and the Straits Settlements the rate will be 1s. 3d., and to Australia 9d. The tickets to Brindisi and Alexandria are available for a month.

MEETINGS FOR THE ENSUING WEEK.

Tues. ...Royal Institution, 3. Prof. Odling, "Burning and Unburning" (Juvenile Lectures).
Thurs...Royal Institution, 3. Prof. Odling, "Burning and Unburning" (Juvenile Lectures).
Fri.......Architectural Assoc., 7½. Mr. G. R. Redgrave, "Architectural Treatment of Rubbish."
Sat.......Royal Institution, 3. Prof. Odling, "Burning and Unburning" (Juvenile Lectures).

Journal of the Society of Arts.

No. 945. Vol. XIX.

FRIDAY, DECEMBER 30, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

DEPUTATIONS.

The Right Hon. W. G. Forster, Vice-President of the Committee of Council on Education, has appointed Friday, the 13th of January, at one o'clock, to receive a deputation from the Society's Committee on Drill; and at the request of the Right Hon. Sir John Pakington, Mr. Forster has appointed Thursday, the 19th of January, at one o'clock, to receive a deputation from the Society's Committee on Musical Education.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

EXAMINATIONS, 1871.

Special Prizes for Writing and Manuscript Printing.

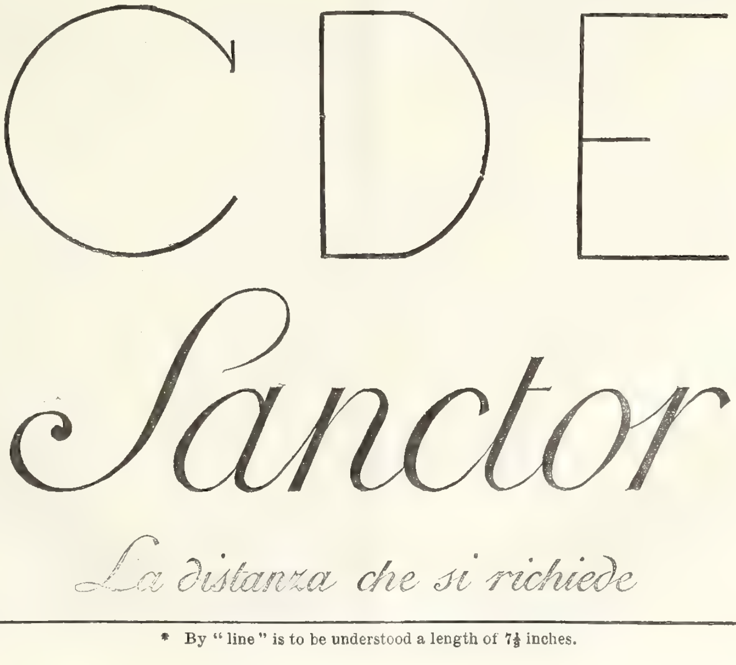
Mr. Henry Cole, C.B., a Vice-President of the Society, offers three Prizes of £3, £2, and £1 respectively, for the best writing and manuscript-printing (done entirely by the hand, and without the use of rulers or other instruments) on a foolscap page, as follows :—

One line* of Italic writing, of $\frac{3}{4}$-inch letters.
One line of Roman capitals, of $\frac{3}{4}$-inch letters.
One line of Italic writing, of half-inch letters.
One line of Roman capitals, of half-inch letters.
One line of Italic writing, of quarter inch letters.
One line of Roman capitals, of quarter-inch letters.
One line of Italic writing, of one-eighth inch letters.
One line of Roman capitals, of one-eighth inch letters.

The Roman capitals are to be formed of single (not double or thickened) lines. For the guidance of candidates, a lithographed specimen page has been prepared, which may be had on application to the Secretary of the Society of Arts, price 1d. This is merely intended to show the style and amount of writing required, and no *copy* of it will be admitted into the competition.

The writing is to be done in the presence of some members of the Local Board, on a day in April, to be fixed by them, and only those specimens that are of sufficient merit to have a chance of obtaining a prize should be sent to the Secretary of the Society of Arts. These are to be forwarded by the 22nd April. No certificates will be given.

The following are some specimens of the kind of writing and printing required:—


CDE
Sanctor
La distanza che si richiede

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* By "line" is to be understood a length of $7\frac{1}{2}$ inches.

PROCEEDINGS OF THE SOCIETY.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The following report from the Musical Committee has been laid before the Council and adopted:—

1. In order to carry on the work already begun by the Society of Arts, with the view of establishing a National Training School for Music, the Committee recommend the Council to make music—as one of the Fine Arts—an object of the Society's attention.

2. For promoting this purpose, the Committee recommend that a musical section of the Society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall.

3. These concerts to consist of performances of vocal and instrumental music of the highest character.

4. After paying the expenses of the concerts, the profits to be applied to the establishment of a National Training School for Music.

5. Members of the Society, for every subscription of one guinea paid to the musical fund, to have the privilege of obtaining a transferable ticket for six evening concerts in the arena and balcony (see woodcut on next page) without further payment, provided that no member as such shall have the privilege of receiving more than five tickets on these terms. Each seat will be numbered and reserved.

6. Persons not members of the Society shall have the liberty to purchase tickets on such terms as the Council may from time to time determine.

7. That the Musical Committee of this Society, consisting of:—

The Lord Henry G. Lennox, M.P., Chairman of the Council, or the Chairman of Council for the time being, and
S. Redgrave, Esq.,* and Seymour Teulon, Esq., Vice-Chairmen of the Council, or Vice-Chairmen of Council for the time being
Lord Gerald FitzGerald *
The Right Hon. Sir J. Pakington, Bart., M.P.*
Sir John E. Harington, Bart.*
Sir. Francis Sandford *
E. A. Bowring, Esq., C.B., M.P.*
Henry Cole, C.B.*
A. S. Cole, Esq.
Capt. Donnelly, R.E.*
The Honourable Seymour Egerton
W. Hawes, Esq.*
C. Wren Hoskyns, Esq.
Frank Morrison, Esq.
J. Puttick, Esq.*
Lieutenant-Colonel Scott, R.E.*
E. C. Tufnell, Esq.

be authorised to carry out the arrangements for the six concerts, as soon as a guarantee fund for not less than two thousand pounds has been obtained, and one thousand subscriptions of one guinea.

That Sir Michael Costa be asked to meet the Committee, to discuss the necessary details.

A guarantee fund for assuring the Society against loss has been commenced, and the following gentlemen have guaranteed the amount set opposite their names respectively:—

	£	s.
F. A. Abel, F.R.S.	10	0
G. C. T. Bartley	20	0
William Beamish	10	0
L. Birnstingl	10	0
Sir W. H. Bodkin	10	0
William Botly	10	0
E. A. Bowring, M.P.	10	0
J. G. Breach	10	0
George Brough	10	0
Henry Butter	10	0
C. M. Campbell	100	0
Andrew Cassels	10	0
E. Chadwick, C.B.	10	0
W. D. Child	10	0
Hyde Clarke	10	0
John Clutton	10	0
Alan S. Cole	10	0
Henry Cole, C.B.	50	0
Henry Creed	10	0
Earl de Grey and Ripon, K.G.	50	0
Sir C. W. Dilke, Bart., M.P.	20	0
Samuel Dean	10	0
Captain Donnelly, R.E.	20	0
Christopher Dresser	25	0
Major-General F. Eardley-Wilmot, R.A.	10	0
Hon. S. Egerton	10	0
John H. Evans	10	0
Berkeley W. Fase	10	0
Captain Festing, R.E.	20	0
Freeland Filliter	10	0
Lord Gerald Fitzgerald	10	0
G. E. Forrest	25	0
John Fowler	20	0
John Francis	10	0
Jacob A. Franklin	10	0
C. J. Freake	100	0
Captain D. Galton, C.B., F.R.S.	20	0
I. Gerstenberg	10	0
George Godwin, F.R.S.	10	10
Frederick Gordon	10	0
Lieut. Grover, R.E.	10	0
C. L. Gruneisen	10	10
Sir John E. Harrington, Bart.	10	0
James Heywood, F.R.S.	20	0
Dr. Hogg	20	0
C. Wren Hoskyns, M.P.	10	0
Bartlett Hooper	10	0
Henry Howell	10	0
Walter Hughes	10	0
Henry Hunt	50	0
T. O. Hutton	10	0
Professor Huxley, F.R.S.	10	0
J. M. Johnson and Sons	10	0
John Kelk	100	0
Right Hon. A. H. Layard	10	0
Lord Henry Lennox, M.P.	50	0
Samuel Lovegrove	10	0
Messrs. Lucas Bros.	250	0
T. A. Masey	10	0
H. Maynard	25	0
J. Maynard	50	0
Admiral E. Ommanney, F.R.S.	10	0
Right Hon. Sir J. S. Pakington, Bart., M.P.	25	0
John Penn, F.R.S.	100	0
J. Pollen	10	0
J. F. Puttick	10	0
H. Ravenscroft	21	0
Samuel Redgrave	10	0
W. S. Rumsey	20	0
Sir Francis Sandford	10	0
Edwin Saunders	20	0
Lieut.-Col. Scott, R.E.	50	0
George Smith & Co.	150	0
G. A. Spottiswoode	10	0
Seymour Teulon	10	0
Henry Thring	20	0
E. C. Tufnell	10	0
Henry Vaughan	10	0

Total amount guaranteed .... £1,942.

List of Subscribers for Tickets.

A. W. Arnold	2
T. W. Baggallay	3
R. W. Bartram	2
W. Beamish	2
L. Birnstingl	2
Sir W. H. Bodkin	2
William Botly	2
J. G. Breach	2
George Brough	2
Henry Butter	2
Andrew Cassels	4
W. D. Child	2
John Clutton	3
Henry Cole, C.B.	5
Henry Creed	2
Maj.-Gen. Daubeney, C.B.	2
S. T. Davenport	3
Samuel Dean	2
P. F. Debary	1
Christopher Dresser	2
Charles Downes	2
John H. Evans	2
Berkeley W. Fase	2
Freeland Filliter	1
P. Le Neve Foster	2
John Francis	2
I. Gerstenberg	1
Frederick Gordon	2
Lieut. Grover, R.E.	2
Arthur Hall	2
Robt. Gardiner Hill, M.D.	2
Bartlett Hooper	2
C. Wren Hoskyns, M.P.	2
Henry Howell	3
Walter Hugher	2
F. W. Hulme	3
T. O. Hutton	5
J. M. Johnson and Sons	2
Samuel Lahee	4
W. G. Larkins	2
Edward Lloyd	4
Samuel Lovegrove	5
Messrs. Lucas Bros. (two members)	10
George Macnair	3
T. A. Masey	1
H. Maynard	2
J. C. Nickisson	2
James Noble	2
O. A. Pegram	2
M. E. Rodocanachi	2
H. Ravenscroft	2
James Revell	2
W. S. Rumsey	2
Edwin Saunders	3
W. F. Simpson	2
Capt. Arthur Styan	5
Thomas Taplin	2
Seymour Teulon	2
W. H. Thomas	2
Henry Thring	2
R. L. Trollope	2
E. C. Tufnell	2
Zachariah Watkins	3

These signed the Report on Musical Education, 1866.

The Council earnestly hope that the members of the Society will support, and co-operate with them in, this important public undertaking, and by joining in the proposed guarantee, and by availing themselves of the privilege of subscribing for tickets at the reduced rate, aid in securing the establishment of a National Training School for Music.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

CANTOR LECTURES.

ON ARTISTS' COLOURS AND PIGMENTS.

By Frederick S. Barff, Esq., M.A., F.C.S.,
Assistant Professor of Chemistry, University College, London.

Lecture I.—Delivered Monday, November 21, 1870.

The Nature of Colour.

It is not necessary to dwell on the importance of the applications of science to the fine arts. It is admitted on all hands. One can hardly look at the beautiful pictures of the old masters without wishing that we could view them in all the freshness with which they left their gifted hands; nor is it possible to see without regret the ravages which time has made on many of their most famous works. Nor is this decay confined to old pictures. The works of some modern artists—those who have lived in our times, or but a little while before them—are losing much of their beauty, and fail to convey to the full the impressions which they were designed to give.

The causes which have produced these calamitous effects will be treated of in these lectures, and, as far as may be, remedies for them will be pointed out. But it is impossible in so brief a space as is allotted to me to do more than give advice, and show ways and means by which greater permanency can be obtained. The adoption of the means rests with artists themselves, and to employ them with effect will require, on their part, study, and a practical acquaintance with those branches of science which bear upon their art. The changes which have taken place in our views respecting education generally have been of rapid growth, and they all point in a direction which causes us to require that science should hold a recognised and important place in our modern systems of education—science, pure and simple at first, science used as a means of training the mind to observe, reflect, and apply knowledge. The object of our school life is not to teach us to apply our powers, as we are called upon to use them when we enter on the course which circumstances mark out for us in our future line of life, but to train, exercise, and develop them, so that they may be applied with good effect in that direction which we desire. Boys learn to draw at school, not that all are to follow art as a profession, but that the eye may be trained to judge distances, and accurately to appreciate forms, that their hands may be firm, steady, and true in performing the behests of their wills; that, from seeing correct forms, and being taught by competent masters to distinguish between what is true and false in art, they may learn to appreciate what is beautiful, and so add greatly to their sources of enjoyment. Boys now learn science, not that they are necessarily to follow chemistry, physics, or zoology as their pursuit in after-life, but that they may know how to observe, how to analyse, not any complex substances but ideas, that they may know how to seek for the causes which produce the effects they see about them, and that they may add to their enjoyment by being able to question nature and understand her answers. And this change in education—this introduction of science-teaching—will bear marvellous fruits, not only in preparing the young mind for the struggles and enjoyments of life, by rendering it more capable of conceiving, and more capacious for receiving ideas, but it will arm it with the power of applying knowledge in particular cases—will prepare it for those applications of science to various branches of art and industry which have received the name "technical," a word which should have but one signification, viz., the application on the part of particular individuals, in a more definite and precise manner, of that knowledge the elements of which have been acquired previously by all alike. From this early scientific training our artists will gain incalculable advantage, for they will learn the principles of science, which will tell them of the composition of the colours they employ, and of the destructive influences to which their works will be submitted, and which can be controlled or modified by this knowledge.

As in times past, we have received benefit from the little art-training which was given to us, though that benefit might have been greater had our teaching been conducted on better principles, so in time to come will those who make the fine arts the pursuit of their lives derive benefit from the science-training through which it is to be hoped they may pass. But the work which I have now in hand is not to insist on the advantages to be derived from early scientific training, but to point out to those who are already following out the profession of art the way in which they may remedy what we must all consider as a defect, namely, the want of a knowledge of scientific principles and methods. The artist's profession is one which requires high development of the imagination and of poetical feelings, whereas it is thought that scientific pursuits rather deaden them, if they do not destroy them altogether. This is a great mistake, for what can more elevate man's soul than the inquiring into those secrets of nature which tell of the various forms which matter assumes, whether organic or inorganic. You have but to read the beautiful lecture which Professor Tyndall delivered before the British Association this year, to perceive that a man of science may be a man of cultivated imagination. The great Sir Humphrey Davy wandered with his fishing-rod on the banks of beautiful rivers, and sought his relaxation in admiring those effects in nature which it was the business of his life to investigate in his laboratory. The anatomist in the dissecting-room patiently and carefully traces out those nervous filaments which convey from the brain, more rapidly than the most perfect telegraphic apparatus, impressions which influence the movements of the muscles of the body; is he, therefore, less alive to the beauty of expression and to the depth of feeling which they are instrumental in imparting to the human countenance? The chemist, in his researches into the nature of hidden substances, often meets with, accidentally, colours as brilliant as those with which nature adorns our fields, and with forms as graceful as any which can delight the eye of the artist, and he, too, sees all these under circumstances most favourable for studying the laws which govern them; and, if hitherto many chemists have failed to appreciate their beauty, it is not that science has deadened their capacity, but because their early education has not properly developed its powers. Depend upon it that scientific pursuits will repay artists, not only in the power and control which they will give them over the materials they employ, but they will open out a new field of beauties in which their imaginations will delight to revel, and from which they may gather ideas for the enrichment of their works.

But not only are artists interested in the permanency of their works, we who feel pleasure and derive benefit from studying them alike feel a keen interest in their durability. Many of us can well remember the delight with which, year by year, we hailed the appearance of the pictures of Turner, perhaps second to none of the landscape painters who ever lived. These marvellous representations of Nature's brightest effects, whose merits consist, not in their being accurate copies of the objects which compose them, but in their giving us as it were the very soul of nature, are now, it is to be feared, losing that brilliancy and contrast of colour upon which those effects mainly depended. The paintings of Sir Joshua Reynolds are becoming in truth the ghosts of what they were, for the delicate tints which gave transparency to the painting and life to the image are fast fleeting away. Amongst the old masters, although many of their paintings in oil are standing well the test of time, yet their larger mural works are undergoing a process of disintegration, which, ere long, threatens to obliterate them altogether. Have we not cause, then, to urge upon our instructors in art the importance of their turning their attention to the study of science, which will greatly help them in selecting their colours, painting vehicles, and painting grounds, so that their pictures may escape the fate of those of their predecessors. The true artist paints not for his own time alone, but for posterity. He desires that his conceptions, which have been the result of much thought and labour, and his methods of imparting those conceptions, which have involved hard work and excellence in mechanical skill, should live long after him, and awaken in the breasts of others sentiments akin to those which inspired them in his. The artist's works, unlike those of the writer's, cannot be reprinted, and with their death dies all knowledge of the author except that which is handed down by tradition. Longfellow in his beautiful lines on the artist of Nuremberg has truthfully represented what doubtless are the aspirations of all true artists—

> Here, when art was still religion, with a simple reverent heart,
> Lived and laboured Albrecht Durer, the evangelist of art;
> Hence in silence and in sorrow, toiling still with busy hand,
> Like an emigrant he wandered, seeking for the better land.
> "Emigravit" is the inscription on the tombstone where he lies;
> Dead he is not—but departed—for the artist never dies.

It is, ladies and gentlemen, to assist the artists of our days in obtaining this immortality for their works that I am here before you this evening, to plead the cause of science as the handmaid of art.

What is colour? Is it a property inherent in matter? Have all substances which are of similar composition colours peculiar to them? Here is some vermillion; it is red. Chemically, this substance is mercuric sulphide; from it, on decomposition, can be obtained mercury and sulphur, in the proportion of 200 parts by weight of the former, to 32 parts by weight of the latter. Now, does this red colour belong to all bodies having this composition? No, for here is some mercuric sulphide, which is black. We will submit this black powder to a high temperature for a short time. The black powder leaves the part of the tube in which I placed it, and appears again higher up in the cool part of the tube. It has been volatilised—converted into gas—and as such has passed as a transparent substance to the place where it has become solid, but it is still black. Higher up the tube is a reddish yellow sublimate, but it is the black powder with which we have to do. We will take some of it out, and rub it in a mortar. You perceive it becomes red, but not so brilliant as the prepared specimen before us. Throughout all these operations this mercuric sulphide has retained the same chemical composition, but it has undergone changes which are termed physical. If I rub some of the original black powder it remains black; it is unchanged in appearance. Heat did not alter the colour of the sulphide, but it was necessary to put the substance into such a condition that friction could do so, and the finer this powder is made the brighter and purer will be its colour. It is, from this experiment, evident that the red colour of vermillion does not depend upon the composition of the sulphide, and it is plain, also, that black mercuric sulphide is not changed in colour by heat, although it undergoes a change in the arrangement of its particles. One change, however, heat does effect, and it is this—the black sulphide, before sublimation, is in the form of an amorphous dull powder, but, after sublimation, it is crystalline, and has a metallic lustre. It is friction which has altered the colour of the substance, whether as such or by causing its division into small particles, it is not easy to say, but from the fact that its redness is greater when it is more finely divided, perhaps the latter is the case. Another good illustration of the effect of friction in altering colours, is afforded by the red iodide of mercury (mercuric iodide), a substance which yields, on decomposition, 200 parts by weight of mercury, and 2 (127) or 254 of iodine. This piece of paper is coated with mercuric iodide. If it be warmed its colour is permanently changed to yellow. Now this change is not owing to decomposition, for it can be melted without decomposition, and volatilised. If I now rub this yellow surface it becomes red where rubbed, and the colour is persistent. This change of colour has been attributed to a change in the crystalline form of the sublimate. This may or may not be the case. In our first experiment on mercuric sulphide, heat did not produce a change in the colour of the whole mass, but in this last, the colour was permanently affected by heat. This sheet of paper is coated with another compound containing mercury. It was discovered by the Rev. S. Williams, in the laboratory at University College. Its definite composition is not at present shown; whether it is a double iodide, or only a mixture of two iodides—that is, whether all the substances composing it are in chemical combination, or whether they are mechanically mixed. It contains mercury combined with iodine, and copper combined with iodine. When this substance is heated, its colour changes from bright red to a dull grey. Now this change is not permanent, for on cooling, the red returns again. The yellow powder with which this paper is covered was discovered at University College about the same time. It contains mercury combined with iodine, and silver combined with iodine. When heated, it becomes red, but on cooling, it returns to its original yellow. In this bottle there is a solution, chloride of cobalt. Its colour is pink, and the crystals from which it is made are pink; but if they be dried, so as to expel their water of crystallisation, they become blue. If I add to this pink solution some strong mineral acid, it will become blue; when I dilute it again with water the blue changes to pink. I will write with this solution well diluted with water, and you now perceive the writing is invisible; on warming it, the letters appear of a blue colour. In all these cases, the presence of water has rendered the cobalt salt pink, but its absence caused it to be blue. I need not suggest to you a very useful practical application of this property of cobalt salts in these days of postal cards. The reason why the writing on the paper was not seen before warming was because pink is not a showy colour, and the solution was very dilute; it was really pink, but so faint that it could not be discerned. I will show one more experiment, illustrating the effect produced by water in change of colour in bodies of similar chemical composition. Here are some crystals of blue vitriol (cupric sulphate); they contain water of crystallisation. When this is driven off by heat they become white. We will now put some of this white powder, obtained by drying the blue crystals, into water, and the water in which it is dissolved becomes blue; in fact, if it be exposed to moist air for a short time it will absorb moisture from the air, and will become blue. I have here a very beautiful substance called magnesic platinic cyanide; when dissolved in water the solution is colourless, but from its solution these red and green crystals will again appear on evaporation.

From these experiments, can we arrive at any conclusion on what the colour of bodies depends? Certainly not on chemical composition alone, for we have seen that black mercuric sulphide and vermillion are chemically the same. We have also seen that without chemically changing the substances, heat has turned red mercuric iodide yellow, and friction has made it red again; it has made this other mercury compound red, but, on its departure, the substance has assumed its original colour. A red crystal of chloride of cobalt has been rendered blue by loss of its water of crystallisation; and a blue crystal of cupric sulphate has been made white by the same process, but the original colours of both have been restored by the addition of water, and the solutions are of the same colours as the crystals. Colour, therefore, does not depend on crystalline forms alone. I will place some magnesic platino cyanide in this white dish. You will perceive that on heating it becomes yellow, and now, on cooling, beautiful red tints appear on the surface of the porcelain. We have seen that colour is not a property inherent in matter; on what, then, does it depend? To answer this question, we must consider briefly the structure of that organ which is the instrument for conveying to us the impressions of colour and form. The eye-ball, which is somewhat globular in form, has a transparent, horny covering in front, almost immediately within which is a lens, by which the rays of light are concentrated and focused on a nervous substance which lines the inner part of the back of the ball, and is therefore directly opposite to the lens. This nervous substance is called the retina, and is formed by an expansion of the optic nerve, which, a short distance from the eye, arises from the base or under part of the brain. The retina is a very complicated structure, largely supplied with blood-vessels, and highly sensitive to a peculiar class of impressions. Any further description of this organ would lead us too far, as it is mainly with the effect of light on the retina which we have to do. But inasmuch as, for the better understanding of our subject, we should compare the sense of sight with other impressions, it will be well to notice in the same brief manner the structure of some other sentient organs. The ear consists of two parts, a soft external part, and a hard, bony, internal part, which is placed within the cavity of the skull; between this external and internal part there is stretched a tight membrane which separates the one from the other; this is called the tympanum or drum, and is connected by means of a series of small bones, so articulated together as to be moveable, with an arrangement inside the bony cavity, by which movements received from without, can be imparted to delicate sacs filled with fluid, over which are distributed innumerable and delicate filaments connected with the nerve of hearing. At the back of the tongue may be easily seen numbers of small prominences, called papillæ; to these and to other parts about the posterior of the mouth are distributed branches to the nerve of taste. In the upper part of the cavity of the nose is lodged the apparatus by means of which we enjoy the sense of smell; it consists of an intricate net-work of nervous matter derived from the olfactory nerve. At the extremity of our fingers the nerves of the special sense of touch ramify in intricate branches. All over the surface of our bodies nerves are distributed which are capable of conveying to us the feeling of pain or that of a certain kind of pleasure. You will perceive, then, that some nerves convey the impressions of special sense, while others convey impressions of what one may term ordinary sensation; all are excited in a similar way, that is, by motion; the pinch which gives pain, communicates motion to the nerve which is transmitted to the brain. The gentle friction which gives pleasure acts in the same way, but, from the different degree of motion communicated. the effect produced is different. The warmth which we experience is produced by motion communicated to the the nerves; we know this when we rub our hands together, the heat in this case is the same in kind as that which we receive from a fire or any other sort of heat. We smell an object when minute particles from its substance strike upon and communicate motion to the olfactory nerve. We hear a sound when the air, set in motion by some object moving sufficiently rapidly, strikes upon the drum of our ear, and communicates motion to the chain of bones already mentioned, which, in their turn, agitate the fluids in the sacs and set in motion the nerves distributed upon them. We see, when the vibrations of an elastic, and imponderable substance, which philosophers term ether, and which fills space, are sufficiently rapid to produce by their impact on the retina the impression of light.

Pure white light is produced by a number of these vibrations, some more rapid than others, which take place at right angles to the direction in which the ray is travelling. When a ray of light is passed through a transparent substance like glass, it is refracted, its course is changed, but if the two surfaces of the glass be parallel, it emerges on the opposite side of the glass in a direction parallel to that at which it entered it, but the light is unchanged. If, however, it be passed through a triangular prism then the ray is twice refracted thus; and, in addition, it is decomposed, or split up into the various colours which compose it.

Mr. Ladd, who has kindly undertaken to illustrate this part of our subject, will throw on this white screen a spectrum, obtained by passing light from this electric lamp through a prism. You perceive how beautiful its colours are; the white light has been broken up into the constituent colours which compose it; below you see red, then orange, then yellow, then green, then blue, and it ends with violet. The red rays are the least refrangible, they make the largest angle, and are produced by waves of greater length and less rapidity than the other colours. The waves which form violet are the most rapid in their motion, and between these extremes we have rays of varying rapidity. Now the moving particles of the ether which produce the sensation of light strike upon the sensitive retina, and by their motion affect it with the impression of light. The slower movement of the red ray produces the sensation of red. We all know that a slow, monotonous motion or sound is more difficult to bear for a long time than a more rapid one. The slow dropping of water on the head is said to cause madness if long continued. I have tried the experiment, but have not carried it to this extent. If after bearing the slow motion of dropping water for some time the rapidity of its fall be increased, immediately a sensation of pleasure supervenes on one of pain. Red is a colour which we cannot endure to look at for long together. When looking at red, if we turn our gaze on green, then a sense of relief is immediately felt. Again, when we gaze on the green fields and the beautiful clear blue sky our sense is satisfied, but the enjoyment is calm, it is one of rest. If a soldier in red and another in blue together appear on the landscape, the scene is enlivened, and the colours which have a discord enter into the general harmony, and, like a discord in music, resolve themselves in the surrounding tints to our complete satisfaction. We listen to a piece of music, all the parts of which are in perfect harmony; for a while it pleases, but at last it produces a sense of fatigue. How is it that we can listen to the magic strains of Beethoven's sonatas without fatigue? How is it that they are ever fresh, ever new, and always awake in us a thrill of delight? It is because the harmony is broken by discords, so introduced that they, having done their work, resolve themselves again into the beautiful harmony which they for a moment interrupted. And so with the sense of sight, the motion which through the the retina affects us with impressions of harmony, like all other motions which affect other senses, becomes monotonous, and to be pleasing must be interrupted by other movements more or less different. When white light passes through coloured mediums, only those rays pass through which are of the colour of the medium. Mr. Ladd will kindly pass the refracted ray through a piece of glass coloured red or ruby by the suboxide of copper. Now, you perceive that half the spectrum contains all its colours perfect, whereas the lower half shows only red, the other colours being almost entirely destroyed. Again, the same experiment is made with blue glass, but you perceive that the blue colour of the spectrum is most intense, though other coloured rays pass through the blue glass. This is owing to the imperfection of the colour of the glass. It is not a blue as pure as that of the spectrum, but the experiment serves to illustrate our point. These glasses have the power of arresting the motion of certain rays down to a certain point, and allow only those to pass through which are of the colour with which the glass is stained. Beyond the rays at each end of the spectrum, which make themselves known to us by producing the sensation of colour, are others which are invisible, some below the red, and therefore of lower refrangibility, only produce the sense of heat. But beyond the violet and the other end of the spectrum are rays whose wave motion is so rapid that they cannot affect the retina with the sense of light. These are termed the ultra-violet rays; they are also called the chemical or actinic rays. It is these which affect the sensitive plate in photography, and by their chemical action on the silver salt used cause the image to be formed. They extend some way into the violet, so that if a negative, with its properly prepared paper, be held in this part of the spectrum, a photographic picture will be produced, whereas if held in the lower part the sensitive paper will not be affected. Now, these ultra-violet rays may be caused to become light rays. There are certain substances which have the power of moderating the rapidity of their motion. Of these, sulphate of quinine is the most convenient for us to use. In this bottle is a solution of that substance. You will notice that it has a peculiar tint, of a bluish colour. The light has been turned down—we are in darkness, and now cannot see it or the bottle containing it, which I hold in my hand. Mr. Ladd has now arranged our experiment; he has passed the ray from the lamp through a solution which is able to absorb the light rays, and on the screen you perceive all is darkness, except a small spot, where a slight violet tint may be seen. I will now hold this bottle near this violet spot; it becomes beautifully luminous, and can be seen by all in this room. I have here a block of glass, coloured by oxide of uranium. You cannot see it, but I will hold it in the same place in which I put the sulphate of quinine. You can see it now, it is very beautiful. Other substances have this property besides those which we have employed. A decoction of horse-chestnuts, and several other bodies, will produce the same effect. It is called fluorescence.

Ladies and gentlemen, I perceive that the hand of the clock has passed the appointed hour, and I ought not to detain you longer. Your kindness, however, encourages me to go on, though I must leave this part of my subject to be completed in my next lecture. Before concluding, let me mention to you that Mr. Benson, a gentleman who has given much time to the consideration of the theory of colour, has been kind enough to explain to me his views, and I must say that he has given such evidence in support of them, that I find it difficult to resist his conclusions. We have always been taught that there are three primitive colours, and that they are red, yellow, and blue. Mr. Benson says this is an error, that red, green, and blue are the primitive colours, and that their complements are sea-green and pink. He has lent me some illustrations in proof of these opinions, and I shall be very happy to show them to any lady or gentleman after the lecture. He has also discovered a very simple method of telling whether a pigment is of a colour as pure as that with which it is supposed to correspond in the spectrum. He takes a narrow strip of card, about 2½ inches long by one-eighth of an inch wide, and in the centre of it he paints with the pigment, for the space of little less than half-an-inch. He then places this strip in a black ground and looks at it through a prism, holding one side of the prism parallel to the ground, and looking straight forward at the image; two spectra are seen on either side of the part painted with the pigment, and only the colour which the pigment represents is seen in the centre if its colour be pure. Not long ago, Mr. Benson read a paper before the Society of British Architects on "Colour," and he has published a work "On the Science of Colour," which I strongly recommend to all who feel interested in the subject.

POSTAL REFORM.

The Committee met on Friday, the 23rd December.

Read resolutions of the Council as follows:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

"That the Postage Committee be requested to appoint an Executive Committee, who are to meet when convenient to them, and collect facts illustrative of the present system."

The Secretary reported that a large and influential deputation from this Committee, including many members of Parliament, had, by appointment, waited upon the Marquis of Hartington, the Postmaster-General, on the 12th day of March last, and had brought before his Lordship the views laid down at the previous meeting of the Committee, more especially with reference to a reduction of the rates on newspapers and printed matter.

The Committee then took into consideration the late reductions and rules made by the Postmaster-General, and the resolutions of the Council given above; and received a report from Mr. Davenport, showing the steps he had taken to bring this matter before the public in the Society's *Journal*, and the amount of subscriptions he had received from mercantile houses in aid of this movement.

A specimen of an envelope was submitted to the Committee to be used as a closed letter for short communications, instead of post cards, and weighing less than such a card. There appeared no sufficient reason why this envelope should not be carried by the Post-office at the same rate as the card. It was suggested that a specimen of such an envelope, with an explanatory notice printed on it, showing its nature and object, should be circulated with the Society's *Journal* and elsewhere.

It was thereupon resolved:—"That the foregoing suggestion be adopted, and that the Secretary take steps for carrying it into effect."

It was further resolved:—"That the Secretary procure actual specimens of the parcel post of Switzerland and North Germany."

It was also resolved:—"That representatives of the seed and other trades interested in a small parcels post be added to this Committee, and that the Secretary write to such persons to that effect, and also to the Royal Horticultural Society and the Botanical Society, asking them to co-operate with the Society of Arts, and each of them to name two members to join this Committee."

Sample Post.—The *Gardeners' Chronicle* says:—"We are very glad to see that the seed trade is bestirring itself in the matter of the sample post. Few, if any, of our great industries are more concerned in obtaining the repeal of the present obnoxious regulations than are the dealers in seeds, and large indeed must be the numbers of gardeners and amateurs to whom the old regulations were a boon, and to whom the present ones are a source of vexation, or even a positive impediment. We do not profess to know the precise grounds on which the Post-office authorities base their operations, but we can imagine that they have been induced to withdraw the convenient privileges afforded by the sample post for several reasons. They may have considered that, by the introduction of the halfpenny postage card (for which, in a great degree, we believe we have to thank a well-known seed firm), they have conferred on us a boon greater than the one they have taken away, and they may have feared that the loss to the revenue would be too great to allow of the simultaneous existence of post-cards and of cheap rates for sample postage. Again, we have heard it said that so many things that were not *boná-fide* samples were sent by this convenient means, that, in their care for the morality of the people, the Post-office authorities have instituted more stringent rules than heretofore, to prevent the violation of their rules, and to preserve the moral feeling of the public. Lastly, the authorities may have feared that the resources of their staff would be unduly taxed by the great increase of work thrown on them by the introduction of post-cards, the extension of telegraph and money-order offices, and other matters, of which the Post-office now takes control. As regards the loss to the revenue, time will, of course, show, but our own idea is that, by the abolition of the sample rate, except for *boná-fide* samples, the Post-office will be the loser in all ways. A lady in the country, for instance, would write for her packet of seed, and she would get it by return of post, but under present arrangements the amount of postage would, in many cases, exceed the value of the seed; in consequence, the seedsman does not get the order, nor the Post-office authorities the postage of letter or packet. Our own experience will illustrate this point. Like most of our contemporaries, we were in the habit of receiving packets by sample post, containing articles so multiform in their nature, that no one but those in like position to ourselves could form an idea of their variety —botanical specimens, plants to name, samples of seeds, fruits, manures, adulterations, black-beetles, wasps, bugs, flies, fungi, in fact, anything and everything relating to gardening, farming, or natural history, of sufficiently small size and weight to be transmitted by post. Now, the influx has by no means wholly ceased, but it has materially diminished since the enactment of the new regulations. Many of these things doubtless could not be considered by any casuistry as trade samples, they had little or no commercial value, they were not articles of commerce, though some of them were trade articles. Seeing that the Post-office exists for the people, and not the people for the Post-office, we submit that the promotion of the public convenience by all means consistent with effective administration is the first consideration. Any dictation as to the nature of the contents of packets transmitted through the post, with certain obvious exceptions, seems to us an absurdity. The proper course for the officials to follow would be to transmit packets of a certain weight or size, without reference to the nature of their contents. The conveyance of such small and light parcels as we are contemplating, would in no way interfere with the business of other carriers, while it would, both directly and indirectly, prove a very fertile source of revenue. Even with the halfpenny card rate, we believe the packet-post would be so remunerative as to afford funds sufficient to defray the expenses of any additions to the staff which increased business might necessitate."

Parcels Post and Letter Rate.

Sir,—The cost of conducting the operations of the Post-office, in the days of double-letter charges, must have been both complex, tedious, and unsatisfactory, as every letter had "to be examined with a candle to see whether it is single or double," and that fact not unfrequently led to theft. Notwithstanding all its complexity, however, Sir Rowland Hill, in his pamphlet on Post-office Reform, estimated that "the average apparent cost of the primary distribution of newspapers, letters, &c., within the United Kingdom, is, for each 84 hundredths of a penny, of which the expense of transmission is one-third, or 28 hundredths of a penny; and the cost of receipt, delivery, &c., two-thirds, or 56 hundredths of a penny." But he adds, "as chargeable letters do not weigh more than about one-fourth of the whole mail, the average expense of transmission for a letter, chargeable with postage, is probably about one-third of the amount above stated, or nine-hundredths of a penny." In another estimate, he stated the cost of conveying a letter from London to Edinburgh, a distance of 400 miles, as one-thirty-sixth part of a penny. The cost of conveyance of the mail bags was estimated at 16s. 8d. per cwt. for letters and newspapers. Again, "the expenses of receipt and delivery are not much affected by the weight of each letter within moderate limits. . . . The charge ought to be precisely the same for every packet of moderate weight, without reference to the number of its enclosures."

Bearing in mind the above facts, Sir Rowland Hill proposed that all letters and other papers, whether single or multiple, forming one packet, and not weighing more than one ounce, should be charged one penny, "and heavier packets, to any convenient limit (say one pound) being charged an additional halfpenny for each additional half ounce. . . . And it is, perhaps, not desirable that the Post-office should be encumbered with heavy parcels." If such was the actual cost of primary distribution and carriage of letters previous to the introduction of railways and steam-boats, it ought to be much reduced at the present time; but, notwithstanding all that has been said and written since 1840, little advance has been made over the improvement then first introduced, by charging a uniform rate for inland letters, and enforcing prepayment of all. It is true that printed matter is now allowed to pass through the Post-office at a postal charge of one halfpenny for two ounces, and *boná-fide* trade patterns and samples, or samples of merchandise, pass at a similar rate, up to 12 oz. in weight; all other like packets can only be sent through the Post-office at letter rate. What, then, does letter-rate mean, and what is the value per ton according to the various letter rates charged by the Post-office authorities? The following statement of comparative cost of conveying letters per ounce, per pound, and per ton, prepared for the Huddersfield Chamber of Commerce, answers that question:—

"1d. the half-ounce is 2s. 8d. per pound, and £298 per ton, being the present inland rate.

"3d. the half-ounce is 8s. per pound, and £894 per ton, being the private ship rate to the West Indies.

"4d. the half-ounce is 10s. 8d. per pound, and £1,192 per ton, being the rate to France; but as the single letter must be under a quarter of an ounce, it is the same rate as if charged 8d. per half-ounce.

"6d. the half-ounce is 16s. per pound, and £1,792 per ton, being the rate to India and China, *viâ* Southampton.

"8d. the half-ounce is £1 1s. 4d. per pound, and £2,388 per ton, being the rate to France, French packet, and to Switzerland.

"1s. the half-ounce is £1 12s. per pound, and £3,584 per ton, being the rate to the United States of America.

"1s. 4d. the half-ounce is £2 2s. 8d. per pound, and £4,776 per ton, being the rate to Hong Kong and Singapore.

"2s. the half-ounce is £3 4s. per pound, and £7,168 per ton, being the rate to Sweden, Russia, and Turkey.

"2s. 4d. the half-ounce is £3 14s. 8d. per pound, and £8,360 per ton, being the rate to California, Oregon, &c.

"Goods are conveyed by the mail steamers at the following rates:—

"To New York, £3 per ton of 40 cubic feet; to the West Indies, Brazil, and the River Plate, £7 to £10 per ton; by the Red Sea to Australia, £34: to China, £40; to Yokohama, £42 6s. 8d. per ton, all of 40 cubic feet measurement.

"A cubic ton of letters would weigh four tons avoirdupois; but taking the cubic ton at 2,240 lbs., the rate to Yokohama is less than $\frac{3}{16}$ of a penny per half-ounce."

Thus it will be seen that the inland postal rate now charged on letters in England is $\frac{13}{16}$ths of a penny in excess of the cost of sending an equal weight of merchandise from England to Yokohama, a rate which is prohibitory, notwithstanding it is highly desirable and necessary that, in some instances, commerce should be able to avail itself of Post-office facilities, the necessity for which is well illustrated by a recent writer in the *Times*, who desired to remit a small parcel of silkworms' eggs to Australia. He was prevented from so doing by the alteration in the postal arrangements, and delay resulted in consequence. This is the more to be regretted as the eggs sought to be forwarded will now probably be hatched before they can arrive at their destination, where an effort is at present being made to introduce the culture of silkworms and the production of silk into that country, with every prospect of success. Without facilities, however, for the introduction of seed, the energy and enterprise of those who are anxious to benefit both Australia and the mother-country, by the production of a supply of raw silk, may be neutralized, or the result may be delayed, if not entirely prevented, by difficulty in procuring the necessary supplies on which their proposed future industry is based.

The Post-office maintains communication with every part of the world for government purposes, and the people are taxed for the payment of subsidies for the packet service. It is highly desirable that what the people are taxed for the maintenance of, both at home and abroad, should be rendered available to the fullest possible extent by the country in general, by the government permitting small packets to be passed through the Post-office, whether such packets be *bonâ-fide* samples of manufactured goods or merchandise, a gift from a friend, or some specimens of a product which may be rendered more largely available in the advancement of the social commerce and industrial condition of the community, by its production in some remote clime to which it is at present unknown.

It is not sufficient to say that commerce can avail itself of railways and steamboats for the performance of the work required of the Post-office; that is not possible, inasmuch as the arrangements made by the varions railway companies for the carriage of parcels by passenger trains are complex, and such as the public cannot avail itself of under other than exceptional circumstances. as each company has carrying powers over its own line only. It is quite true, that, since the establishment of the railway clearing-house, facilities for the interchange and carriage of parcels by one company for another has been considerably simplified; but the public does not know, nor can it ascertain from the published railway guides, what is the total cost of transmitting a parcel from one place to another, say from Exeter to Inverness, or *vice-versa.* Neither can it ascertain how long a parcel will be in course of arrival and delivery, nor what company would be ultimately liable for its safe custody. Some companies charge for weight in proportion to distance, others for weight only, without reference to distance. Then every company publishes that it will not be responsible for delay in delivery if the parcel is sent to it through any other than its own special agents. There are limitations as to time of delivery, and nature, and value of goods forwarded, booking fees, cost of transmission and cost of delivery if more than one mile from the local station at which it is left; instructions as to the mode of address necessary to be observed; Acts of Parliament for the protection of common carriers and others to be known, as shifting all liability from the railway companies on to the shoulders of the senders. There are also insurance rates to be paid, if the parcel is of value or requires ordinary care in handling and a thousand and one "if's" and "buts," prohibitions, exceptions and conditions to be observed which vary with every change of circumstances, and the difficulty after all, if all were capable of being mastered, remains that their agency does not provide a box or an officer in every remote district, even of this country, for the reception of small parcels, to say nothing of the ignorance and inability of many of the railway *employés* at remote country stations to assist or instruct the public as to the means by which parcels can be forwarded with certainty, economy, dispatch, and freedom from all further charges to foreign countries or remote British possessions.

It is true that parcels are booked through to and from many of the leading towns; but when all has been done that can be done as between railways and the public, there is great uncertainty, and in the majority of cases delay in the delivery of small parcels in remote villages and hamlets, as compared with the regularity of delivery through the Post-office.

Is then the maintenance of a letter-rate for the carriage of small parcels consistent with the duties of a national post-office, and the interests of the commerce of the country generally? Are similar rates enforced by the authorities exercising similar exclusive rights in foreign states? It has already been shown by the comparative statement of the postal systems in several European Kingdoms that such is not the case, and it is sincerely to be hoped that they will not long continue in force in our own. No civilised or industrial community can now exist without a post-office. In England, the Government has long since claimed to exercise the exclusive right of performing for the public the duties involved in a national post-office, It has its agencies established throughout the length and breadth of the of the land. Every village and hamlet has its post-office official. The result is, that in this country it has in its hands an organisation available for the delivery of such small parcels as Sir Rowland Hill was desirous should be allowed to pass through the hands of its servants; while its relations with the postal organisation of foreign countries affords opportunities for aiding the extension of commerce into every portion of the civilised world.—
I am, &c., H. G. H.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel. Scott, R.E., secretary.

Racing Cups and Testimonial Plate.—This branch of fine art will be very fully represented. A very large and beautiful collection of plate of all kinds is being gathered together for exhibition, including many works of the celebrated chaser, Antoine Vechti.

Stained Glass.—The windows in the vestibules and corridors of the exhibition buildings are appropriated for the display of large specimens of stained glass, such as windows. A space is, however, reserved for the exhibition of smaller and more finished specimens. This affords an opportunity for the display of works of the highest artistic excellence.

Warming.—The public should know that all parts of the buildings are being fitted up with warming apparatus by Messrs. Weekes and Co., including, of course, the galleries. In previous exhibitions this has not been the case.

The Bradford Chamber of Commerce.—At the monthly meeting of the Bradford Chamber of Commerce, held on Tuesday, Mr. Jacob Behrens in the chair, the minutes of the committee for the Exhibition for 1871 were read. Mr. Ripley reported that three meetings had been held. The committee had come to the resolution that it would be more conducive to the trade of Bradford that there should be a collective display of the textile products of the district. Practically, the space allotted to Bradford would afford room for 1,200 or 1,500 patterns, and the convenient lengths of each description of cloth would be about three yards. It was proposed to open the Exhibition on the 1st of May. The chairman said that the only expense would be the carriage of the goods up to London. He moved that the proceedings of the committee be approved, and that the committee be requested to continue their labours. Mr. C. Semon seconded the resolution, which was carried. It was also ordered that the resolutions of the committee should be printed in a circular, and sent to all the manufacturers in the district, in order to solicit their co-operation in the effort to effect a collective display of goods.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

Protection to Inventors at Exhibitions.

Sir,—As it is to me a matter of great interest that new inventions and designs, when first introduced to the world at public exhibitions, should obtain efficient protection against piracy, and as I was led to take a principal part in the movement to obtain a legislative enactment for this purpose, perhaps you will permit me to explain, for the benefit of inventors and designers, who desire to exhibit at the forthcoming Exhibition of 1871, the exact position they are now placed in by the Protection of Inventions Act, 1870, which was the final result of the movement, and also to make a suggestion in regard thereto.

By this Act (see section 2) any exhibitor, being the true and first inventor, is relieved from any disability as to securing letters patent, which, according to the ordinary law, would attend a public exhibition of his invention previous to obtaining such letters patent, provided the patent be applied for within six months from the day of opening such exhibition; and, be it noted, this relief from disability as to prior publication by exhibition of the invention is restricted to such an exhibitor only, and hence, if he does not so apply for a patent no other person can afterwards legally do so, although other persons were permitted to do so by the Acts 25 and 26 Vict., cap. 12 (Exhibition, 1862); 28 Vict., cap. 6 (Dublin Exhibition Act); and 28 Vict., cap 3 (Industrial Exhibitions Act), from the fact that those Acts made such exhibitions no bar to any person whatever obtaining a patent.

So far, then, the Act of 1870 is a great advance upon the former acts, but it is very defective in regard that it does not provide, as I endeavoured to do in a bill drafted by me, which was submitted to the Board of Trade last year, that there should be a provisional registration effected (which I arranged should provisionally protect either a patentable invention or a design for a whole year). Consequently, the evidence for identifying an exhibited invention is in no way provided for.

Now, as the Act referred to specially applies to the forthcoming International Exhibition, 1871, I would suggest that a registry be kept at that Exhibition, in which explicit descriptions, supplied by the exhibitors, should be preserved, which could hereafter be produced for evidence if needed.

With regard to new designs, the new Act does not prevent any person other than the exhibitor from registering the design, but as provisionally registering under the Designs Act is very cheap, the remedy there is for the exhibitor to provisionally register at once. Moreover, a fraudulent registration can, under the Designs Act, be transferred to the party who has the just right thereto.

I would, in conclusion, observe that the Act 28 Vict., cap. 3, is not repealed, but that Act requires a certificate from the Board of Trade to make it available; and I would recommend no exhibitor to take such a certificate, as otherwise the effect of the Act of 1870 may be rendered nugatory.—I am, &c., F. W. Campin.

Temple, 26th December, 1870.

HOUSE ACCOMMODATION FOR THE LEARNED SOCIETIES.

A series of drawings, designed by Mr. E. W. C. F. Schmidt, architect, together with a report showing the utilisation of the centre block, No. 4, Westminster-chambers, with the vacant ground in the rear, situated nearly opposite the Westminster Palace Hotel, have been submitted to the delegates of the various societies that are seeking accommodation. The general arrangement of these plans can be easily adapted to any other site.

In block plan No. 1 there is shown a frontage of 58 feet 8 inches in Victoria-street, and a total area of 17,920 feet.

Plan No. 2 shows, in the basement, office space for two separate societies. The rest of space is devoted to refreshment rooms, kitchen, office, workshop, grand and back staircases, heating apparatus, porters' rooms, lavatories, water-closets, &c., and a space proposed to be let for storeage, wine vaults, &c.; a lift also rises to each floor for the conveyance of passengers, goods, &c.

Plan No. 3, ground floor, shows the arrangements for a large lecture theatre, capable of seating 1,200 persons, approached by a spacious entrance from Victoria-street, through a handsome corridor 11 feet in width, with recesses on either side, which admits of the display of statuary and groups of armour, or for any other objects of interest. The floor of the theatre can be arranged, when needful, for conversaziones or other large assemblies. In this plan there is also space for two separate societies, museums, ladies' and gentlemen's dressing-rooms, hat and cloak-room, inquiry office, water-closets, lavatories, lift, grand staircase on either side of corridor, staircase to theatre. There are also four other entrances and exits from theatre, a corridor entering from Dean-street, at right angles to the principal corridor, and an entrance to lecture-room.

Plan No. 4, first floor, shows two grand staircases on either side of corridor; provides 4,485 feet for three societies; the rest of space is devoted to a gallery in theatre, with a staircase and corridor. The latter has wall space of about 1,962 feet, which is available for museum and library purposes; entrance to principal library is from this corridor. This library has wall space for 50,000 volumes. A general meeting room, to hold 250 persons, with lavatories, &c., on same floor.

Plan No. 5, second floor, is similar in arrangement to plan No. 4 with regard to office space and general meeting rooms, &c.

Plan No. 6, third floor, has its space mostly devoted to museums, with a spacious corridor suitable for pictures, photographs, &c., well lighted from the top.

Plan No. 7, fourth floor, has space for three societies.

In plan No. 8, top floor, provision is made for eight bedrooms for gentlemen curators, housekeeper, bathrooms, &c.

The cost of carrying out the scheme is estimated as follows:—Cost of purchase of vacant land and existing buildings, £55,000; cost of proposed alterations, with additional buildings, £50,000; total, £105,000.

EDUCATIONAL NOTES.

School Boards and the Education Department.—The concluding paragraph of the circular issued by the Department to the boards already elected, quoted in last week's *Journal* (p. 102), has called forth severe comments from a portion of the press:—"In the circular issued," says the *Daily News*, "to the chairmen of the boards, it is distinctly laid down that they are not to supply any deficiency in the means of education till the Education Department have declared and defined what the deficiency is. So that the first step the boards have to take is to make a complete inquiry into the local provisions for education, to report the results of that inquiry to the Department, and then to wait the order of the Department before they take any steps to supply the deficiency. In fact, the School Board is to wait upon the Department, and to have no initiative whatever. . . . . . This autocratic assumption of supreme power by the Department will take many of the boards by surprise. Parliament did not know what kind of bodies they would be, and therefore put them in leading strings till it saw they could be trusted to run alone. We have no hope that the system of local elective bodies under central irresponsible rule will permanently work. The School Boards will, we hope, achieve their own independence by showing that they are worthy of it." The *Examiner*, in an article headed "Servants out of livery wanted," uses much stronger language. It holds that "it would have been much more honest and much more constitutional that the government department should have been entrusted with the whole responsibility, pecuniary as well as administrative, of the expanded education scheme. But Parliament would have no right to pass an Act enabling the Committee of Council—that is the two Cabinet Ministers who compose it—to put on local gloves in order to grasp the power of taking the money of particular localities, for such purposes as they might from time to time think fit, without their consent, and without giving them, through their local representatives, even a veto. Had Parliament done this it would have done, on plausible pretences, a most flagrant wrong. But we differ from the *Daily News* in thinking that the Elementary Schools Act was ever passed with such an intention, or that, fairly construed, it warrants any such enormity; and we are fully convinced that, if the School Boards have only the self-respect and firmness to take issue on the threshold against this usurpation of authority, it will either be renounced as a blunder or baffled by a legislative declaration that this was not the intent and is not the meaning of the statute."

The London School Board.—In accordance with the resolutions passed at its last meeting, the Board invites applications from candidates for the following posts:—1. The clerk of the Board, at a salary of £800 a-year, who shall discharge the duties of secretary; 2. A clerk at a salary of £350 a-year, who has the qualifications of an experienced statistical officer; 3. A clerk at a salary of £250 a-year, who must be a competent bookkeeper and accountant; 4. A clerk at a salary of £200 a-year, able to take minutes and a good shorthand writer; 5. A junior clerk at a salary of £100 a-year, not under 21 years of age. Applications are to be made according to certain specified regulations, on or before the 5th of January.—Mr. George Potter has forwarded to Mr. Forster a protest against the decision of the Department not to inquire into the alleged irregularities of the Westminster elections to the School Board. Mr. Potter reminds the government of the interest which the working classes took in placing them in power, of the lack of support accorded to working men's candidates by the Treasury, and points out the difficulties which he must surmount before he can appeal to a court of law in respect to the contested seat.

School Boards in Country Parishes.—The Education Department has issued general regulations for the first election of School Boards "in parishes not situate within municipal boroughs or within the metropolis." The number of members of the Board is to be from five to fifteen, as may be determined in each case by the Department, and the returning officer is to be the clerk of the union of which the parish forms part. The first election is to be held on some day to be fixed by the returning officer, and within 28 days after the date of the requisition to elect a Board. The poll is to commence not earlier than 8 a.m., and close not later than 8 p.m., but not to be open for more than seven hours. Voting papers are to be used, but the ballot is not to be adopted; each paper is to be signed with the name of the voter. Regulations as to passing resolutions "for application for School Boards" in such parishes have also been issued. Upon requisition in writing, signed by fifty ratepayers, or by one-third of the ratepayers of any parish, the summoning officer is to convene a meeting of the ratepayers, for the purpose of considering a resolution "that it is expedient that a School Board should be formed for the said parish." If the resolution, duly proposed and seconded, is carried, and no demand for a poll is made, the chairman is to declare the resolution passed; but any ten ratepayers may demand a poll in writing, and the poll is to be taken by signed voting papers. The Department has further resolved that "no requisition for the formation of a School Board under the above regulations will be issued without taking into consideration the population and area of the parish, and the expediency of forming a school district larger than such parish."

The Education Act in the Provinces.—The Town Council of Carlisle has resolved, by 23 votes against 7, to apply to the Department for a school board. An order has been issued for the election of 13 members to form a board for Leicester. School boards have been adopted at Helston, Launceston, Liskeard, and East and West Love. Devonport has also applied, through the town council, for a board; at a public meeting it was stated that there were 90 schools in the borough, and 40 of them were rooms in which people lived, and in many cases slept. Four teachers had been found who could not write, and who, instead of writing their names, had simply put marks. The voluntary principle has been adopted at Dawlish, Ilsington, Wendron, Sithney, Marazion, Pelynt, and Lifton.

The Education Question in Scotland.—At a recent meeting of the Town Council of Edinburgh, a motion, of which the following is the substance, was carried by a majority of 18 to 7:—To memorialise the government to introduce in the ensuing session of Parliament a Bill to regulate national education in Scotland, by providing a popular, unsectarian, and undenominational system, embracing, among others, the following provisions:—1. The formation of a general Board of Education, to be elected by public bodies elected by popular representation, or by local committees grouped for that purpose, and whose meetings should be held in public. 2. That all the existing parochial schools and other schools receiving government aid should be converted into national schools, and that all national schools should be supported by grants from government and local rates. 3. Wherever a parochial school is converted into a national school, the funds hitherto payable by the heritors for the support of the school should be applied towards the reduction of the school rate. 4. In every parish there should be a local school committee, who should fix the branches of education to be taught, and, subject to an appeal to the general board, regulate the management of the schools. 5. That the school committee in burghs be elected by the town councils, and in all burghs numbering 50,000 inhabitants or upwards the committee should not be under 13 in number. 6. That no sum be paid, either from public funds or local rates, to any school not conducted as a national school. 7. That while the Bible shall be retained in the schools of Scotland, its reading shall be left to be regulated by the local school committees, it being understood that a conscience clause be embodied in the Bill. 8. That compulsory education be provided for in the proposed Bill for Scotland.

NOTICES OF PUBLICATIONS.

The Milk Journal.—The first number of this new journal has appeared. It addresses itself to all consumers of milk, but it will also and especially supply information needed by all dealers in milk, dairy farmers, cattle breeders, butter and cheese makers and factors; to those who are concerned in the preservation of milk, and the preparation of its products and substitutes; to all who preside over the commissariat of large bodies of individuals and of public and private establishments. It will deal with those aspects of milk which concern the mother, the physician, and the sanitarian. From all it will collect and supply the latest information. It will favour and furnish original investigations.

The Transformations of Insects, by P. Martin Duncan. F.R.S., Professor of Geology in King's College, London, *(Cassell, Petter, and Galpin.)* This volume is an adaptation of M. Emile Blanchard's popular work on the "Metamorphosis of Insects, for English Readers," with the addition of much matter from the writings of Newport, Dugès, Darwin, Heroldt, Schiödte, Müller, Packard, Lubbock, and others. It deals exclusively with the metamorphosis of insects, under which term are included insecta, myriapoda, arachnida, and crustacea, so that much of the original work of M. Blanchard has been omitted. The author, in his preface, says he has endeavoured to suppress all doubtful facts, and has introduced here and there some opinions upon the nature of the metamorphosis, and its relation to the evolution of the creatures subjected or not to it. The work is most profusely illustrated with over 40 full-page, and more than 200 textual, illustrations. The total number of pages is 480. The book seems admirably adapted to afford a knowledge of the subject it treats upon, and to be full of interesting matter pleasantly put together.

OBITUARY.

Patrick McDowell, R.A., sculptor, has just died, aged 71. He was elected Royal Academician in 1846, and had just resigned his fellowship when he died. He was a native of Belfast, where he was born on August 12th, 1799. His father having met with some reverses of fortune, he, at the age of eight, was sent to a small school in Belfast, where the first tokens of genius displayed themselves in the direction of art by the copying of such models as chance threw in his way. At twelve, he came to England with his mother, who apprenticed him to a coachbuilder in Hampshire; but the bankruptcy of his master set him free, and fortune having made him acquainted with a French sculptor, he found an opportunity of improving his talent. He could hardly have been of age when he engaged a studio near Euston-square, and set up as a sculptor on his own account. After some previous attempts, which were only partially successful, he made his first essay on an ideal subject, which he took from Moore's "Loves of the Angels." The first commission with which he was entrusted for a group in marble was from Mr. E. S. Cooper, formerly M.P. for Sligo. The subject was "Cephalus and Procris," and the conception and style of execution were such as to fix at once Mr. M'Dowell's position in the world of art. The work which fully established his fame, however, was his charming figure of "A Girl Reading," which was afterwards repeated for the late Lord Ellesmere. He had scarcely completed his first large group for Mr. Beaumont, when that gentleman, desirous that the sculptor should visit Italy, supplied him with the necessary funds. After an absence of eight months, he returned to England, and completed his "Love Triumphant." To this succeeded "A Girl at Prayer," "Cupid," "Early Sorrow," "Psyche," "The Death of Virginia," and "Eva," all of which formed leading attractions in the International Exhibition of 1851. In 1846, Mr. M'Dowell was entrusted by the late late Sir Robert Peel with the execution of one of the national statues of British Admirals (Lord Exmouth) for the decoration of Greenwich Hospital. He also executed those of Pitt and Chatham for the House of Lords. His latest work was the group representing Europe on one of the angles of the Albert Memorial.

GENERAL NOTES.

Richard Cort.—An appeal is being made on behalf of Elizabeth Cort, widow of the late Richard Cort, son of Henry Cort whose inventions were the foundation of the British iron manufacture. She is, in her declining years, absolutely destitute; she suffers from chronic bronchitis, rendering her residence in a purer atmosphere than that of the metropolis indispensable. Donations or annual subscriptions are to be made payable to Mr. Charles Manby, 24, Great George-street, Westminster.

Indian Tobacco.—The *Pall Mall Gazette* states that we owe our supplies of Indian cotton to the American war, and we may have to refer the cultivation of tobacco in our colonies to the present campaign. A good deal of the leaf employed in the manufacture of cut tobacco comes to us from the Continent, and of course that source is now closed; but the smoker may be consoled by hearing that India, Jamaica, and Natal are all engaged in cultivating the plant. Latakia from the West Indies has been received in London and reported upon favourably, and the samples of tobacco from Natal are said to be remarkably good. What the Indian government has already done for the cultivation of tea, cinchona, and ipecacuanha, it is now doing for the tobacco plant. Seeds of the best varieties have been distributed in suitable districts, and the time may speedily come when the Bengal cheroot may be a production of the presidency.

An Indian Tea Association for London has been recently proposed, with the avowed object of improving the quality and increasing the consumption of Indian tea.

Coal in Norway.—In the Island of Andöe, on the coast of Norway, by means of boring, seven beds of coal have been found, which have the following thicknesses:—twelve, eight, four, two, fourteen, three, and twenty inches.

Wool.—Mr. Archibald Hamilton read lately before the Statistical Society a paper "On the Wool Supply," in which he pointed out that flax has increased in thirty years 25 per cent.; silk, 59; cotton, 110; and wool, 349. Our home-grown wool was estimated thus:—From sheep shorn, 124,017,421 lbs.; lambs, 2,470,158 lbs.; skin wool, 33,481,629 lbs.; total, 159,969,208 lbs. The amount of wool retained for home consumption in the year 1869 was shown as follows:—Domestic wool, as estimated, 159,969,000 lbs.; foreign and colonial imports, 255,161,000 lbs.; skin wool from sheep imported, 2,381,000 lbs.; total, 417,511,000 lbs. Exports:—Domestic, 12,410,000 lbs.; foreign and colonial, 116,589,000 lbs.; leaving for home consumption, 288,512,000 lbs.

Beet-root Sugar.—The *Chamber of Agriculture Journal*, on this subject, says:—"A favourable season has proved what might have been known before and long ago from experience, that both the climate and a great portion of the soil of England are quite as well adapted to the cultivation of the sugar or Silesian beet, as well as all other kinds of roots, as any part of the European continent; and that, with careful cultivation, the per-centage of sugar will be quite as great as in either France or Belgium. Professor Church, of the Royal Agricultural College at Cirencester, has taken up the subject in a spirited manner, and is throwing light upon it in a course of lectures delivered before the Cirencester Chamber of Agriculture. His lecture at the October meeting of the Chamber bore upon the feeding properties of the pulp of beet-root rather than on the cultivation of the plant; and he showed by the results of analysis that one ton of the pulp is equal in feeding power to a ton and a half of the gross roots and to two tons of the common mangold wurzel. This is on account of the large proportion of albumenoids contained in the sugar beet, as well as other nutritive substances. This statement corresponds with the experiments of Dr. Voelcker, as recorded in the *Journal of the Royal Agricultural Society of England.* Professor Church also ascertained by analysis that the beet-root grown upon the College Farm contained from 12 per cent. to 13·5 per cent. of sugar, which is quite equal to what is produced in any part of the Continent, and superior to most, where, however, the manufacture is carried on successfully." Another authority, speaking of the effect of the war upon the supplies of this class of sugar, remarks:—"The war will affect our supplies in one particular, and perhaps be the means of introducing into our country another branch of industry. The import of beet-root sugar into England from the Continent is far more considerable than is generally supposed, and has averaged during the last three years something like 50,000 tons—an amount equal to that which we draw from Mauritius. The war and the drought will combine to check the supply, and the working man's breakfast table will perhaps slightly suffer. But there seems to be no reason why beet-root should not be profitably cultivated in the United Kingdom, and the soil and climate of Ireland are said to be especially favourable to its growth. From 16 to 40 tons of roots per acre have already been produced there, and it is calculated that eight per cent. of sugar can be obtained by a simple process of extraction. Nothing need be wasted on a beet-root farm. The pulp is admirable for fattening cattle, spirit may be manufactured from the juice, and out of the residues potash salts may be derived in sufficient quantities to prove remunerative."

Waterproof Composition.—Dr. Scherzer, says the *Eastern Budget*, an Austrian official at Pekin, has just sent to his government some specimens of a Chinese composition called "Schioicao," which has the property of making wood and other substances perfectly water-tight. He says that he has seen in Pekin wooden chests which had been to St. Petersburgh, and had come back uninjured, and that the Chinese use the composition also for covering straw baskets, which are afterwards employed in carrying oil for long distances. Cardboard, when covered with the composition, becomes as hard as wood; and most wooden buildings in Pekin have a coating of it. It consists of three parts of blood deprived of its fibrine, four of lime, and a little alum.

Plaster Casts of Natural Objects.—At the Manchester Literary and Philosophical Society, Mr. Boyd Dawkins exhibited a number of casts in plaster of Paris of various objects of natural history, and explained the process, by which anyone can make them for himself. The material of the mould is artists' modelling wax, which is a composition akin to that used by dentists; and, as it becomes soft and plastic by the application of heat, though in a cold state it is perfectly rigid, it may be applied to the most delicate object without injury. As it takes the most minute markings and striations of the original to which it is applied, the microscopic structure of the surface of the original is faithfully reproduced in the cast. This method is briefly this:—1. Cover the object to be cast with a thin powder of steatite or French chalk, which prevents the adhesion of the wax. 2. After the wax has become soft, either from immersion in warm water, or from exposure to the direct heat of the fire, apply it to the original, being careful to press it into the little cavities. Then carefully cut off the edges of the wax all round, if the undercutting of the object necessitates the mould being in two or more pieces, and let the wax cool with the object in it, until it is sufficiently hard to bear the repetition of the operation on the uncovered portion of the object. The steatite prevents the one piece of the mould sticking to the other. The original ought to be taken out of the mould before the latter becomes perfectly cold and rigid, as in that case it is very difficult to extract. 3. Then pour in plaster of Paris, after having wetted the moulds to prevent bubbles of air lurking in the small interstices; and if the mould be in two pieces, it is generally convenient to fill them with plaster separately before putting them together. 4. Then dry the plaster casts either wholly or partially. 5. Paint the casts in water colours, which must be fainter than those of the original, because the next process adds to their intensity. The delicate shades of colour in the original will be marked in the cast by the different quantity of the same colour, which is taken up by the different textures of the cast. 6. After drying the cast, steep it in hard paraffin. The ordinary paraffin candles, which can be obtained from any grocer, will serve the purpose. 7. Cool, and polish the cast by hand with steatite. The result of this process is said to be far better than that obtained by any other.

MEETINGS FOR THE ENSUING WEEK.

Mon. .. Entomological, 7.
Medical, 8.
Asiatic, 3.

Tues. ...Royal Institution, 3. Prof. Odling, "Burning and Unburning" (Juvenile Lectures).
Pathological, 8. Annual Meeting.
Anthropological, 8.

Wed. ...Royal Society of Literature, 4¼.
Obstetrical, 8.

Thurs...Royal Institution, 3. Prof. Odling, "Burning and Unburning" (Juvenile Lectures).

Fri.......Geologists Association, 8.

Sat.......Royal Institution, 3. Prof. Odling, "Burning and Unburning" (Juvenile Lectures).

Journal of the Society of Arts.

No. 946. Vol. XIX.

FRIDAY, JANUARY 6, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

January 18.—On "How Meat is Preserved." By Richard Jones, Esq. On this evening Professor Huxley, F.R.S., will preside.

January 25.—On "New Paper-making Materials, and the Progress of the Paper Manufacture." By P. L. Simmonds, Esq.

February 1.—On "The Preservation of Vegetables." By Geo. Buchanan, Esq.

February 8.—On "Ornamentation considered as a 'High Art.'" By Dr. Christopher Dresser, F.L.S.

February 15.—On "The Commerce of India." By Dadabhai Naoroji, Esq.

February 22.—On "Water Meters." By Frederick C. Bodkin, Esq.

INDIA COMMITTEE.

A conference on the "Utilisation of Peat in Indian Locomotives" will be held on Friday, January 25th, at 8 o'clock. The opening paper will be read by Lieut.-Colonel Wragge.

THE LIBRARY.

The following works have been presented to the Library :—

Report of the Registrar-General of Victoria on Patents and Patentees, vol. iii. And also on Abstracts of Specications of Patents. Presented by the Registrar-General of Victoria.

Specifications as bases of Patents. By W. Spence, Assoc. Inst. C.E. Presented by the Author.

Khana, a Hand-book on the Resources of India. By Col. G. T. Haly. Part i.

Reports of Conferences of the Friendly Society Association.

Music in Speech and Speech in Music. Two Lectures. By the Euing Lecturer on Music.

Memoir of the late David Boswell Reid, M.D. By Hugo Reid. Presented by the Author.

Euclid as a School Book, and on Teaching Elementary Mathematics. By Hugo Reid. Presented by the Author.

The Insidious Red Tape System of Government in England. By T. Baker.

Jahresverichte der Handels und Gewerbetammern in Württemberg jür das Jahr, 1869.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The following report from the Musical Committee has been laid before the Council and adopted :—

1. In order to carry on the work already begun by the Society of Arts, with the view of establishing a National Training School for Music, the Committee recommend the Council to make music—as one of the Fine Arts—an object of the Society's attention.

2. For promoting this purpose, the Committee recommend that a musical section of the Society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall.

3. These concerts to consist of performances of vocal and instrumental music of the highest character.

4. After paying the expenses of the concerts, the profits to be applied to the establishment of a National Training School for Music.

5. Members of the Society, for every subscription of one guinea paid to the musical fund, to have the privilege of obtaining a transferable ticket for six evening concerts in the arena and balcony without further payment, provided that no member as such shall have the privilege of receiving more than five tickets on these terms. Each seat will be numbered and reserved.

6. Persons not members of the Society shall have the liberty to purchase tickets on such terms as the Council may from time to time determine.

7. That the Musical Committee of this Society, consisting of :—

The Lord Henry G. Lennox, M.P., Chairman of the Council, or the Chairman of Council for the time being, and
S. Redgrave, Esq.,* and Seymour Teulon, Esq., Vice-Chairmen of the Council, or Vice-Chairmen of Council for the time being
Lord Gerald FitzGerald *
The Right Hon. Sir J. Pakington, Bart., M.P.*
Sir John E. Harington, Bart.*
Sir. Francis Sandford *
E. A. Bowring, Esq., C.B., M.P.*
Henry Cole, C.B.*
A. S. Cole, Esq.
Capt. Donnelly, R.E.*
The Honourable Seymour Egerton
W. Hawes, Esq.*
C. Wren Hoskyns, Esq.
Frank Morrison, Esq.
J. Puttick, Esq.*
Lieutenant-Colonel Scott, R.E.*
E. C. Tufnell, Esq.

be authorised to carry out the arrangements for the six concerts, as soon as a guarantee fund for not less than two thousand pounds has been obtained, and one thousand subscriptions of one guinea.

That Sir Michael Costa be asked to meet the Committee, to discuss the necessary details.

A guarantee fund for assuring the Society against loss has been commenced, and the following gentlemen have guaranteed the amount set opposite their names respectively :—

	£	s.		£	s.
F. A. Abel, F.R.S.	10	0	J. G. Breach......	10	0
Wm. Atkinson....	10	0	George Brough ..	10	0
G. C. T. Bartley ..	20	0	Henry Butter	10	0
William Beamish..	10	0	C. M. Campbell ..	100	0
P. H. Berthon....	10	0	Andrew Cassels ..	10	0
L. Birnstingl	10	0	E. Chadwick, C.B.	10	0
Sir W. H. Bodkin	10	0	W. D. Child......	10	0
William Botly....	10	0	Hyde Clarke......	10	0
E. A. Bowring, M.P.	10	0	John Clutton	10	0

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* These signed the Report on Musical Education, 1866.

	£	s.
Alan S. Cole......	10	0
Henry Cole, C.B...	50	0
Messrs. Coutts & Co.	200	0
Henry Creed	10	0
Earl de Grey and Ripon, K.G.	50	0
Sir C. W. Dilke, Bart., M.P.	20	0
Samuel Dean	10	0
Captain Donnelly, R.E.	20	0
Christopher Dresser	25	0
Major-General F. Eardley-Wilmot, R.A.	10	0
Hon. S. Egerton ..	10	0
John H. Evans ..	10	0
Berkeley W. Fase	10	0
Captain Festing, R.E.	20	0
Freeland Filliter ..	10	0
Lord Gerald Fitzgerald	10	0
G. E. Forrest	25	0
John Fowler	20	0
John Francis	10	0
Jacob A. Franklin	10	0
C. J. Freake......	100	0
Captain D. Galton, C.B., F.R.S.....	20	0
I. Gerstenberg	10	0
George Godwin, F.R.S.	10	10
Frederick Gordon	10	0
Lieut. Grover, R.E.	10	0
C. L. Gruneisen ..	10	10
Sir John E. Harrington, Bart. ..	10	0
James L. Hart....	10	0
James Heywood, F.R.S.	20	0
Dr. Hogg	20	0
Bartlett Hooper ..	10	0
C. Wren Hoskyns, M.P.	10	0
Henry Howell	10	0
Walter Hughes ..	10	0
Henry Hunt	50	0
T. O. Hutton	10	0
Prof. Huxley, F.R.S.	10	0
J. M. Johnson and Sons	10	0
John Kelk	100	0
John Kidd	25	0
Right Hon. A. H. Layard	10	0
Lord Henry Lennox, M.P.......	50	0
Samuel Lovegrove	10	0
Messrs. Lucas Bros.	250	0
T. A. Masey......	10	0
H. Maynard......	25	0
J. Maynard	50	0
W. Needham	10	0
J. Nettlefold......	20	0
Capt. Oldershaw ..	10	0
Admiral E. Ommanney, F.R.S.	10	0
Right Hon. Sir J. S. Pakington, Bart., M.P.	25	0
John Penn, F.R.S.	100	0
J. Pollen	10	0
J. F. Puttick	10	0
H. Ravenscroft....	21	0
Samuel Redgrave..	10	0
W. S. Rumsey....	20	0
Sir Francis Sandford	10	0
Edwin Saunders ..	20	0
Lt.-Col. Scott, R.E.	50	0
George Smith & Co.	150	0
G. A. Spottiswoode	10	0
Seymour Teulon ..	10	0
Henry Thring	20	0
E. C. Tufnell	10	0
Henry Vaughan ..	10	0

Total amount guaranteed .... £2,237.

List of Subscribers for Tickets.

J. A. Alsop	2
A. W. Arnold	2
W. Atkinson	2
T. W. Baggallay	3
R. W. Bartram	2
W. Beamish..........	2
P. H. Berthon	2
L. Birnstingl	2
Sir W. H. Bodkin	2
William Botly	2
J. G. Breach	2
George Brough	2
Wm. Brown	3
Henry Butter	2
Andrew Cassels	4
W. D. Child	2
John Clutton	3
Henry Cole, C.B.	5
Henry Creed	2
Maj.-Gen. Daubeney, C.B.	2
S. T. Davenport	3
Samuel Dean	2
P. F. Debary	1
Christopher Dresser ..	2
Charles Downes	2
John H. Evans	2
Berkeley W. Fase	2
Freeland Filliter	1
P. Le Neve Foster	2
John Francis	2
I. Gerstenberg	1
Frederick Gordon	2
C. A. Gould	3
Lieut. Grover, R.E. ..	2
Arthur Hall	2
James L. Hart........	2
Robt. Gardiner Hill, M.D.	2
Bartlett Hooper	2
C. Wren Hoskyns, M.P.	2
Henry Howell........	3
Henry Huggins	5
Walter Hugher	2
F. W. Hulme	3
T. O. Hutton	5
J. M. Johnson and Sons	2
John Kidd	3
Samuel Lahee	4
W. G. Larkins	2
Edward Lloyd........	4
Samuel Lovegrove	5
Messrs. Lucas Bros. (two members)	10
George Macnair	3
T. A. Masey	1
H. Maynard	2
J. Middleton	2
W. Needham	3
F. Nettlefold	3
J. C. Nickisson	2
James Noble	2
Capt. Oldershaw......	3
O. A. Pegram	2
M. E. Rodocanachi ..	2
H. Ravenscroft	2
James Revell	2
W. S. Rumsey........	2
Thomas G. Sambrooke	2
Edwin Saunders	3
W. F. Simpson	2
Capt. Arthur Styan....	5
Thomas Taplin	2
Seymour Teulon	5
W. H. Thomas	2
Henry Thring	2
R. L. Trollope	2
E. C. Tufnell	2
Zachariah Watkins....	3

The Council earnestly hope that the members of the Society will support, and co-operate with them in, this important public undertaking, and by joining in the proposed guarantee, and by availing themselves of the privilege of subscribing for tickets at the reduced rate, aid in securing the establishment of a National Training School for Music.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

CANTOR LECTURES.

ON ARTISTS' COLOURS AND PIGMENTS.

By Frederick S. Barff, Esq., M.A., F.C.S.,

Assistant Professor of Chemistry, University College, London.

Lecture II.—Delivered Monday, November 28, 1870.

Chemistry and Manufacture of Colours and Pigments.

On last Monday evening, I fell into an error which, I believe, is common to many who desire to do too much in illustration of their subject. I owe you my apologies for so doing, and I hope on this occasion to make the best reparation in my power, by finishing some of those experiments which were not then completed, and also by introducing to your notice a few others which were prepared, and which were of some importance in illustrating my subject; and I hope also to be able to draw conclusions from what I then said, and from what I am now about to say, in order to illustrate those views which I wish to lay before you for your especial consideration.

One of the experiments which I performed last time was, I know, visible to only a few; that was the action of heat upon chloride of cobalt. I will, therefore, now repeat that experiment in such a way that it may be visible to you all. Here is a solution in this bottle, some of which will be gradually warmed, and you will see that instead of a pink it will have a blue colour, whilst on pouring water into it, it will again become blue. Another experiment which I commenced, and was unable to finish, was this: I heated some crystals of cupric sulphate, or sulphate of copper, and when heated they became white; but I did not show the sequel of that experiment, viz., that they become blue again when water is poured upon them. Here are some dry crystals of this sulphate. I will put some of the white powder which I obtained the other evening by heating the blue crystals into a foot glass, and will then add water, and as you see the solution becomes blue again, and as the dry matter dissolves the solution will become of a deeper blue tint.

The experiment with which we concluded on Monday last was a very beautiful one, performed in a most efficient manner by Mr. Ladd. If you remember, all the rays were cut off from the electric light, except those which were in and beyond the violet; we then held in that portion of the spectrum a bottle of sulphate of quinine, and it became luminous. Some letters were also written on paper with sulphate of quinine, and they became luminous, and a piece of uranium glass assumed a beautiful luminous appearance when put in those ultra-violet rays. Now the explanation of this phenomenon is necessary to what I wish to impress upon you this evening. Beyond those rays which give light, there are others which do not give light—do not cause us to experience the sensation of light, because their vibrations are too rapid. But when certain foreign substances, such as sulphate of quinine, or a thin piece of uranium glass is placed in the path of the rays, this rapid motion is arrested and modified, and these rays, which in themselves are not luminous, are reflected back to our eyes as luminous rays. The rapidity of the undulations is moderated; and so our retinas become sensitive to them as rays of blue light.

I tried to explain to you what colour did not consist in, and I did that at some length, but I was very brief in endeavouring to explain in what colour does consist; but that arose from the fact that I had not time to do so, although I delayed you longer than I ought to have done. We saw that colour does not depend solely upon chemical composition, it does not depend upon the aggregation of the particles solely, but it depends upon these, and other things besides these—upon things which we are not able to explain. All matter is in a state of motion. When you heat a substance you communicate to the particles of which it consists an increased activity of motion. Now, when certain coloured rays of light are falling upon a substance, these coloured rays of light have a motion peculiar to themselves. It may be that the extent of motion in that substance, either communicated to it by artificial heating, or as it exists in it in its natural state without heating, is such that those rays of light are those which that substance is not capable of sending back to our eyes, and they are then absorbed or destroyed in some way —I cannot say in what way—by the particular state in which that substance is upon which they fall, and those rays which the substance is capable of reflecting back are mainly sent back to our eyes. So we find that a substance called vermillion has the power of reflecting back nearly pure red rays to our eyes. That you saw in the experiment I was able to show you individually, after the lecture last Monday evening, by means of the prism. Those colours, such as blue, yellow, and green, absorb certain rays more or less perfectly, and reflect back in the main blue, green, and yellow to our eyes. Now, it is quite certain, if that is true, and I believe there is no doubt about its truth, that it does behove those who are studying colour, and who are interested in the purity and in the permanency of colour, to understand at least the principles of that science of light which tells them of the action of light upon various bodies which they use as pigments in their paintings. If we put together two substances, one of which destroys the chemical condition or state of the other, then one of those substances at least, if not both, will lose the colour which they had before they came into contact with one another. It is, therefore, you will see, most important that artists and gentlemen engaged in the preparation of colours should make this science of light a study; and not only the science of light, but the science of heat, for we saw what heat could do in changing the conditions of a substance. The black sulphide of mercury was sublimed by heat, and then, after that sublimation, we found it bad properties imparted to it by heat which it did not possess before, viz., that it could by trituration be brought to a red colour. It was upon these points that I wished to dwell at length, and I should like to dwell more at length, if I could do so without trespassing too much on the time which should be occupied by another subject this evening. But I have said enough to show you, I think, in what direction my experiments and remarks tended the other evening, and I must with that leave it to you to consider the matter, and think upon it, and to refer to those authorities which will give you fuller information upon the subject than I can; and if by anything I have said I lead any of you who are engaged in the art to think of and study these sciences, it will help you to a considerable extent, and my end will be altogether answered.

I have here a few experiments that I think will interest you, and they will illustrate what I said. When, on Monday night last, the spectrum was shewn so beautifully by Mr. Ladd upon the screen, he held in the source of light some soda, or salt of sodium, and you may remember that almost all the coloured rays of light were cut off but one, and there was a little band in the yellow part of the spectrum. That is because the sodium flame is almost monochromatic; it cuts off all the other colours but the yellow. Then, again, where the metal thallium was held in the flame, you saw that a green band only remained in the place which the green occupied in the spectrum. I have some experiments this evening which will, I think, illustrate that more clearly than even the experiment which was shown with the spectrum. With your permission, I will now perform two or three of these experiments. Here are some strips of colour, arranged in the order of the colours in the spectrum, although not shading one into the other as they do in the true spectrum. Mr. Newton has been kind enough to prepare these for me today, and, as you see, the colours are extremely brilliant and lustrous. I will now throw upon these colours a monochromatic light, and you will perceive that when the monochromatic light from sodium is reflected upon these colours, that all of them will be obliterated except the yellow; and we will then, after that, throw the light caused by a lithium salt upon the same colours, and you will see that all will be obliterated except the red, lithium being almost entirely monochromatic. I have now got the sodium light, and you see nothing but a dark patch in the place where the red, blue, green, and violet colours were, while the yellow colour is the only one which stands out at all clearly, and that has become rather lighter; the orange band next to it has also a slight tinge of yellow. Now we will try the lithium flame. You see now that the colours are not so much obliterated, but they are very dull, with the exception of the red. I will now show you the general effect of the sodium flame upon the whole room, not concentrating it specially upon these pieces of paper. You notice the lurid and ghost-like effect which it produces upon the whole room and the faces of the audience. Now I will show you, in the same way, the effect of the strontium light. That, you see, gives us all a rosy tint, instead of the ghost-like appearance caused by the sodium light.

In one of these glass jars we have a gas called nitric oxide; with that I will shake up a little of the substance called bisulphide of carbon, and when we apply a light to it you will see that we shall have an extremely beautiful white light, almost like a sudden flash of lightning. The light which we now see is the magnesium light; it is another example of a beautiful white light. These last two lights show all colours perfectly well, and not only are they rich in those rays which produce this effect, but they are rich also in chemical rays—those rays beyond the violet, which you saw the other night by means of the solution of sulphate of quinine. By these lights you are able to photograph, just as you can by putting a sensitive plate in the rays beyond the violet in the spectrum when illuminated by the electric light. Now, to leave this part of our subject, which should have been concluded on Monday night, we will pass on to this proper subject of the lecture, the preparation and the chemistry of pigments, and also the method of detecting the impurities which frequently exist in them.

The first pigment which I have selected for our consideration is one well known, and which has been used for ages past; it is known by the name of white-lead. Here is a solution of acetate of lead, called by chemists plumbic acetate. If we put some of it into a foot glass, and then pass carbonic acid through it, you will find we shall get no precipitate. Carbonic acid is not able to precipitate lead carbonate from this solution, which is formed by the action of acetic acid or hydric acetate upon oxide of lead. That solution is a normal solution. It consists of a certain weight of lead to a certain weight of this acid, which converts it into the acetate. Carbonic acid has no power to separate out from it the lead, and form carbonate of lead. But this substance—this acetate of lead—has the power of dissolving a considerable quantity of oxide of lead in addition to that which was used in its first formation, and when this additional quantity of oxide of lead is dissolved by the acetate, a substance is formed which is termed a basic acetate, that means an acetate which contains more of the base (the lead oxide) than the normal acetate itself does. From such a solution we are able to precipitate, by means of carbonic acid, a white substance, which white substance is a carbonate of lead.

We will now pass carbonic acid gas into a solution of basic acetate of lead. If time had permitted, I should have liked to have gone through the whole of this process before you, and to have dissolved in that normal acetate some oxide of lead, and thus have shown you that the normal acetate was able to dissolve this oxide of lead, but the operation would take too much time. I therefore prepared some before the lecture, and will now show you the result of passing carbonic acid gas through it. You see already the solution is becoming milky, and in a short time, a white precipitate will be formed. Thénard, a French chemist, proposed to make white-lead in this way, but it was found that although the colour was pure and good, yet the lead had not sufficient body to satisfy the wishes of artists and painters. White-lead has been made for years past according to what is called the Dutch method. Lead is cast into plates, and these plates, in some factories, are rolled into coils. These coils then are immersed in earthen pots; the pots are placed in a row, and a small quantity of vinegar is put into each pot. On the top of one row of pots a board is placed, and then other pots above, and so a stack is made. Between the interstices of the pots is put spent tan, or some other substance which by oxidation will evolve heat, and also carbonic acid gas. Now, the heat which is evolved in oxidation of the spent tan is useful in volatilising the acid from the vinegar, and in the presence of this acetate the oxygen of the air oxidises the lead. The oxide of lead is dissolved by the acid, and the substance which I first showed you, viz., the normal acetate of lead, is formed. More oxide is produced, and this is dissolved by the normal acetate, and then you have basic acetate. When substances containing carbon are oxidised, carbonic acid is the reproduct of the oxidation when the oxygen is in excess, as in this particular case. Carbonic acid is then formed by the oxidation of the spent tan. We formed it here by acting on the carbonate by an acid which was sufficiently strong to turn the carbonic acid out. The carbonic acid then unites with the oxide of lead which was dissolved in the normal acetate, and a thin film of lead carbonate is formed. These thin films go on forming in succession, until at last nearly the whole of the lead is converted into carbonate, which retains the shape of the original lead. In some cases, gratings of lead are used; and here are some specimens that were so employed. This cast-lead has been submitted to the action I have already described to you; and here are some pieces of the white-lead carbonate formed by that process. When the lead is in this state, but much cleaner than these specimens I have here, it is ground in water and reduced to a fine powder, and is then made up into the sort of pigments required, either with water or with oil. This is, or rather was, an operation attended with considerable danger to the workmen, who were subjected to what is termed lead-poisoning, to which, unfortunately, many painters, from want of cleanly habits, are subject now. There have been introduced, however, improvements in the grinding of white-lead, which have to a considerable extent freed the workmen from the liability to this kind of poisoning.

I have now briefly described the method in which white-lead is prepared. Other pigments containing lead have been used in lieu of white-lead, but none of them are found to possess the same body. There is a process known as Patteson's process, of making oxy-chloride of lead, but it is not necessary to take up time in describing the process, because I dare say no gentleman uses any pigment made of this substance, for it has not the body which white-lead has. Probably the fact that white-lead possesses the body it has is the reason why it has been so largely used, and why so many of our paintings which have have been painted with it have come to a most untimely end. I know of no pigment so liable to change of colour as white-lead. In saying this I know that there are many gentlemen here present who will not agree with me. They know that white-lead works well and easily, and they like it because it covers down well, but when I have pointed out to you some of the great defects under which it labours, I hope I shall convert at least some of you to my opinion. If you take some oil, and if to that you add lime-water, you know that the oil will mix with the lime-water, and form a kind of emulsion. Again, if you boil oil or fat with soda, you know that a kind of soap is formed, and the process of manufacturing soap is termed the process of saponification. Now if, instead of boiling fat with soda or alkali, we boil it with plumbic oxide or oxide of lead, we shall form a soap, and that soap goes by the name, amongst medical men, of *emplastium plumbi*, or lead plaster. Here is a roll of it. This is a substance made by the saponification of oil with the oxide of lead. Because this oxide and carbonate of lead have the power of saponifying oils, you get in white-lead that peculiarly smooth easy working which you do not get with any other white pigment; and it is on this account, for one reason, that it is liked by artists and painters. Here I have a piece of paper, coated with some of this lead plaster, and if we throw a light upon it, you will see that the substance is semi-transparent. Mr. Newton was kind enough to give me a few valuable hints for my lecture this evening; and amongst other things, he spoke to me of this peculiarity of lead, that it will saponify and form this sort of transparent substance. He told me an anecdote of the famous landscape painter, Mr. Wilson, who made an addition to a room in his house. The old part of the room had been painted a dark colour; the new part, of course, when it left the workmen's hands, was perfectly white, and therefore the painters painted down the dark colour with white lead, until the whole room displayed one uniform tint. After a while, however, it was found that the part which was originally painted dark became dark again; the dark paint, in fact, showed through the white-lead. Sometimes, possibly, when an artist wishes to put in figures upon a dark background that he has painted, he uses white-lead, and the figures will stand out well and brilliantly at first, but after a time the dark colour upon which they are painted strikes through the lead, and the figures of course recede. Now, this striking through is owing to a slight process of saponification, no doubt owing to an interchange between the carbonic acid of the lead-carbonate and the stearic and oleic acids of the oil with which the lead is mixed; so that, in time, the white-lead, which has a body which makes it so great a favourite with artists, loses that body, and becomes a transparent or semi-transparent substance, something like this lead plaster. Here is a reason why white-lead should not be used unless the ground has previously been brought to a light colour; and I have been informed by Mr. Newton, also, that it was the custom of Mr. Stanfield, the celebrated marine painter, whenever he had to paint a rope in over other painting, he always cut away his painting from behind it, being well aware that otherwise the colour of that painting would strike through the white-lead.

There is another objection to the use of white-lead, and really a very valid one it is. It often strikes me with wonder how persons can go on year after year laying out sums of money for having their houses painted with white-lead, when other pigments which will keep their colour might well be employed. A house painted with white-lead after some time darkens in tint considerably; the colour is changed by some influence that is acting upon it through the air, and that influence is sulphuretted hydrogen gas. If you paint doors placed near a drain from which this gas escapes with white-lead, those doors will become browned and blackened, as we all know. I will now show you the effect which is produced upon white-lead by sulphuretted hydrogen gas; of course, it will be done rapidly here, but the same effect is, by lapse of time, produced quite as effectually by the repeated action of small quantities of the gas upon the pigment. Here is some common white-lead in a dry state, which was procured at a oil-shop, and here is some mixed with oil. We will put these specimens under a bell-jar, and then evolve some sulphuretted hydrogen gas in their neighbourhood. Here is some sulphide of iron, to which I will add some water and sulphuric acid; the gas will be given off, and in a short time the white-lead will become blackened.

Whilst this experiment is going on, I will show you how to test the purity of white-lead, for, if we do use this pigment, we should certainly like to employ it in as pure a state as possible. Now, white-lead is very often, particularly that which you procure at ordinary shops, adulterated with a substance called sulphate of baryta, or, commonly, barytes. This is much more transparent when ground with oil than white-lead itself, and you will perceive that it will materially impair that property for which white-lead is valued, viz., that of covering down well and solidly. White-lead adulterated with baryta has, generally speaking, a bluish sort of look, it is semi-transparent. It has not that opacity that pure white-lead has. I will take a small piece of this white-lead and put it into a test tube, and add to it a little of the substance commonly known by the name of nitric acid, or aquafortis, and some water. If the lead is pure the whole of it will dissolve in this liquid, and we shall have a clear solution. If it does not dissolve there is a white precipitate, which you will see after the lecture; it will fall down to the bottom of the tube, and that precipitate is sulphate of baryta. Sulphate of baryta is insoluble in aquafortis, but carbonate of lead, and most lead salts, are soluble in it. Here is a specimen of Cremnitz white, given to me by Mr. Newton. We will test this, and see whether it dissolves or not. I will ask Mr. Taylor to boil the two specimens and let them stand, so that you may see the result after the lecture. There is another very excellent test for the purity of white-lead, which is this. If you take a small portion, and grind it up with a little carbonate of soda into a small pellet about the size of a pea, and then put it upon a piece of charcoal, and hold it in the middle flame of a blow-pipe for some short time, the sulphate of baryta becomes decomposed, and you get sulphide of sodium formed. If this sulphide of sodium be acted upon by an acid liquid, sulphuretted hydrogen is given off, which could not be formed from carbonate of lead, for in it there is no sulphur at all; and inasmuch as sulphate of baryta is the impurity for which we have to look, the presence of sulphide after this treatment indicates that it was with the white-lead which was examined.

Now, I will show you what has taken place with these specimens of white-lead which I put under the bell-jar. Here is the white-lead which was mixed in oil, and here is the powdered white-lead, both turned to a dark brown colour. If the action went on sufficiently long, it would become absolutely black, and in the course of time the action of sulphuretted hydrogen in atmospheric air will produce effects almost as decided as this. I had intended to have shown you another experiment illustrative of the same fact, but I think there is no necessity for so doing. I had intended showing you the precipitate formed by sulphuretted hydrogen in solutions of lead salt, to prove how rapidly the sulphide is produced, and that it really is as black as I have already described to you, but I am sure, from what you have seen, you will be able to judge of the effects, and I dare say any of you who have not seen it will take my word that it is so.

As I have given you reasons, extremely cogent, why white-lead should not be used as a pigment, you will no doubt ask me, what is to take its place? I cannot tell you, not if the requirements of all artists are to be met. I cannot suggest a substance that will paint as easily as white-lead. I am, however, going to suggest one which has advantages so infinitely superior to white-lead, in giving permanency to your pictures, that I am sure the little mechanical difference that will arise in its employment will not be considered, when you know that it is a substance which is absolutely indestructible as to its tint, if submitted to those influences which destroy the purity of the colour of white-lead. The substance I allude to is zinc-white. Here is a solution of zinc sulphate. I will put a small quantity of it into this beaker glass, and will then add to it a solution of caustic soda. You see we shall get a white precipitate. I add the caustic soda cautiously and slowly, because the white precipitate formed is soluble in an excess of caustic soda; as you see, by adding more of the soda, it is gradually disappearing. The substance precipitated is called zinc hydrate, that is to say, zinc oxide united with the elements, which forms what is termed by chemists a molecule of water. The presence of the water in this compound destroys its body entirely, so that in this form it cannot be used as a pigment. If the substance precipitated—the zinc hydrate—be submitted to the action of heat, this water of hydration can be driven off, and we shall get a white powder. There is some in this bottle, which is zinc oxide, containing zinc and oxygen only, made in this way; the zinc white has more body, of course, than it has in the hydrated form, but it has not sufficient body for a pigment. This specimen of zinc-white is made by Messrs. Winsor and Newton, on a large scale, by another process. Zinc is kept at a high temperature, and a current of air is gradually admitted to it. The zinc burns in the oxygen of air, and the product is zinc-white, much more dense than that which can be procured by any method of precipitation. I have arranged an experiment here to show you how zinc-white can be prepared. Owing to some sort of mischance, the furnace which Messrs. Griffin have been kind enough to lend us has not worked so well as I should have wished it to do, but I hope the zinc in the crucible will be raised to a sufficiently high temperature to show you pretty well the experiment which I now wish to exhibit. In this iron bottle there is a quantity of oxygen gas, compressed, so that when the tap is turned it will rush out; and what I propose to do is, to inject some of this oxygen gas into the molten zinc in the furnace, and then you will see, if the zinc be heated to a sufficiently high temperature, that it will burn with considerable brilliancy, and that flakes of white will be distributed about the room. I think you have seen enough to show you the formation of zinc oxide. The process, as conducted for manufacturing purposes, is not as rapid as this. Although rapid, it is much slower than what I have shown you, and I doubt much whether the oxide formed in this way would be as good as that by the method employed by Messrs. Winsor and Newton. In both methods a quantity of metal zinc in fine division is mixed up with the oxide, and that is got rid of, I believe, simply by washing. The zinc particles sink to the bottom, and when this is run off they are allowed to subside, and are then ground for use.

Now, the question is, is zinc-white liable to the same destructive influences as white-lead. I will show you an experiment to prove that it is not. This is a solution of zinc sulphate, to which I added some caustic soda. I will now put water to it and pass in sulphuretted hydrogen gas, when you will see that the precipitate formed will be white, and not black. We will put some zinc-white into the bell jar, for the very obvious reason that sulphuretted hydrogen gas has a most unpleasant smell. Here is a specimen of zinc-white. If we were to submit this to the same test to which we submitted the white-lead just now, you would find no change take place whatever in its colour, for sulphuretted hydrogen has no effect upon zinc as to its colour, because zinc sulphide is white. I wish, if possible, to mention one other point with regard to lead as a base of pigments, before we separate this evening. Here is a solution of the same substance which we took earlier in the evening—acetate of lead. If we add to this a solution of what is commonly known as bichromate of potash, we shall get a yellow precipitate produced. This yellow precipitate is what is termed lemon-chrome, the middle tint of the three chromes. If along with this, some sulphate of lead is precipitated, we should then get a lighter chrome, the lightest tint of chrome. It is not pure lead chromate, but the presence of sulphate of lead in it is not really an impurity, it is essential to giving it that particular tint which is desired. If I boil some of this chromate of lead with a little potash or caustic soda, you will see a change produced in its colour, and it will assume a deep orange tint. The precipitate here formed is what is commonly known by the name of orange chrome. The difference between orange chrome and lemon chrome is that the orange chrome contains more chromic acid; and inasmuch as when there is more oxide of lead in the soloution from which carbonate of lead is precipitated, we call it a basic acetate; so when there is more oxide of chrome in this precipitate, we speak of it as a basic chromate. I have now mentioned to you all but one of the lead colours that are usually employed as pigments, and I will leave that to the next lecture, for I find that, from my desire to show you an interesting experiment, I have affected the throats of many of my audience very painfully; and I think, therefore, it is better for us all that we should bring our lecture to a close. Therefore, ladies and gentlemen, on Monday evening next, I will continue this subject of the preparation of colours, and go on to show you the mode of analysing them, and of detecting impurities in various other colours with which you, as artists, have to deal.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

The Pattern and Sample Post.—The re-organisation of the pattern and sample post, says the *Civilian*, is under the immediate consideration of the postal authorities, and early in the year very extensive alterations in the existing state of affairs will be made, greatly to the advantage of the public.

Samples versus Completed Orders.—The *City Press* says:—"The sample post is doomed, but it must give place to something better. The great agitators are the representatives of the cotton, silk, and seed trades; but it is a public question, and must be dealt with in a broad spirit even by those who are only anxious about their own particular interests. If the Post-office carries genuine samples at a loss, we do not see why the public should be taxed for the benefit of the particular trades that the sample post benefits, for that is the necessary result in the first hypothesis. On the other hand, if there is the slightest gain, or even no actual loss, on the carriage of samples, then there may be made upon the office a reasonable claim for the carriage of parcels of any and every kind at the same rates, provided certain necessary regulations are complied with. The parcels must be dry, they must never consist of combustibles, or other articles which might by any accident prove injurious to the contents of a post-bag; and, of course, there must be limits assigned for size and weight, and sharp corners of packages must be prohibited. But the miserable question of 'sample' *versus* 'completed order' must be made obsolete, for it opens the door for any amount of fraud, and the office must exercise superhuman power to detect it. We could name houses that send out goods by post labelled 'sample' as a mere subterfuge. The conscientious trader, who scorns the shabby procedure, is outwitted in the market by the sharpshooters. We want a cheap parcel post, and the word 'sample' must be suppressed.

Parcels Postal Reform.

Sir,—A national post-office should be conducted upon the principle of prepayment of all letters, according to an uniform scale for weight, sent through the post, and the letters should be delivered at the shortest possible interval after the deposit of them in the receiving-boxes, consistent with regularity in the performance of the duty by the Post-office officials and servants.

A letter weighing half an ounce was to be charged one penny postage, which was to be prepaid by affixing a stamp to the letter, and the postmasters, receiving-house keepers, clerks, sorters, and postmen were at once to be relieved of three-fourths of their labour, complexity and irregularity of accounts got rid of, time saved in the delivery of letters, and doubt as to cost rendered impossible.

Who can wonder, then, that the public readily understood and eagerly urged the adoption of a system which evidently possessed such palpable advantages over the complex system of single and double letters, general mail and local post letters, all varying in rate of charge, according to distance carried, and a thousand-and-one other circumstances, real or imaginary, and known only to the Postmaster-General, and resorted to as a means of increasing the Post-office revenue.

Such are the principles which have been recognised and acted upon by the Post-office authorities in this country since 1840, so far as the letter-post is concerned. Such were the principles laid down by Sir Rowland Hill, and to which he gave effect with such eminent advantage to the merchants, manufacturers, bankers, and public generally.

Nearly a generation has passed away since the penny post became the postal system of England, yet it appears to many of us as but yesterday that the old system prevailed, and our children look amazed when we tell them of the difficulties and impediments which existed in our days to free correspondence with friends and relatives resident in some county town of England or capital city of Europe.

The penny post having become an established fact, the Post-office opened wide its doors to aid the more rapid and easy diffusion of knowledge throughout the length and breadth of the land. The proprietor of the *Penny Magazine* had shown what stores of useful knowledge the printing press could pour forth for the instruction of the people, and our postal system was speedily modified so as to admit of its use in the spread of knowledge. Watt had perfected his steam engine, railways had applied it as a motive power for drawing heavy loads, and Applegarth soon applied it as a motive power to the printing press, within the last few years Hoe has followed in his steps and greatly added to the power of printing our daily, I might almost say hourly, editions of periodical literature. But even the steam engine and its aids to our productive power have not placed the limit to our means of communication and necessity for increased postal facilities. The electric telegraph of Cooke and Wheatstone came into existence almost at the same moment as the penny post, but it was a new power, the capabilities of which had to be learnt, and its use had to be made familiar to a public ever difficult to teach; but novel as was its character, the unprecedented speed with which it was capable of being applied in the transmission of correspondence, and the aid it thus afforded to commerce, soon made its power to be felt. A few years later, and gutta-percha coating its copper wires had enabled seas to be spanned and ocean spaces annihilated, and steam-engines, railways, steam-boats, and electric telegraphs, aided by steam-presses and a penny post, combined to make known the desirability and possibility of creating a World's Fair, to promote an equally rapid knowledge of the capabilities and productions of the remote corners of the earth. Manufacturers of all nations flocked to England in 1851, to discover new sources of industry for the people, and commerce has since expanded to an extent and with a rapidity altogether unprecedented in the annals of any previous age. And what has the Post-office done of late to aid this onward movement? It has claimed the right to hold not only the postal system in trust for the people of the country, but has now consolidated and taken into its keeping the telegraph system of the country also; it is to be hoped that it will work both, and promote by their means to the fullest possible extent, and at the least possible cost to the public, the social and commercial as well as the political interests of the country. How then, it may be asked, can this best be done? Is the railway system of the country worked to the greatest possible advantage and under the most economic conditions in aid of the postal requirements of trade and commerce?

While modifying our postal system from time to time, have aids to progress been given up, which were then no longer required, but which might now, in some modified form, be re-introduced to second and supplement our existing system of letter and parcels distribution? Have facts been established which prove that the penny post system is capable, in its turn, of being again re-modelled, and further simplified, thereby carrying out to a fuller extent the plans and objects of its originator? Has our telegraph system been placed upon the most economic base, thereby lending its aid and courting its use by rich and poor in every part of the country? And has the postal system of the country been so expanded and simplified that there is nothing left to desire in the way of further improvement? Facts which cannot be gainsaid prove that such is not the case. Privileges once granted but now withdrawn cry out that it is not so, and many a humble but industrious worker is sorrowing over the loss of occupation because postal facilities are denied as a cheap means of enabling them to forward from their cottage homes, or humbly respectable though concealed homes of poverty, to the manufacturers, the products of their brain and hands. The manufacturer, the merchant, and commercial traveller, together with the shopkeeper and the public, are alike deprived of the free use of the Post-office in the despatch of small parcels in execution of orders, or as gifts.

Thus the industries of the country as well as the people of the country suffer, and that at a time when it cannot be denied that the aid asked might be rendered without detriment, but, on the contrary, with every prospect of advantage to the revenues of the Post-office.

The Post-office authorities have admitted, and the government of the country have authorised, a reduction in the postal rate from one penny per half-ounce to one halfpenny for a postal card weighing 32 grains, which they supply to the public with an impressed stamp upon it, and allow to be circulated through the Post-office from one end of the land to the other. The Post-office authorities admit that they can, and the government permits the Post-office to carry, two ounces of printed matter for one halfpenny—this they do without loss; and the same principle is attempted to be applied, but is limited in its application, to other products of industry. They have thus admitted two facts, but in attempting to limit their application they have re-introduced rules, complexities, and doubts, and deprived the commercial world and the people of the benefit which the principle is capable of conferring if left free and in its simple but intelligible nakedness.

What then is the duty of the Society of Arts, in the interest of the objects it is established for and seeks to promote? Is it not to endeavour to obtain from the government for the authorities at the Post-office permission to make one-quarter of an ounce the normal weight of a letter at a postage of one halfpenny, leaving the public to provide its own paper or card, as it deems fit. To declare that if two ounces of printed matter can be carried for one halfpenny, that two ounces of calico, lace, silk, or any other fabric or industrial product of like weight, may also be carried at the same cost, without attempting to set up a judgment as to what is or what is not an article of value; and to let the public take the risk of loss or damage, if there be such.

It may, however, be desirable and necessary to define the limit of weight, bulk, and value of parcels to be received and carried through the Post-office. So also is it found necessary, and in the interest of the public, to restrict and provide for the transmission of money. To limit the bulk or weight of a parcel is only equivalent to limiting the number of words which can be sent for a given sum of money by telegraph, though it may be doubted if the limit now set is that which is most economic or might be found most beneficial to the interests of the community, or even the revenues of the Post-office itself. If the concessions here pointed out as desirable to be asked for should be obtained and give rise to an increase of the business of the various postal departments, it is only necessary that the letters should be dealt with by themselves, and book packets, printed matter, and parcel packets by themselves. The postman should continue to be the letter-carrier, without hindrance to his duty by being compelled to carry parcels where numerous, and, if necessary, a special staff of servants, and even a horse conveyance, should be provided for the speedy and regular delivery of parcels, with the object of promoting, by means of the Post-office, to the fullest extent of its capabilities, the interests of education, and the social and industrial condition of the country.

With this letter I shall conclude a series which, I fear, has already encroached too much on the space at your disposal in the *Journal of the Society of Arts*, but the question as to whether the country shall possess the advantage of a free parcels post is, to my mind, so important, and calculated, if granted, to aid so largely the industries and trade of the country, that I have been induced to forward them to the editor for insertion.—I am, &c., H. G. H.

Postal Rates and Rates for Freight.

Sir,—In a letter signed "H. G. H.," which appeared in the number of your *Journal* for 30th ult., there is a comparison drawn between postal rates and the rates of freight per mail steamers, which is unjust to the Post-office. Although the needless restrictions of the Post-office must impose an enormous amount of unnecessary trouble on that department, and must entail on it a very heavy loss, we must, in our comparisons, be just to it, notwithstanding.

In making the comparisons referred to, the fact has been lost sight of that freight is but one of many items which are all required before you can ascertain the cost. Were a ton of goods sent from this to Yokohama or elsewhere, besides the freight, the following would likely all form part of the cost:—Porterage and cartage to the railway, carriage per railway to Southampton, dock dues, export duty, and agents' commission, shipping. At the port of arrival there would likely be—Import duty, landing charge, cart and coolie hire to merchants' towns, and carriage to inland destination; and, abroad, this last very often forms the heaviest item of all. These have all been omitted in the present cost, whilst they are all included in the postal rates. Could "H. G. H." supplement this, a comparison then would be of great value.—I am, &c.,

H. F. Alexander.

Edinburgh, January, 2, 1870.

100 Years Ago.

Sir,—With reference to postal reform, I would ask what have we gained during the last hundred years? Thus, in "The New Complete Guide to London," (1771) of the Penny Post-office:—"The Penny Post-office is chiefly under the care and inspection of a comptroller, and the custom of the officer is to receive one penny upon the delivery of every letter or parcel not exceeding one pound in weight, and to be delivered not above ten English miles distant from the General Letter-office in London." These places are "besides what it delivers in its own proper district in London."

In the tabular list of distances to the offices, Throgmorton-street, opposite St. Bartholomew's-lane, is given as the site of the General Post-office.

Morning.		Afternoon.	
9	..	3	Copenhagen (fields)
10	..	4	Hoxton
9	..	3	Wood's-close

are given as distances within that circle. Westminster Post-office, in Coventry-street, delivers at

Morning.		Afternoon.	
7	..	2	Kensington
7	..	2	Notting-hill and Shepherd's-bush.
7	..	2	Sion House
7	..	0	St. John's-wood

Comment is needless.—I am, &c.,

Edward Belcher.

22*a* Connaught-square, Jan. 2, 1871.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel. Scott, R.E., secretary.

Albert Hall.—The Queen has fixed Wednesday, the 29th of March, as the day on which Her Majesty proposes to open the hall.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

Evening Exhibitions.

Sir,—When the Exhibition of 1851 was proposed to be held, and the idea was conceived of bringing together large masses of the public within the building subsequently erected, the proposition was so new, and its effect so untried, that considerable doubts were entertained as to whether it was politic to carry it out, for Sir Richard Mayne, if my memory serves me rightly, said, that if 20,000 persons were brought together in the building he would not be answerable for the peace of the metropolis. These fears were singularly ill-founded, for as many as 90,000 visitors were at one time in the building without the slightest approach to disorder taking place. The Exhibition of 1862 proved the same fact. At both these periods the wish was often expressed that, as the great mass of the public can only visit such exhibitions either at the sacrifice of their daily earnings, or after the ordinary hours of labour, that means of lighting them should be adopted, thus permitting of evening exhibitions. This, however, was found to be impracticable. The building of 1851 has been reconstructed at Sydenham, and thousands have been, from time to time, assembled within it, both by day and by night, without giving rise to serious inconvenience, immorality, theft, or any of the dreaded evils, and it has been found easily possible to light the building and protect the property. At the South Kensington Museum, another outgrowth of the 1851 Exhibition, similar satisfactory results are to be witnessed, and some of the largest and most orderly assemblages are those that take place on the evenings when it is open free. It has now become an accepted fact that large buildings may be lit up and thrown open to the public, not only without detriment, but, on the contrary, with great educational advantage to the public, but with a decided money advantage to the enterprise. Workmen and skilled artisans have shown, in the exhibitions which they have held of their own industries, that they not only desire to visit such exhibitions, but to do so with their wives and families of an evening, when their day's work is done; and my object in writing is to inquire, through the official organ of the Commissioners, if it is contemplated to light up and open of an evening the forthcoming exhibition. There ought not, it appears to me, to be any practical difficulty in realising so desirable an object, and one that would add so considerably to the receipts at the doors. As the Albert Hall is to be available for evening concerts, it would only be the extension of the lighting arrangements to the wing buildings.—I am, &c.,

An Art Workman.

ON PIANO-TUNING AS AN EMPLOYMENT FOR THE BLIND.

By T. R. Armitage, M.D.

Much has of late years been done in England to improve the condition of the blind. The degradation and misery which existed among this class forty years ago can hardly be conceived by any one who knows only their present state. During this period of time, not only has reading by touch become general, which then was scarcely thought of, but institutions have sprung up in most of our principal towns whose object is to teach trades to the blind, and to help them in the best possible manner, by disposing of their work and by encouraging habits of industry and self-reliance. Though a great amount of good has undoubtedly been thus effected, and though the exertions and devotion of many of the promoters of these institutions deserve all praise, there is still much to be done before we can congratulate ourselves on having placed the blind, as regards their education and employment, in a condition as satisfactory as the circumstances of their case permit, especially in all that concerns the education of the young. The Executive Council of the British and Foreign Blind Association has, for the last two and a-half years, been working assiduously at this subject, and have come to the conclusion that by far the best form of alphabet is that invented by M. L. Braille, in 1834, described at length in the *Journal* of January 28th. By this method a blind man can read, write, and print with the greatest ease, and its wide diffusion over the whole civilised world is one of the many proofs of its general usefulness among the young and intelligent blind. This method has hitherto scarcely been known in the United Kingdom, there not being a single institution which employed it when the executive council commenced its labours. There are now five which have introduced it, and several others are about to commence. It is certain that, when blind children have once enjoyed the advantages which it gives, it will be difficult to induce them to adopt any other plan. One of the many advantages of this method is, that it lends itself more readily than any other to musical notation; and it would seem that the power of readily reading and writing music is almost as essential to the blind as to the seeing, if they are to become thorough musicians. It will be objected to this that some good musicians are found among the pupils of the English blind schools, where no system of musical notation worthy of the name is used. This is, however, due to great natural musical talent in the pupil, not to the defective system by which he has been trained. Most professional musicians will, I am sure, agree with me that we are not giving a pupil a fair chance of acquiring a thorough and exact knowledge of music if he is not taught, to some extent at least, by written or printed notes.

We ought to understand exactly what is to be aimed at in the education of the blind. In all those who are of the class which finds admission into public institutions, the object constantly to be kept in view is not to make them first-rate readers, writers, geographers, mathematicians, &c., and then to allow them to go out and starve, or be a burden to their friends or the community, but to enable them to earn an honest livelihood. That branch of industry, therefore, deserves to be most cultivated which pays the best.

There are now a great number of institutions for the employment of the blind in this and other countries, and the universal experience seems to be that, as a rule, it is difficult for the blind to support themselves by any handicraft, without their wages being supplemented by some form of charity. The reason of this is obvious. A person with four senses is brought into competition with those who have five, and the sense which he has lost happens to be the most important of all.

The only kind of employment, as far as I know, in which the blind are not inferior to the seeing, is that of tuning pianos. In the mechanical part of this art, the blind, when well trained, are not much inferior to the seeing, while the concentration of their minds upon impressions derived through the ear often produces a nicety and perfection in this organ rarely met with in the seeing. It is now simply a matter of experience that the blind, when gifted with a good musical ear, may be made into first-rate piano tuners. I went over to Paris in December, 1869, for the express purpose of obtaining on the spot a practical knowledge of the Braille musical notation, and of ascertaining as accurately as possible what was being done there to form tuners. The staff of the Paris Institution consists of M. Guadet, head of the educational department; M. Levitte, chief superintendent, with four others under him, and eleven blind professors. Indeed, all the teachers are blind, being assisted in maintaining order by seeing superintendents. To M. Guadet, and M. Levitte, I was already known through correspondence, and both are members of the British and Foreign Blind Association. Nothing could exceed the kindness of all the officers of the institution, in which I spent the greater part of every day during my ten days' stay. The facts that I am going to give respecting the Paris school are derived partly from an interesting pamphlet published by M. Guadet, in 1859. There are about 250 pupils in the institution. The great object seems to be to turn out as many good tuners as possible. The commencement and development of this branch of industry has been due entirely to the exertions of the blind themselves. About the year 1830, Claude Montal and a blind fellow-pupil of the Paris Institution attempted to tune a piano on which they practised. It, as well as the other pianos in the institution, was kept in very indifferent tune by a seeing tuner. This man complained to the director, who administered a sharp reprimand to the two blind pupils, forbiding them ever again to touch the works. Nothing daunted, however, the two friends procured an old piano, and obtained permission to keep it in the institution. The practised themselves in taking it to pieces and re-mounting it; nor did they rest contented until they had thoroughly repaired it, and brought it into good tune. As the director had daily seen them at work, he could have no doubt that the transformation of this old instrument was really due to the unassisted efforts of the two blind friends. Struck with the talent which they evinced, he confided to them some extensive repairs in the organ belonging to the chapel. They had two seeing workmen at their disposal, whose movements they directed. The experiment proved perfectly successful, as no professional organ-builder could have done his work in a more masterly manner. By degrees, they obtained permission to keep all the pianos of the house in tune, and to make little repairs where necessary. The next step was, to begin regular instruction in tuning, and thus commenced the tuning classes, which have made the Paris school famous throughout the civilised world. Montal soon left the institution, and endeavoured to obtain a private tuning connection, but the same prejudice which now exists in London against blind tuners was then in full force in Paris. No one liked to trust a piano to the blind man, and for some time he was glad to be allowed to tune gratuitously. During all this time he was steadily working at the theory of tuning. He eagerly studied everything that had been published upon the subject, and his own talent and thorough knowledge of the theory of music soon led him to adopt a better and more scientific system of tuning than that generally in use. A circumstance now occurred, which was the turning-point in his fortunes. One of the professors of the Conservatoire, having heard of the skill of the blind tuner, sent for him, and showed him two pianos which he had in his apartment. They were of different construction, and from different makers. It was important that they should be in exact accord, and none of the numerous tuners who had attempted this task had been able to succeed. Montal said he would make the attempt. He first carefully examined the differences in their construction, and making allowance for these, set about his work in a scientific manner, and the result of his tuning was a perfect success. He was now patronised by the other professors of the Conservatoire, and soon was employed by some of the leading professional musicians of Paris, by whose recommendations his practice and fame as a tuner rapidly increased. In 1832, he gave a course of lectures on the art of tuning, which were very well attended. In 1834, at the Industrial Exhibition, most of the makers had their pianos tuned by him, and he took advantage of this opportunity to circulate a short treatise on tuning, which was sold in the exhibition building, and contributed much to his reputation as a tuner. He now began, on a small scale, to repair and to make pianos. This was the commencement of the well-known manufactory of which he was long the head. In 1836, he published his full treatise on the art of tuning. While Montal was pursuing this successful career, and proving that it is possible for the blind not only to equal, but to surpass the seeing in the art of tuning, other blind pupils of the institution were there developing the course of systematic tuning. These pupils, on leaving, followed in Montal's steps. During the first years, the same difficulties and prejudices had to be encountered, but by degrees makers and the general public grew accustomed to blind tuners, and the obstacles thrown in their way became daily less. Some makers, indeed, made a practice of always sending blind tuners to those among their customers who were most particular; and, as the instruction at the institution was kept up to a high standard of excellence, and care was always taken to give a certificate of tuning to those only who were really masters of their art, the blind became more and more popular as tuners. The blind and their friends became every year more alive to the fact that tuning was the best and most remunerative employment they could follow, and a constantly increasing pressure was put upon the authorities of the institution for admission into the tuning classes. In this way it has come to pass that in the Paris Institution, at the present moment, the great object is to turn out tuners. As far as I could ascertain, the proportions of the different classes among the male pupils who leave the institution are at present nearly as follows:—About 60 per cent. follow music as a profession; the remaining 40 per cent. practise various trades. Of the musicians, nearly one-half, or 30 per cent., obtain their diploma as tuners.

We will now proceed to examine the probable future of these three classes. Those who obtain the tuning certificate are certain of maintaining themselves in a degree of comfort which is quite unknown in the same class here. £80, £120, and £150 a-year are not by any means unusual incomes, while I was told of one man who makes about £250 a-year by tuning. Five old pupils are now established in Paris, and are doing extremely well as piano manufacturers. If a pupil has a good ear, but is otherwise not well qualified, he becomes an organist or teacher of music, and has to maintain a hard struggle for existence. The same difficulty of finding remunerative employment for blind organists and teachers of music exists in this country, as is too well known to the managers of our own institutions. The remaining 40 per cent., whom nature has not endowed with sufficient musical talent, have to content themselves with various handicrafts, in which their success is about equal to that of blind men employed in a similar way in England, as they can only earn upon an average about five or six shillings a week. Some, no doubt, are able to earn more, but in no case is any kind of handicraft work to be compared for a moment with tuning as an employment for the blind. Every pupil in the Paris school, besides receiving a good general education, is taught theoretical and practical music; for it is found that sometimes the musical faculty seems to lie dormant until it is called forth by education, and the managers do not wish any child to be deprived of the chance of following music as a profession. If, after a reasonable time, it is found that no musical talent exists, some handicraft is taught. The special training for tuners extends over three years. During the first, the teacher makes his pupils thoroughly acquainted with the external form and internal mechanism of the piano, which is repeatedly taken to pieces and remounted under his direction. During the second year, the pupils learn the theory and practice of tuning, an hour and a half every day being devoted, under the direction of the professor, to keeping in order the numerous instruments in the institution. During the third year, the pupils go out to work in different factories in the town, returning to sleep at the school. Many great advantages result from the way in which this last year is spent. They become familiar with instruments of various shapes and make; they become accustomed to find their way in unfamiliar places; they are obliged to work quickly; they are brought into immediate contact with seeing workmen, which confers on them many advantages, one of these is that they find their proper level, losing the shyness peculiar to some of the blind, and the conceit and over-estimate of themselves found in others. They become accustomed to many new aspects of life, and learn much by free intercourse with the outer world. They are thus gradually prepared to dispense with the fostering care of the institution, and when they leave they do so as finished tuners, who are able at once to obtain good wages.

When we compare this state of things with that unhappily still existing in our own country, the comparison is not flattering to ourselves. Here, a blind tuner who can live by his art is a rare exception, and numbers of gifted blind musicians are to be found who are obliged to depend on charity, or to obtain a scanty subsistence by basket-making, brush-making, &c. These men, if they had the good fortune to have been Frenchmen, would certainly have been able to maintain themselves in comfort by tuning. It is high time that the facts of the case should be generally known, and that our blind institutions should turn their attention specially to this branch of work. Some of the more advanced provincial blind schools are already alive to the necessity of training tuners, but have great difficulty in carrying out what they know to be right, partly in consequence of the comparatively small number of their pupils, but principally because it is almost essential, for the proper training of tuners, to have pianoforte makers within easy reach. It belongs especially to the metropolitan schools to take the lead in this matter, and the St. George's Blind School, with its large revenue and great number of pupils is in a peculiarly good position to undertake this work, for which its continuance in the metropolis is of course absolutely essential. An Act of Parliament was obtained by this school, about two years ago, to authorise its removal to the country. It is fortunate for the blind that no use has been made of this power, as, among the numerous other objections to such a course, all prospect of its undertaking the training of tuners would have to be abandoned, and thus the best profession a blind man can follow would either have to remain untaught, or a new institution must be founded to do that which the present school might have done much better. To sum up, it is scarcely possible to state the case better than in the concluding words of M. Guadet's pamphlet, published eleven years ago, and the truth of which has been abundantly proved by the experience of the Paris school:—"Whenever an art or trade is of such a nature that the blind can follow it on equal terms with the seeing, or in other words, that there is a peculiarity in it which causes a disappearance of the inequality generally existing between them, this art or trade is especially well suited to the blind, and it is our duty to teach it with as little delay as possible. Now, in pianoforte tuning, the blind are not inferior to the seeing, but, on the contrary, possess certain advantages over them; we must, therefore, train tuners. There is no fear of the demand ceasing, therefore, we must train as many tuners as circumstances will permit."

A FRENCH LADY ON ENGLISH HOMES AND ENGLISH HOUSEWIVES.

The *Daily News* has published the following letter:—

"Sir,—May I venture to send you a few lines suggested to me by a several weeks' sojourn in England, where the terrible strife now raging on the Continent has led me to seek a refuge. What I have to say has no doubt been said many times by English writers, teachers, and preachers, far better than I, a Frenchwoman, can presume to do. Still, some subjects can never be too often treated, and my foreign and most likely incorrect way of expressing my views upon them may be acceptable in this age of female interference and Education Bills. I have been for the last three months living in England, alternately in the country, north and south, in a country town, and in lodgings by the seaside. Everywhere the same feature of English life has struck me, whether staying with rich friends or inquiring into much humbler spheres of life—the incapacity of Englishwomen in what we Frenchwomen consider to be the first duties of our everyday life—knowing how to work, to cut out, to mend, to sew, to knit, to wash, to cook, to look nice, and make all around you look nice, even with the smallest means. It saddens and disgusts me to see the rags, the old finery, the dirty clothes in which children (your lovely English children, we should be so proud of), girls, and even men, go about without the slightest apparent sense of shame, and which could be repaired with a few moments' labour and a needle and thread. Why, their wives and mothers ought to be ashamed of themselves at this degrading want of care and trouble on their part. And, from all I see, it is not that they do not care about fine clothes and smart dressing when they can get it. No, they will buy new clothes as soon as they can afford them; but no woman seems to consider it her first duty to mend and keep clean those garments which her husband's wages have hardly earned, and which her lazy or unclever fingers do not care to preserve tidy to the end. How I wish some of your good English wives (honest, brave souls, with perhaps more sterling virtues then many a French one) who let their husbands go to their daily work with dirty and unmended shirts, tattered vests, and torn socks, how I wish they could see many a French blouse, old, worn, faded, but neatly patched, cleanly washed, tidily repaired by the active fingers of our *menagères*. That is the word, that is the quality which, to my mind, is so missing in English households, high and low.

"That fearful vice of drunkenness which seems so sadly flourishing in England, would it so thrive were the working man, or, even to rise above the lower classes, many a man of business, to find his home, his clothes, his food, more pleasing, nicer, more attractive?

"Here, too, is another subject of my reflections, and daily in the lodgings where I am now staying does it recur to me personally, and in a most forcible manner. Why do not Englishwomen know a little more about the plainest elements of cookery? Is it so very difficult for them to master a few of the very simple rules and receipts which make daily food pleasanter to the eye, to the taste, and, I do believe, to the stomach? Why, I, like most other French ladies, though we have at home but the trouble of ordering an excellent meal to get it, know more about cooking than any usual professed cook I have met with here; and I can assure you that the good woman who superintends the dinners I now eat will be far wiser when I leave her lodgings, from my very simple directions in the way of treating vegetables and daintily warming up scraps. Why, because English roasts and steaks are so well done, many English puddings so good, some English dishes so acceptable, must your vegetables be raw, your omelettes like shoe-leather, your sauces uneatable, your spinach like bitter herb? Why, because England's fair daughters have many and rare accomplishments, her women true, noble virtues which few countries can boast of, can they not also be clever with their fingers, tidy in their habits? In England, married women are seldom called upon to earn their living, as they daily are in France. Would it not be a noble and quite as real a way of doing so, if by mending, making, turning to account, they saved much of what is earned for them? Where does the evil lie? Is it in the want of early training at home, or of useful classes in schools? I leave this to more competent persons than myself to say. But when I hear of ladies' brains busied upon such subjects as the Contagious Diseases Act, and then see my landlord's very intelligent and nice little daughter of twelve, who can neither sew nor knit, though she goes to school, I marvel why clever and influential women will '*chercher midi à quatorze heures*,' and not seek to remedy evils nearer and more fitted to their Christian efforts.

"A French Lady.

"December 10th."

SUPPLY OF TEACHERS FOR THE NEW SCHOOLS.

Sir James Kay-Shuttleworth, in a long letter, draws attention to the necessity for an immediate and very large increase in the number of efficient teachers for the new schools to be created under the Act. It appears by the report of the Committee of Council for 1869-70, that out of 3,251 masters of schools in England and Wales, to which annual grants have been made, 83 per cent., and out of 3,054 schoolmistresses 81 per cent. had been educated in the 35 existing training colleges. The Department estimates that this source could furnish, if the schoolship of a teacher is estimated at 20 years, a staff of 25,000 trained teachers for our elementary schools, without taking into account the number that enter the profession through other channels. But, adopting the estimate of the Department, that one-sixth of the population ought to be in elementary schools, then in England and Wales teachers will be needed for more than 3,500,000 scholars. Calculating one principal teacher for every hundred scholars, then a staff of 35,000 principal teachers would have to be provided and kept up. Thus, ten thousand more teachers would be required than the number which it is estimated could be supplied and kept up by the existing English training colleges. But much has to be done to complete the supply to schools either existing or in course of foundation, for the actual number of such teachers in inspected schools was only 11,752 in 1869, and the colleges were not full. They could have received about 500 more students. There is great need, therefore, to keep the present colleges full of students, and to increase the number of colleges.

The writer considers that "the proportion of the teaching staff ought not to be less than one for every 25 scholars, and that in a school of 150 scholars there ought to be one principal teacher, two assistant, and three pupil teachers; for 100 scholars, one principal, one assistant, and two pupil teachers." "There is, therefore," he proceeds, "every reason to encourage the apprenticeship of pupil teachers. This can be most surely effected by increasing the rewards of the profession of elementary teacher, by providing a career for him through well-defined successive grades of promotion, and by securing him a pension;" and he suggests to the various education societies and diocesan boards to found scholarships to the training colleges, to be awarded annually, upon competition, to the best pupil teachers completing their apprenticeship.

In conclusion, he points out that "the voluntary schools will now have to compete with rate-provided schools for such teachers as exist. Their emoluments will rise in proportion as the supply is less than the demand. The borough schools will probably be provided with a highly-paid staff of principal and assistant teachers. Such schools can overcome all difficulties as to the apprenticeship of pupil-teachers by offering better stipends, and thus more effectually competing with the market for labour. Under such circumstances, the promoters of voluntary schools will do well to consider by what means they can, at an early period, extend the existing training-colleges, or, what would be better, can found new colleges."

CORRESPONDENCE.

MILITARY, NAVAL, AND TECHNICAL SCHOOLS FOR VOLUNTEERS.

Sir,—There are many subjects connected with volunteer and military establishments which have no proper place in the *Journal of the Society of Arts*, but there is one which may, I think, be made to have a direct bearing, and rightly be submitted to our members, that is, instruction for volunteers, so much required in the present situation of political affairs, and on which a good deal has been written. It is, however, useful to go beyond the narrow attempt to educate volunteer officers, and to increase the instruction of the mass of volunteers, the more particularly combining that technical instruction which makes men better citizens and better soldiers, and that is the direct purpose of these few lines.

It will be good to make the volunteer movement something beyond a gymnastic and pipe-smoking movement, by combining with it those intellectual characteristics which will elevate the mass and benefit the individual. At the same time, it will enlist in that movement many scientific and professional men, besides those already enrolled as surgeons. There is an indirect advantage in the association of engineers, surgeons, clergymen, and musicians in the volunteer movement; it will be none the less to enlist the interest of chemists, mathematicians, and mechanics. It will add to the strength and power of our organisation for many purposes.

There is no reason why, by the co-operation of corporations and public bodies, by subscriptions and donations, and by honorary services, we should not have in each town a military and naval school for volunteers, and to which naval and military officers would have access. It will be seen that this is converting literary and mechanics' institutions, evening colleges, and Society of Arts' examinations to the special benefit of volunteers.

Such a military and naval school would, in a small town, be a small affair, but in a large one it would attain the proportions of a college. It should not be restricted to technical instruction in tactics, strategetics, and artillery, but it should embrace a wide range of collateral studies, so as to interest the learner and be of use to him in his own pursuits. Everything in volunteering should be of civil use, even to the coat and trousers. The courses should include mathematics, mechanical drawing and modelling, mechanics, physics, chemistry (particularly as applied to war), navigation, surveying, plan drawing, field engineering, physical and political geography, geology, history, political economy, and not last or least, hygiene, German, French, and Russian should be taught.

It will be recognised that many coadjutors may be found for these purposes. All professors, lecturers, and examiners should have a staff-rank and uniform, as naval instructors have, and graduated promotions according to their services. Thus many will be attracted, and a suitable system of rewards provided.

All volunteers serving, and all freed volunteers, who have attained a certificate of efficiency, should have a preference for attendance on the classes for rewards. Certificates on examination in each class would be conferred, which would be available to attest capability for civil employment. In this the Society of Arts could co-operate.

In the Ottoman and some other armies, a good system prevails of bestowing on such candidate who has passed his examination a right to wear a special distinction. Thus, a lieutenant just out of the staff school may have gold or silver cord floriating on his arm, and giving a distinction which the foreigner may suppose belongs to a colonel, but which the colonel cannot wear if he is destitute of the same qualifications, although he may be covered with many attributes of rank and distinction. It is a purely intellectual distinction, and one which we may beneficially apply.

The value of such schools in giving activity of pursuit to old naval and military officers, and opportunities for study to the younger in country quarters, will not be without benefit.—I am, &c., Hyde Clarke.

32, St. George's square, S.W., Jan. 2nd, 1871.

TOBACCO CULTIVATION IN INDIA.

Sir,—The *Pall Mall Gazette*, as quoted in the last number of your *Journal*, infers that India will be indebted to the present war for a new product, whereas tobacco is already one of the staples of agriculture in that fertile land, and has long been so. Moreover, it is of good quality, and used largely by millions of people over the length and breadth of the country. In Bengal particularly, with its 38,000,000 of inhabitants, tobacco is smoked by all ages, and by both sexes, and is a constant comfort to the poor, who do not in any way, I believe, suffer in health from the use of it. The best tobacco districts are Sandoway, and the Island of Cheduba, in Arracan; Rungpoor, in Bengal Proper, and Bhilsa, in the Central Provinces. In these and in many other provinces the quantity of tobacco grown is enormous, as the low price at which it sells to so many millions of consumers clearly proves. Fine-leaf tobacco may be bought in Rungpoor at 6 to 8 lbs. for one shilling. It is the high rate of duty in England that keeps Indian tobacco out of the country, and this also goes against the Indian government in deriving a tobacco tax, by which, no doubt, its revenue might be largely increased. I would further say that the "Bengal cheroot," looked for by the *Pall Mall Gazette* as the result of the war, has long been known. The cigars made at Chinsura, near Calcutta, are used largely by the British soldiers and others in India, and are cheap and wholesome. The enormous duty keeps them also out of the reach of the poorer classes in England. A tobacco tax in India is a subject which might well occupy the attention of the Indian Committee of your Society. As to the distribution of superior sorts of tobacco seed in India, it is nothing new. More than 20 years ago it was commenced by the Agricultural Society of Calcutta, and by private persons also, but the good effects have not been great; and I quite agree with you in advocating the direct assistance of government for the improvement of Indian tobacco, in the same way as has been done so effectually and successfully for tea and cinchona, and is, at last, being done for cotton. A similar course is required for the distribution of the best sorts of sugar-cane, *i. e.*, the Otahiete, Cuba, &c.

I am, &c., A. Campbell.

January 2nd, 1871.

NOTICES OF PUBLICATIONS.

The Elements of Practical Perspective, by Ellis A. Davidson.

Drawing for Carpenters and Joiners, by Ellis A. Davidson.

These are two more of the technical manuals published by Messrs. Cassell, Petter, and Galpin. The object of the editor is to give a series of useful and really elementary lessons to artizans, teachers, and the public generally, and the studies are based upon the actual experience gained during nearly twenty years' teaching. All these manuals seem to contain just the information needed by artisans who desire to gain a knowledge of the principles, and to foster an intelligent interest in their work of construction. They are quite within the comprehension of any one who may not possess mathematical knowledge. A fair estimate of the manner of their author in imparting instruction may be gathered from the following extract:—"Absolute construction does not come within the province of this manual, but, as already stated, the more acquainted a man is with the principles involved in what he is doing, the better will he do his work, and certainly the more interest will he take in it; and, therefore, although nothing like a scientific treatise would be in character with the object in view, it is hoped that the following notes on wooden bridges, their history, and peculiarities of construction, may be of interest to those who are now, or who may at any time become, engaged in such works. It will be easily understood that, when a plank is laid across from wall to wall, and a weight is placed on any part of it, it bends, because the particles of which it is formed are pressed close together on the upper side, whilst on the under side they are drawn out. If across a plank so placed you had previously drawn lines exactly corresponding with each other, you would find that when a weight is placed on the plank the lines on the lower will be further apart than those on the upper surface. Thus you will understand that two forces are acting on the beam at the same moment, for the upper portion is subjected to a compressing force, whilst a tensile or stretching force is acting upon the lower side. It is the strength with which these two forces counteract each other that constitutes the rigidity of timber, and it will be evident that there must be some intermediate plane between the upper and lower surface of the beam in which the two opposite contending forces will meet, in which, of course, neither will preponderate. This is denominated the neutral plane, and will be differently situated according to the thickness of the beam, and the power of cohesion which is possessed by the fibres of the various kinds of timber."

The Educational Review. *(John Marshall and Co.)*—The first number of this publication appeared on the 1st January. It is described as "embracing topics of interest in general literature and science," and is edited by J. S. Laurie, formerly Her Majesty's Inspector of Schools, Assistant Royal Commissioner, and Director-General of Public Instruction, Ceylon. No. 1 contains the following papers:—1. The Crisis of National Education, by J. D. Morell, LL.D., Her Majesty's Inspector of Schools. 2. A Plain Reading of the Education Act, by Scott Dalgleish, M.A. 3. A Few Words about the Education Act, by Matthew Arnold, LL.D. 4. The Metropolitan School Board and its Work, by Edwin Pears, LL.B., Secretary to the Social Science Association; and 5. School Denominationalism in Ireland, by the Editor. Mr. Morell's paper, which, like the others in this review, has the great merit of brevity, begins by pointing out that national education is essentially a "modern idea." Formerly education was only for the few. "The idea of sending a whole nation to school never entered the calculations of our forefathers." He then goes on to trace, in a very clear and concise manner, the progress of national education in Europe generally, and in England in particular, and this brings him gradually to the Act passed last session, "which," he says, "gave the first expression on the part of the country to a seriously considered determination, that every child should have the means of proper education brought within its reach. To this great national demand every obstacle has had to give way. Religious scruples have had to be dismissed; voluntaryism to acknowledge itself insufficient; party jealousies to accommodate themselves to each other as best they might; and over the whole the tide of popular opinion has rolled, legalising at once the right and the duty of universal instruction. To this point we are now fairly brought, and to this we may fairly give the title of the Crisis of National Education. The Act itself, we must observe, has been so framed as not to run counter to the agencies by which national education has hitherto been supplied. To set aside those voluntary efforts, which have hitherto done all the work, would have been impolitic, if not unjust. To give them, under certain conditions, a place in the new system of things was wise, nay, we may almost say, inevitable. In looking forward, therefore, to the future, we see the country supplied to its entire requirements with schools of two classes; 1st, those still remaining upon the old voluntary foundation, and presided over by self-constituted managers; and, 2nd, those maintained by local rates, and presided over by the local school boards. For some time to come, at least, the former of these two classes of schools will be by far the most numerous. They were first in the field—they have occupied their ground successfully—they are already in full operation. The others are not yet in existence—they have their way to make, and to approve themselves worthy of public confidence. As time rolls on, however, the discrepancy between the two classes of schools, in point of numbers, will be sure to diminish. In addition to the activity of the boards in starting new schools wherever they are wanted, there will be a constant tendency on the part of the voluntary institutions to lapse into rate-supported ones. Hence, in all probability, the rate-supported schools will gain steadily upon the others, and become, in the long run, the mainstay of the education of the country. There is one circumstance, however, which will insure the existence of a large number of voluntary schools for many years to come, and that is, the feeling of superiority evinced by the better paid of the working people over the poorer classes," and thus the public elementary schools will be separated, roughly, into two classes—a higher and a lower. "The higher class will be voluntary, charge a good school fee, and be kept to a large extent select. The lower class will be rate-paid, will charge a small fee, and will take in the lower strata of society. To this result no one, I think, ought to make objection. It merely represents the process by which a large portion of the community will rise gradually above the level of governmental or any public aid, and take the education of families virtually into their own hands. In thus representing the natural rise of a higher class of public elementary schools, we, at the same time, indicate the process by which a large development will gradually take place in the quality of the instruction afforded by them. Our notions of the instruction proper to the schools of the people are moulded more by the experience of the past than by the wants of the future. The sons of toil are not destined for ever to be the mere human machines they have been. As intelligence slowly yet surely advances amongst them, the demand for skilled labour must become greater, and the iron hands of machinery, from the steam hammer down to the sewing machine, will perform most of the work which has hitherto worn out the bone and sinews of human labourers. There are yet in the world vast tracts of fertile soil never yet visited by the hands of human industry. As intelligence advances amongst the labouring classes, emigration will increase; skilled labour will have to make up, as it does already to a large extent in America, for the comparative paucity of hands, and every man will have to increase, by means of education, his capacity of industrial productivity. The schools of the people will have to keep up with the steady pace of the world's progress—will have to respond to all increasing demands, and to fit the rising race for the new life which is opening upon them." Some of the other papers in this publication will be noticed in a future number of the *Journal*.

GENERAL NOTES.

Interesting Excavations are being carried on in various parts of Italy, especially at the Campo Santo of Bologna, where a stratum of Etruscan interments has lately been discovered underneath the mediæval and modern strata; and also at the Leucadian promontory, where Professor Giovanni Capellini reports that traces of cannibalism have been found.

The Mont Cenis Tunnel.—The final perforation was made on Christmas-day, 1870. The Prefect of Savoy was present, and he was received by the engineers and workmen with shouts of "Long live France." At the inauguration banquet he delivered a speech, in which he said:—"It is well that the world should know that, notwithstanding the peril and anguish of the struggle for the defence of the honour and existence of France, the Republic is associated by its representatives with the great emotions of this day, which marks a solemn hour for the whole civilised world, in view of so colossal a work gloriously accomplished." This speech was loudly applauded. On their arrival at the end of the tunnel, the Prefect said:—"France and Italy are united in this work of civilisation." At the end of the *soirée* the Prefect proposed a toast in honour of the two capitals most illustrious in the world—"Rome, which you have conquered; and Paris, which we shall not lose."

Preserved Meat.—There has lately been a trial of preserved meat from Rosario, in the Argentine Republic, with, it is stated, satisfactory results. Preservation was effected by immersion in bisulphite of lime, according to the process of Messrs. Medlock and Bailey, of Wolverhampton; and the meat was sealed up in a cask, in the presence of the British Consul at Rosario, on August 10th last, and brought by him to England in a recent steamer. It had, therefore, been kept four months, and had made a passage across the line.

Indian Social Reform.—The *Daily News* says—"Baboo Keshub Chunder Sen seems to have been putting in practice some of his English experiences since his return to Calcutta. In company with some of his co-religionists, he has organised an "Indian Reform Association," for the promotion of the following objects:—1. Female improvement. 2. General and technical education. 3. Cheap literature for the poor. 4. Temperance. 5. Charity. Each of these sections is placed under separate managers, who also act in combination as a general committee, under the president of the society, Baboo K. C. Sen. The sections for female improvement and cheap literature have already commenced operations, and the new journal started by the latter section, the *Sulav Sumachar*, or *Cheap News*, is already a decided success. It is published at one pice (less than a halfpenny), and 'will contain, besides miscellaneous news, easy and short essays on moral, political, and social topics, and the biographies of great and good men.' This journal is selling by thousands already. Morning and evening schools were shortly to be opened for the middle and labouring classes, where useful instruction of various kinds would be given. The prospectus is both practical and modest, and the scheme deserves the hearty sympathy of Englishmen."

The Report of the Special Committee appointed to carry out comparative experiments with the mitrailleuse and Gatling guns has been published at Woolwich. The committee, which consists of Colonel E. Wray, C.B., R.A. (president), Captain the Hon. F. Foley, R.N. Colonel G. Shaw, R.A., Lieutenant-Colonel Fletcher (Scots Fusilier Guards), Captain Beaumont, R.E., Captain Noble, R.A., and Lieutenant-Colonel Heyman, R.A. (secretary), offer no opinion as to the merits of the rival weapons tried in competition, but give the results of each experiment in full detail in a series of tables, with a simple column of remarks relative to the conditions of the various trials, and the general conclusion is decidedly in favour of the small Gatling of ten 0·42 in. barrels. In a special competition between this gun and the Montigny mitrailleuse of 37 barrels, the former made 618 hits in 3 min. 31 sec. in 720 rounds at 600 yards; the Montigny, at the same range, and with the same number of rounds, scoring 538 in 4 min. With 555 rounds at 800 yards the result was even more favourable to the Gatling, which made 439 hits in 2 min. 26 sec., against the Montigny's 292 in 3 min. 8 sec. The trials against field guns firing shell and infantry armed with Snider and Martini-Henry rifles were likewise favourable to the small Gatling, and a comparison of the total effects of the experiments versus weight of ammunition expended gives the following figures:—The small Gatling, weighing 3 cwt., expended 492 lbs. of ammunition, and scored 2,803 hits; the Montigny mitrailleuse of 3 cwt., expended 472 lbs., and scored 1,708 hits; the 12-pounder breech-loading field gun, weighing 8 cwt., expended 1,232 lbs., and scored 2,286 hits; and the 9-pounder muzzle-loader, weighing also 8 cwt., expended 1,013 lbs., and made 2,207 hits. The report concludes with the details of some practice made with the several guns before the Secretary of State for War and his Royal Highness the Field-Marshal Commanding-in-Chief.

Improved Method of Producing Hydrogen Gas.—MM. Tessié du Motay and Maréchal, who have lately discovered a mode of obtaining cheap oxygen for illuminating and medical purposes from the manganates of soda, have sought a more practical and economical method of producing hydrogen by the decomposition of water by means of carbon, and they have discovered the following method, which has given the most extraordinary results. Alkaline and earthy alkaline hydrates, such as the hydrate of potash, soda, strontium, baryta, chalk, &c., mixed with charcoal, coke, anthracite, pit coal, peat, &c., and heated to a red heat, are decomposed into carbonic acid and hydrogen, without further loss of heat than that due to the production of the carbonic acid and hydrogen. The hydrates of potash, soda, &c., and more especially the hydrates of chalk or lime, decomposed by the coal into hydrogen and carbonic acid, can be used indefinitely in this process, provided they are moistened each time with water, so as to reproduce the decomposed hydrates. In this operation, the hydrogen gas is generated without any special production of steam, and may thus be produced without any other generating apparatus than the retorts themselves. These retorts, not being exposed to the direct action of the steam, are not subject to any interior alteration or damage. It follows, therefore, that the hydrogen gas produced by the decomposition of the above-named hydrates by means of carbon can be generated at a very small cost, and with the same facility as carburetted hydrogens from the distillation of pit-coal or other organic hydrocarbon matter. These alkaline and earthy alkaline hydrates may be mixed with the different mineral or vegetable combustibles, either in a definite chemical proportion, or without a fixed or determinate proportion, and in any suitable distilling or heating apparatus, in order to produce, when heated to a red heat, hydrogen gas for illuminating and heating purposes. The advantage of the production of hydrogen as cheaply as oxygen, which has been obtained, is likely to create a revolution in many industries, and especially in metallurgy. A cheap method of producing a great heat in order to reduce metals, such as platinum, gold, silver, and iron, has long been sought for in Europe, where the oxyhydric blowpipe is now used to melt the platinum in a calcium crucible. By this discovery it becomes possible to obtain an immense heat which could be regulated by a simple tap. Enamellers and porcelain makers may thus get rid of one of their greatest troubles.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal Geographical, 8½.
British Architects, 8.
Medical, 8.

Tues. ...Royal Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. G. B. Rennie, "An Account of Floating Docks, and more especially of those of Cartagena and Ferrol."
Photographic, 8.
Ethnological, 8. 1. Lieut. S. P. Oliver, R.A., "On the Pre-historic Remains in Brittany." 2. Dr. Hooker, "Exhibition of Some Implements from Queen Charlotte's Island." 3. Rev. D. R. Thomas, M.A., and T. McK. Hughes, M.A., "On a Cairn near Cefn, St. Asaph."

Wed. ...Geological, 8.
Graphic, 8.
Microscopical, 8. 1. Mr. B. T. Lowne, "On the Anatomy of *Ascaris lumbricoides*." 2. Mr. H. J. Slack, "On the Use of *Colloid Silica* in Preparing Crystals for the Polariscope."
Royal Literary Fund, 3.
Archæological Association, 8.

Thurs...Royal, 8½.
Antiquaries, 8½.
Royal Society Club, 6.
Mathematical, 8.

Fri.......Astronomical, 8.
Quekett Club, 8.
Architectural Association, 7½. Mr. J. D. Crace, "Colour Decoration."

Sat.......Royal Botanic, 3¾.

Journal of the Society of Arts.

No. 947. Vol. XIX.

FRIDAY, JANUARY 13, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

DEPUTATIONS.

The Right Hon. W. G. Forster, Vice-President of the Committee of Council on Education, has, at the request of the Right Hon. Sir John Pakington, appointed Thursday, the 19th of January, at one o'clock, to receive a deputation from the Society's Committee on Musical Education; and Mr. Forster has appointed Friday, the 20th of January, at twelve o'clock, to receive a deputation from the Society's Committee on Drill.

INDIA COMMITTEE.

A conference on the "Utilisation of Peat in Indian Locomotives" will be held on Friday, January 27th, at 8 o'clock. The opening paper will be read by Lieut.-Colonel Wragge.

THE LIBRARY.

The following works have been presented to the Library:—

Victoria, the British El Dorado. By a Colonist of Twenty Years' Standing. Presented by the Author.

Transactions of the Historic Society of Lancashire and Cheshire, vol. x. Presented by the Society.

The Food Journal, vol. i. Presented by Messrs. Johnson and Sons.

Catalogue of the Library of the Institution of Civil Engineers. Presented by the Institution.

Elementary Problems in Practical Plane Geometry. By John Lowres. Presented by Messrs. Longmans, Green, and Co.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The following report from the Musical Committee has been laid before the Council and adopted:—

1. In order to carry on the work already begun by the Society of Arts, with the view of establishing a National Training School for Music, the Committee recommend the Council to make music—as one of the Fine Arts—an object of the Society's attention.

2. For promoting this purpose, the Committee recommend that a musical section of the Society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall.

3. These concerts to consist of performances of vocal and instrumental music of the highest character.

4. After paying the expenses of the concerts, the profits to be applied to the establishment of a National Training School for Music.

5. Members of the Society, for every subscription of one guinea paid to the musical fund, to have the privilege of obtaining a transferable ticket for six evening concerts in the arena and balcony without further payment, provided that no member as such shall have the privilege of receiving more than five tickets on these terms. Each seat will be numbered and reserved.

6. Persons not members of the Society shall have the liberty to purchase tickets on such terms as the Council may from time to time determine.

7. That the Musical Committee of this Society, consisting of:—

The Lord Henry G. Lennox, M.P., Chairman of the Council, or the Chairman of Council for the time being, and
S. Redgrave, Esq.,* and Seymour Teulon, Esq., Vice-Chairmen of the Council, or Vice-Chairmen of Council for the time being
Lord Gerald FitzGerald *
The Right Hon. Sir J. Pakington, Bart., M.P.*
Sir John E. Harington, Bart.*
Sir. Francis Sandford *
E. A. Bowring, Esq., C.B., M.P.*
Henry Cole, C.B.*
A. S. Cole, Esq.
Capt. Donnelly, R.E.*
The Honourable Seymour Egerton
W. Hawes, Esq.*
C. Wren Hoskyns, Esq.
Frank Morrison, Esq.
J. Puttick, Esq.*
Lieutenant-Colonel Scott, R.E.*
E. C. Tufnell, Esq.

be authorised to carry out the arrangements for the six concerts, as soon as a guarantee fund for not less than two thousand pounds has been obtained, and one thousand subscriptions of one guinea.

That Sir Michael Costa be asked to meet the Committee, to discuss the necessary details.

A guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed, announced in last week's *Journal*, was £2,237.

The following gentlemen have since guaranteed the amount set opposite their names respectively:—

	£	s.		£	s.
James Andrews ..	10	0	V. Cary Elwes ..	10	0
John Ball........	10	0	Edmund Phillips..	10	0
G. W. Clark	10	10	T. J. Williams ..	10	0
Rev. Arthur R. Cole	10	0			

The number of tickets taken, as announced in last *Journal*, 194.

George Allan	2	D. Griffin	2
Jas. Andrews	2	F. M. Harsant........	2
John Ball	3	W. Mort	3
M. L. Brown	1	Edmund Phillips......	5
G. Cheverton	1	R. Rawlinson, C.B.....	2
W. H. Child	3	Chas. Reeve	2
G. W. Clark	5	Francis Rogers	3
V. Cary Elwes........	3	W. F. Simpson	1
John E. Evans........	2	T. J. Williams	2
I. Gerstenberg........	2		

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* These signed the Report on Musical Education, 1866.

The first concert will be given on April 12th, and it will be the first public performance in the hall after the opening ceremonial by Her Majesty the Queen. The dates of the other Concerts are April 19th, July 5th, 12th, 19th, and 26th.

The Council earnestly hope that the members of the Society will support, and co-operate with them in, this important public undertaking, and by joining in the proposed guarantee, and by availing themselves of the privilege of subscribing for tickets at the reduced rate, aid in securing the establishment of a National Training School for Music.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

CANTOR LECTURES.

ON ARTISTS' COLOURS AND PIGMENTS.

By Frederick S. Barff, Esq., M.A., F.C.S.,

Assistant Professor of Chemistry, University College, London.

Lecture III.—Delivered Monday, December 5, 1870.

Artists' Colours and Pigments.

Ladies and Gentlemen,—I owe you an apology for the concluding experiment of my last lecture. I am very sorry that the noxious vapours so much distressed you, as I understand they did; but you may be sure of this, that had there been really anything injurious to health in those vapours, I should not have allowed you to be brought under their influence, and you may feel assured that no experiment I shall perform will be one that can cause any serious danger, although it may slight inconvenience. With regard to the zinc-white which we formed last Monday evening, by burning zinc in oxygen gas, zinc heated to the point of volatilisation, unfortunately the crucible containing it has inadvertently been mislaid, and, therefore, I cannot show you the products of that experiment this evening. The crucible was filled with powder, oxide of zinc, a specimen of which is on the table before us, amongst those samples, which are kindly lent by Messrs. Winsor and Newton. Here is a specimen of the white powder, such as I should have shown you in the crucible, if I had had it here. I must tell you that, in describing the manufacture of zinc-white on a large scale, such as is practised by that firm, I made one mistake. Mr. Newton, who was present, corrected me after the lecture, and I feel it my duty to mention this mistake, in order to correct it, as it is liable to lead some into error as to the process which is used by that firm; and from the way in which they make their zinc-white, you will see, I think, that it must have a greater body and a greater density than that which is made in the way I described. I told you that after the zinc had been burnt, not in a current of oxygen gas, but in a current of atmospheric air, that the zinc-white, together with particles of metallic zinc which passed along with it, was treated with water and levigated, and that, by subsidence, it was separated from the small particles of metallic zinc. Now, that is a method which has been employed largely, but it is not the method which is employed by these gentlemen. They pass the oxide of zinc in such a manner, over a bridge from the place where the furnace is, that it is perfectly free from particles of metallic zinc; the oxide passes into a chamber beyond—a chamber of wood,—and, you will judge, therefore, that it has got pretty cool before it has arrived there. It is collected in this room, and when the room is about half-full, so full that when a man walks in, the oxide of zinc is almost up to his waist, it is collected in pieces of sacking, and these pieces of sacking are drawn together and squeezed up tightly, so that the oxide of zinc, when newly prepared, is pressed into hard, dense masses. It is found that by this process the substance, as a pigment, has a greater body than when prepared in the other way; and inasmuch as the want of body in zinc-white is one of the objections to its employment by artists and by decorative painters, this remedy does, to some extent, rectify that defect. But I cannot say that, by any process whatsoever, zinc-white can be made to have the body of white-lead. I think it cannot; but still I think it is the duty of those who are engaged in art to weigh in the balance the disadvantages of both substances. I think I showed you the other evening, and I shall show you again to-night, that white-lead is a substance which loses its colour, and, in time, loses that for which we most prize it, viz., its body. Now, zinc-white does not do that, and if there is a difficulty in employing it in the first instance, still it is better to employ it than to use a substance which is liable to such destructive influences as white-lead. Do not let it be understood for one moment that I am attempting to make a crusade against white-lead. I have no object in speaking against it, but my desire is that the works of artists, whether those engaged in high art or decorative art, or whether they be simply house painters, should be performed with materials which will effect as perfectly as possible the objects which they wish to attain. If a wall is painted with white-lead, it can be finished with zinc-white. I shall be met with this objection, perhaps, by practical painters, that the zinc-white will not cover well upon the lead. That is true, if the flatting is done in the ordinary way, but if you will simply allow a man to follow the person flatting with a large stippling-brush and stipple, then you will get your covering sufficiently solid for all purposes, and it will have a better effect upon the eye than if it were absolutely solid, for the small interstices that are left between its particles show the ground well, and give transparency to the effect of the mass upon the eye. We know well how beautifully stippled work looks. We know also that when we paint with a mixture of colours, intending to produce a certain tint, that the tint produced is not as satisfactory as if we paint with these colours separately, one upon another. Why is it that artists glaze? It is simply that the ground colour underneath may have its value through the superimposed tint. From what we said about the effect of colour upon our visual organs the other night, viz., that waves of light are passing to a certain substance that absorbs all but one, or nearly all but one, and sends back that to our eyes, it follows that if we get wave motions of two distinct colours acting upon the retina, the sensation is much more satisfactory to us than if we got them so mixed that the wave motions act upon one another, and neutralise one another to produce that effect. If we desire to paint a wall with a sort of sage green, or Quaker green, as it is sometimes called, we know that by mixing a certain green pigment with a certain amount of red colour and yellow, we shall produce such an effect; but if we paint the wall first with red, and then stipple the green pigment over it, we shall have small spots of red sending back their reflected rays to our eyes, and the effect of such a treatment is far more agreeable, and the colour far more beautiful, and the tint far more pure, than if we were to mix all the pigments together which produce that colour, and lay them on all at once.

I think I alluded in a previous lecture to this fact, that the subjects in nature which we paint are none of them flat-coloured. The green leaves we see, and depict in our pictures, are not really all green, for, if you examine them under the microscope, you will find that they derive their colour from a number of small particles of green floating in an almost colourless menstruum, so to speak. Again, the human face represents to us a certain colour, but there is no large surface of that face which is of the colour which we see. There is a colourless skin over a skin which gives colour to the human physiognomy, and therefore the light, before it is reflected back to our eyes, has to undergo refraction. Then again, when we look at the skin beneath, and examine it, we find that the colour is not evenly distributed over its surface; that here and there are spots, more or less near one another, of red, and others yellow, the red derived from the blood-vessels, and the yellow derived from fatty matters, and so forth, so that what we see is not a flat colour; and the way in which we represent that, I humbly suggest, should not be according to a simple flat treatment of combined colours, but the effect should be obtained from a judicious admixture of those colours by a process somewhat akin to stippling.

We will now put underneath this bell-jar some pieces of paper painted with different pigments, about which I have already spoken. Amongst others there is here, zinc-white ground in oil, and zinc-white in water, white-lead in oil, white-lead ground in water, and also some chromates of lead. I mentioned to you the formation of chromates of lead at the conclusion of our last lecture. I will put these underneath this glass, and allow sulphuretted hydrogen gas to escape, and you will see in a short time the effect which it produces upon these different pigments. The test to which I am putting these lead colours now is not the test to which they are submitted in actual practice. Here they are being acted upon before they have become perfectly dry, and this makes some difference in the rapidity of the action. At our next lecture I shall have to speak to you upon vehicles and media, and the process of oxidisation which takes place in oil, serving as a protection to the colours used with oil. When time has been allowed for the colour to dry, it is protected by the oil which is used as its vehicle, and it takes longer to affect colours with this sulphuretted hydrogen gas that have been painted for a long time. But what we see taking place rapidly here does take place slowly with pictures that have been painted and allowed to dry. I must make these remarks now to protect myself from the charge of inconsistency when I speak later on, as I shall do, of those protective influences which are produced by oxidisation of oils.

I showed you, on Monday night last, that the chromates of lead were produced by precipitating a lead salt with a salt of chromic acid, and that the difference in tint was owing to the different quantity of the chromic acid which was present in the salt. I mentioned to you that the orange chrome was a basic chromate of lead, and I think I said that basic chromate of lead contained more of the chromic acid than is present in the lemon chrome. I also stated that the lightest chrome contained some sulphate of lead precipitated with the chromate. All these colours contain lead, and are therefore liable to the influence of sulphuretted hydrogen. Now, if a chromate of lead is bought hap-hazard anywhere, it may or may not be pure, but, generally speaking, unless the chromates are obtained from makers who are careful in the preparation of their colours, they contain many other substances besides chromate of lead. For instance, they contain a quantity of the solution, in a dry state, from which they have been precipitated, and are by no means pure. I need hardly mention to you also that there is an inducement to men who sell cheap colours to adulterate them, to bring them down with whitening, and so forth. In that case the chrome loses its body; if it is brought down with lead sulphate it has more body, but when chrome yellows are prepared and mixed with good oils, and put on carefully, and those oils have time allowed them to become oxidised, perfectly dry in fact—I do not mean dry in the sense in which an artist considers a painting dry, but perfectly hard—then the action of sulphuretted hydrogen in the atmosphere will not be of such great moment as if the colours are impure, or if they are submitted to the influence of that deleterious gas before they have become perfectly hard.

But, then, ladies and gentlemen, is it well, if we can get other colours that will answer our purpose, to use these colours which are, under some circumstances, and in time under nearly all circumstances, liable to be destroyed by the ordinary destructive influences with which they meet in the atmosphere. I imagine that the object of everyone is to produce pictures which will last not only for our lives, but for ages to come; and, therefore, what I am most anxious to enforce upon those engaged in art, whether in the higher branches or the lower, is this, that they should try as far as they can to understand the composition of the colours which they employ chemically, and also the molecular arrangement of those colours, that is, the influence that physical agents, such as heat, have upon them, and that by understanding them they may be able to single out and select those which will be the most enduring, as well as those which will most easily enable them to produce their effects.

Now, another objection to the chromes is this, they are soluble in alkali, and so are many other colours. If a painting is painted with chromes, and if that painting be washed with an alkaline soap, it is quite certain that some of the chromates will be dissolved up. Suppose the minute and delicate touches, upon which the artist depended for some of the best effects of his picture, are removed with soap and water, what a serious matter it is. I would recommend, and I fancy all of you will accept the recommendation, that no painting should ever be washed with soap and water at all; but there are certain colours which will withstand the action of soap, even if it is intensely alkaline, while others will not. Here is a precipitate of lemon chrome, and if we act upon this with potash or soda, it dissolves up the yellow precipitate, and destroys it altogether. I think that is another argument against the use of chromes.

But if we are not to use chromes, what yellows are we to use? There is a very beautiful yellow, which you all know by name, and have had great experience in the use of, no doubt, the cadmium yellow. This yellow is a most permanent colour. It is a sulphide of the metal cadmium, is thoroughly permanent, and may be obtained in several tints. I think there are two different tints of it on the table. It is made by the precipitation of a salt of cadmium by sulphuretted hydrogen. The salt I have here is some of the nitrate, and I have here a solution of sulphuretted hydrogen. I use this instead of the gas, that you may not have the unpleasant odour of it in the room. You see that, on adding the solution, we immediately get a yellow precipitate. It is lighter than the specimens in the bottles on the table, but this will get a little darker, and by proportioning the precipitant to the quantity of material to be precipitated, we can obtain pretty much the tint we desire, although there is considerable difficulty in the process, and it requires great practice to do it with nicety. Mr. Newton told me himself that their great difficulty was to precipitate the cadmium according to the desired tint. Although I am acquainted with the chemistry of colours, I should not like to undertake to make any colours at all approaching in beauty those in the bottles on the table.

There is another yellow which is also a most beautiful colour, and which has the advantage of being permanent, except under the influence of one particular re-agent. It is called aureolin yellow, and it is a double salt—a nitrite of potassium and of cobalt. I have here a solution of chloride of cobalt, and here I have some carbonate of potash. The carbonate of potash, on being mixed with the chloride of cobalt, precipitates carbonate of cobalt. Here, again, I have some acetic acid or hydric acetate, which I will add until the precipitated carbonate is dissolved. You see the carbonic acid is escaping freely, and in a few moments the precipitate will be dissolved. Now, to the clear solution I will add some of the nitrate of sodium. It requires to be warmed, and then, when the effervescence has subsided, I think you will find that we shall get a yellow precipitate. This is really a permanent colour, except under the influence of strong alkalies, but in that respect it unfortunately resembles the chromates of which I have just been speaking. However, it is so permanent, except under this influence, that one may safely recommend its use. Perhaps you will say to me—But, then, suppose the painting be washed with soap and water, what then? Let me ask you to wait for the answer to this question until next Monday evening, when I shall have to speak of vehicles; but, at all events, it is not affected by sulphuretted hydrogen, as the lead salts are.*

I will now take out the pieces of paper which we put under the bell-jar, where they were submitted to a very violent test, and you clearly see the effect produced upon them by sulphuretted hydrogen gas. They are all very much affected, except the zinc-white, which has stood the test well, and would stand it for any length of time, simply because the sulphide of zinc is itself white. I precipitated a solution of the oxide of zinc with sulphuretted hydrogen, and the precipitate was perfectly white.

The next colour is King's yellow. This, I believe, is not a favourite with artists; but one of the reasons why I introduce it to your notice is because it enables me to show you, by an easy process, the method of analysing colours. If those who are engaged in art would only devote a day or two a week for a few months to practising chemical analysis, they would be able to analyse the colours which they are using, and to know their composition, and this would be giving them information of very great value.

I will show you, because the analysis is a very simple one, the method in which a chemist would set to work to analyse a colour which was brought before him. Of course he would first look at it, and if the colour was yellow, he would not think of looking for copper or for iron. The colour of the pigment itself leads him to select certain things for which he would look. To a chemist's eye, a yellow colour suggests the idea of certain things; first of all, cadmium, and he would soon ascertain whether it was cadmium or not by its solubility in alkalies. For instance, the yellow precipitate which I got just now, the cadmium yellow, is insoluble in ammonia. This reaction would settle the question of cadmium at once. He would immediately go from that to the sulphide of arsenic, and would set about testing for arsenic, and it is that which I am now going to do. King's yellow is a sulphide of arsenic, mixed with a certain portion of a white powder called arsenious acid, the common arsenic of the shops, which is the lower oxide of arsenic. I will take a small quantity of arsenious acid and mix it with cyanide of potassium and carbonate of soda, the latter having been previously dried, so as to drive off the water of crystallisation. As soon as they are mixed together and put into a small reduction tube, we will subject them to heat, and I hope you will be able to see from all parts of the room that a black sublimate is formed, which is a sublimate of metallic arsenic. I perform this experiment first, to show you that we get exactly the same result by treating some of the King's yellow in the same way. I do not know whether this pigment is now a favourite amongst artists or not, but in the days when I was engaged in artistic pursuits it was frequently used, as in water colours. I do not, however, introduce it so much to recommend it as a pigment—although it is perfectly permanent under the action of sulphuretted hydrogen, which formed it, and therefore cannot injure it or change its tint—but to show you the analysis of it. Here is the arsenious acid, mixed with the cyanide of potassium and carbonate of soda; and as I heat this mixture you will see a black sublimate thrown up the tube, which will be a ring of metallic arsenic. Those who look at it after the lecture will see that it has a thoroughly metallic lustre. This is one of the tests to which all compounds of arsenic are submitted. Here, again, is some King's yellow, which has been supplied me by Messrs. Winsor and Newton, and we will treat that in the same way. If you notice, you will see that there is a black ring of metallic arsenic thrown up this tube also. A small quantity of the sulphide sublimed up first; that is, because in performing the experiment in the hurried way in which we are obliged to do in lectures, hardly sufficient of the cyanide of potassium was put in to decompose the whole of it at once, but we have a ring of metallic arsenic sufficiently clear and distinct for our purpose. I do not mean to say that a chemist would be perfectly satisfied with this, and would rest here, saying I am sure this is arsenic. He would feel sure of it himself, but he would try other tests in order to prove conclusively whether he had arsenic present or not. For instance, if we take that black sublimate, heat it gradually in a current of air, we convert it into a substance similar to that which we have here on the table, this white arsenic acid. If we dissolve some of it up in water, and submit it to a number of other reagents, we should get confirmatory tests. I need not do more than mention them to you, as chemical analysis is not the subject of this lecture. What I have done is sufficient to show you the method in which chemists operate. This trial test would prove to us in an instant whether the substance under analysis contained arsenic or not. Before we conclude this evening's lecture, I shall have the pleasure of showing you another analysis of a pigment, and there again I shall be able to point out other methods which we pursue under different circumstances.

We pass on next to the reds. Red-lead is rarely, I believe, used by artists. I was told an anecdote of the great Turner the other day, that he went into the shop of a colour manufacturer some years back, and asked him for some red-lead. The person who served him with it cautioned him against using red-lead, as it was a colour that would not stand. His reply, I believe, was this—"Sir, your business is to grind colours, it is mine to use them." However, red-lead is a colour that will not stand.

We have seen that the other compounds of lead, such as the chromates and white-lead, will not stand the action of sulphuretted hydrogen, neither will red lead. And again, red-lead is liable to this objection, the oils with which it is mixed saponify, and if it have opacity when first put on, it will lose that opacity in the course of time. Red-lead, then, has its disadvantages, and I cannot pass it over without a word of remark. Mixed with oil, it undergoes a more rapid oxidisation, and so it is found to be very useful in painting iron-work and cement-work, as it forms a good protective covering, and for these purposes it is very useful. But the object I have in view in mentioning red-lead this evening is to show you that it is composed of two oxides of lead, not a chemical compound, at least, we believe not. It is a peculiar mixture of these two oxides, and the one can be easily separated from the other. I have put a small quantity of this red-lead into a foot-glass, and will treat it with an acid liquid, nitric acid, and as you see, its colour changes very rapidly. From a red it becomes brown, and the reason is this. There is an oxide of lead called litharge, the protoxide of lead. This litharge, together with that brown oxide, formed the red-lead, and when this nitric is put in, it dissolves the litharge, and leaves the brown oxide undissolved. There is another way of getting this brown oxide, and it is to lead up to that I have shown you this experiment, because I wish to show you what I think will prove to be an extremely useful colour for artists. I will take a solution of lead acetate, and add to that some caustic soda. There is a precipitate formed, which is called lead hydrate; it is, as you see, soluble in excess of the caustic soda. If I boil this with some chlorine water, the lead oxide, or hydrate, which was dissolved up, and which is chemically the same as this protoxide of lead, will become converted into brown bin-oxide of lead, and during the conversion in the first stages of it, you will see, if the experiment succeeds, that the colour will be yellow, and then that the colour will change from yellow gradually to a rich brown. The bin-oxide of lead obtained by the first method is of a puce or a purple tint, but made in this way it is yellow, passing on into a deep brown. If it commences as yellow, and ends as a brown, it may be presumed, I think, that if you take the brown pigment and dilute it, you will get the yellow tint at last. I believe that it is much desired by artists to have a brown which will wash down to a true yellow, and also that the yellow shall be transparent. I tried an experiment with this a year or two back, and I have recommended it to several gentlemen, and I believe they were thoroughly satisfied with it. It will take some little time to warm the solution, but you will soon see the yellow tint, and the brown precipitate will be thrown down. But, then, perhaps I shall be met again with this remark, that it is a lead colour, therefore it is subject to the destructive influences of sulphuretted hydrogen. That is true, but I believe I shall be able to show you in my next lecture how, by the use of certain vehicles, this destructive influence may be very much prevented, and perhaps you will allow me to defer until then my defence of this lead colour. You will see it now beginning to turn yellow. Perhaps you will say it is rather a dirty yellow, but it is beginning to get yellow gradually, and it will get darker and darker, until at last we shall get a brown precipitate.

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* Well-prepared aureolin yellow does resist the action of caustic alkalies, as will be shown in next lecture.

There is a colour used commonly by artists, decorative painters, and house painters; it is an extremely beautiful colour; I mean vermillion. At our first meeting I told you that it was nothing else but the black sulphide of mercury, having a different molecular arrangement, or different aggregations of the particles, to that of the black sulphide. We sublimed some of the black sulphide, and saw that it sublimed with a metallic lustre, and on crushing it a brick-red powder was produced, which brick-red powder would have become of a purer tint had it been ground finer in water. This vermillion is nothing else but that black substance. The manufacture of vermillion is one which has been kept secret by vermillion makers. Chinese vermillion was for many years considered the very best brought into the market, on account of its beautiful carmine tint, but of late years English manufacturers have been able to make it even better than the Chinese. There are some specimens on the table from Messrs. Berger, who have been kind enough to send some as beautiful as any that can be seen anywhere; and there are some specimens amongst those of Messrs. Winsor and Newton's which are, I think, equally beautiful; and they are both of English manufacture, at least, they are not Chinese. This vermillion is made in several ways. There is the dry method, and there is the wet method. In the dry method, a quantity of mercury is triturated with a certain quantity of flowers of sulphur. The whole then forms a black mass. This is the Dutch method. There are long, narrow, earthern pots, heated at the bottom and cooler at the top, into which it is thrown from time to time. These pots are covered over with plates of metal, and the whole is heated up to a sufficient temperature to cause the sulphide of mercury to sublime. It sublimes in a manner unlike that which we sublimed in the glass tube, inasmuch as it sublimes red, and the best portions of the red sublimate are then picked out, washed, and prepared for the market. In this way it is made by the dry process. Then there is the wet method, and I believe it is thought by many that the Chinese adopt this latter process. Mercury and sulphur are triturated together just the same as before, but then they are boiled in a solution of caustic potash, and are heated for a considerable length of time in this way. At last the colour of the vermillion comes out, and when it has reached the proper tint the operation is stopped. If they go beyond the proper time of heating, or allow the temperature to rise too high, then the colour becomes brown, and the brilliant red disappears. You see that obtaining the proper tint is a matter of time, and that great care is required in the process; a little more heating will destroy the colour, and the heat to which the whole is raised is only about 50° cent. A little above this the colour is destroyed entirely. What I want to argue from this is, that if the colour of a pigment depends upon such a delicate manipulation as this, you have evidently a substance which is liable to detriment by atmospheric influences, a rise of temperature, or what not; and we do know, I think, experimentally, that one of the faults of vermilion as a pigment is, that it in time assumes a brown colour. It is a pity that so brilliant and useful a colour should have any doubt thrown upon its durability; but I think any artists who may be present, and those practically engaged in the manufacture of colours, will agree with me that vermilions do, in the course of time, turn to a brownish tint. I believe that this is owing to the fact that the red colour is given to the sulphide by keeping it for a definite length of time at a certain temperature, whereas it would have been destroyed if it had been heated to a higher temperature, or for a longer time.

Again, vermillion is a colour which is very often adulterated, and it is sometimes adulterated with a colour which is somewhat near it in tint. This is a very beautiful specimen, produced by Messrs. Blundell and Spencer, of what is called Persian red. I think, at a distance, you would hardly be able to tell it from a fair specimen of vermillion; but if we take a small portion, and rub it up in a mortar, the brilliant vermillion-looking red will be destroyed, and we shall get a simple orange red left behind. This will show us that the colour of a pigment depends upon the arrangement of the particles, in the same way as in the case of the black sulphide of mercury, which we found changed colour by trituration. The vermillion would not be altered in colour by being rubbed up in a mortar, nor would it be changed by sulphuretted hydrogen, for it is itself a sulphide; but this Persian red is not a vermillion at all, it has no single constituent of what composes vermillion. It is not a mercurial compound at all, but is a chromate of lead made in a particular way, deeper in colour than the orange chrome. It is made by adding small quantities of bi-chromate of potash to carbonate of lead, kept at an even temperature, and this process is kept on until the required tint is arrived at. Vermillion is sometimes adulterated with this colour, and sometimes with red-lead, sometimes with brick-dust, and sometimes its colour is brought up with what is called dragon's blood. It is quite clear that if a person practically engaged in art were able to test the purity of his vermillion, it would be a great advantage. It would be almost impossible for me to perform all the tests for these substances, for I have not time to go through them, but I will give you one or two hints on the subject. If the adulteration is with chromate of lead, the rubbing-up of the vermillion will prove it, as the colour will lose its brilliancy. If the impurity happens to be red-lead, if you boil it with hydrochloric acid, you will get chlorine gas evolved. If it is brick-dust, you may prove it by sublimation, the sulphide of mercury will go up the tube, and the brick-dust will remain behind at the bottom. If the colour has been brought up with dragon's blood, you will, on subliming it, smell the odour of burning organic matter.

I have not time to touch upon the madders and lakes, and they are beyond the scope of the present lectures, involving considerations which do not enter into them. You all know that the lakes are excessively fugitive, as also the carmines, and that madders are permanent.

We now come to the greens. Here is an emerald green in this bottle. It is a compound of arsenic and copper; and Mr. Taylor will submit some of it to the treatment I am going to describe, which will prove that it is a compound of these two metals. Here, again, is a green pigment, which is not often used, but of which I shall have to speak in subsequent lectures. It is the green oxide of chromium. This is a laboratory specimen, not an artist's specimen, the colour not being at all attractive, but when carefully prepared in a particular way, you may get various tints of green that are exceedingly beautiful from this oxide of chromium. It has this advantage, that it is absolutely stable; no ordinary agent will decompose it. It is this green substance which gives the beautiful colour to certain green glasses; it will stand the heat of the glass pot, in fact, it will stand almost any test to which it may be subjected without losing its colour. I mention this because it is a very valuable colour. I will not speak more of it now, because in speaking of fresco and siliceous painting I shall have to do so more at length.

The process going on here with the emerald green is this. It is a compound of arsenic and copper. Into this retort Mr. Taylor has put some hydrochloric acid along with the emerald green. Arsenic has the property of forming volatile compounds with chlorine, and the arsenic will be carried over into this little flask which he has in his hand as a chloride of arsenic. It will be dissolved in the water, and when we add sulphuretted hydrogen to the water, we shall get a yellow precipitate, of the colour of King's yellow. The residue remaining behind will be a salt of copper, and I will show you how we shall be able to prove it. If I take a solution of a copper salt, for instance, some sulphate of copper, or blue vitriol, such as I have here, and dilute it so that the colour nearly disappears, and then if to this I add some ammonia, I shall, in the first instance, get a precipitate, and then that will be dissolved, and we shall have a deep purple-coloured liquid. This is a very good test for copper. There is only one other metal which will do the same, and that is nickel, but it does not give as blue a tint as the copper. First, you see we get a dirty blue precipitate, and by adding more ammonia we get a deep purple liquid. That is a test for copper. There are other tests as well, which will detect much more minute traces of the metal than this. For instance, if a salt of copper is present in ever so small a quantity in a solution, and you add to it some of this hydrochloric acid, and then put in a solution of ferrocyanide of potassium, you will get a brown precipitate. Here we have a solution of chloride of arsenic in water obtained from the emerald green. We will put this into a glass, and add some sulphuretted hydrogen water to it. You see we get a copious yellow precipitate, which is the colouring matter of King's yellow. Of course, as I said before, when speaking of testing King's yellow, we should submit this precipitate to further reactions, for example, we should test its solubility in sulphide of ammonium, for if I add ammonia to this it dissolves. That is a peculiar property of sulphide of arsenic, and this property separates it from the sulphide of cadmium, which does not dissolve under these circumstances. We could go on with other tests to prove that it is really arsenic, but that would be sufficient to tell any chemist, and it would tell you, if you only practised analytical chemistry for a short time, that the substance you were analysing contained arsenic. Here is what was left in the retort. This I said was copper; and now we will put it to the test to which we put the liquid, which we knew contained a solution of copper. You see we get a blue colour, as we did in that instance.

In this way we are able to separate out in a short space of time the constituents of the colour, emerald green. It is a colour which has great stability. It stands well, and I would recommend it to your use most confidently, from its permanency. There is, however, this objection; that it is a difficult colour to use when we have a large flat surface in decorative painting to cover. It must be stippled in order to get it to lie well on the surface, but if it is stippled on a ground of proper green, it gives a sort of beautiful bloom, such as you see on greengages, which is extremely beautiful. Moreover, care must be taken in mixing it with any other colour, such as cadmium yellow.

Here is some more of this copper salt, and I will show you the precipitate with ferrocyanide of potassium. You see we get a deep brown precipitate.

Now, we pass on to the blues, Prussian blue and Chinese blue, which is a variety of it well known to you all. I will now show you, before we conclude, the method of precipitating Prussian blue. In this bottle there is a solution of what is commonly called the yellow prussiate of potash. It is a ferrocyanide of potassium. When a salt of the higher oxide of iron is added to this ferrocyanide of potassium, this blue compound is formed, which is termed Prussian blue. I must make it very dilute, in order to show it to you, as the colour is so strong it will hardly show blue without I do so. I will take some of this sesque-salt of iron, and when this is added to the ferrocyanide we shall get a blue precipitate formed, which is Prussian blue; but the Prussian blue of commerce is not made in this way. A ferrous salt, the proto-sulphate of iron, is added to ferrocyanide of potassium, and then we do not get the deep colour we did in the last experiment, but we get a sort of dirty blue, a kind of bluish white, thrown down. You see we do not get that beautiful colour, but a sort of dirty, pale, greenish blue. If to this we add some of this liquid, bichromate of potash, and some of this oil of vitriol, we then get the deep blue colour formed at once. I am afraid you can hardly see the colour, it is so intensely blue now, whereas before it was a dirty, greenish blue. That is the way Prussian blue is made commercially on a large scale. It is a colour which is permanent in acid liquids, but which is destroyed by alkalies, and therefore it is liable to the objection to which the chromates are liable. If I add a solution of caustic soda to it, the colour disappears at once, or it would if I added more of the solution, for I have not sufficient of the re-agent here to show you the experiment perfectly. However, any one who will look at this after the lecture will see it is no longer a blue liquid.

Ultramarine blue is well known to all of us, from the beauty of its colour, as well as from its great cost, and also from its permanency. Ultramarine blue was formerly, and is still, obtained from lapis lazuli, by a long and elaborate process. This valuable mineral is broken up into small pieces, about the size of hazel nuts, heated, and then the pieces are quenched with some vinegar. This is in order to render them friable, and to dissolve off from them any carbonate of calcium, or common chalk, which might adhere to them. The substance is then ground up to a fine powder, with syrup of sugar and dragon's blood, and with some resinous matters. It is afterwards made up into a mass, with the resinous matters, and allowed to stand for some length of time. These masses are placed in warm water, and the warm water dissolves out very gradually the finely powdered lapis lazuli. The material, to begin with, is very expensive, and the process is also expensive, which accounts for the great cost of this colour. Of late years, however, artificial ultramarine has been prepared which nearly equals in brilliancy and purity of colour the natural ultramarine. This is a specimen here. It is made by heating together charcoal, soda, or carbonate of soda, sulphur, and a substance called kaolin, a material used in the manufacture of china porcelain. It is a silicate of alumina. These are mixed in proper proportions, and the whole is put into a crucible, which is luted down, that is, the cover is put on and bound down with fire clay, and heated for three and a half hours in a furnace. Afterwards, it is found that a green mass remains behind. This mass is what is called green ultramarine, of which there is a specimen on the table. The manufacture of ultramarine is carried on principally in Germany. This green ultramarine, of which we have a specimen here, when it is heated for some time to a red, or rather white heat, changes its colour from green to blue. The green ultramarine is taken out from the pots, and is oxidised by the action of the oxygen of the air at a high temperature, and so changes from green to blue. What is the colouring matter of the ultramarine green is not known. Chemists have not discovered what it is, although they have made many experiments. Although we do not know what gives the colour to ultramarine, we know that it is a most permanent pigment. It may be used with confidence; it will stand the test of alkalies. It is a colour that we shall have to speak of more on Monday evening next, when we deal with fresco and siliceous painting. It is a silicate, and when you have pigments that are silicates, you may be sure that they will stand the action of almost any destructive influence that may be fairly brought to bear upon them, or that they may be likely to be submitted to in actual practice.

Another blue is the cobalt blue, called smalt, and with that I will conclude this evening's lecture. It is not the oxide of cobalt, as many people imagine, for that is black. It is not the hydrated oxide of cobalt, for if you remember when I experimented with some cobalt, a little time ago, to make aureolin yellow, the precipitate went down of a pinkish colour. That was a case of carbonate, but if I had experimented with some caustic soda, or potash, we should have had a precipitate of exactly the same colour. Cobalt blue, or smalt, is a silicate, and, therefore, it is a permanent colour. It is nothing else but deep blue glass ground up. Oxide of cobalt, when used in very small quantities, imparts an intensely deep blue colour to any silicate. In Saxony, this cobalt is made to a large extent, and I should have been glad, if time had permitted, to have given you a description of the process, but I must leave it for want of time. It is made in the most careful manner. I had also an experiment prepared to show you an analogous operation to that performed in the smalt works in Saxony, but I must defer it to another lecture.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions: —

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

The following subscriptions have been received:—

	£	s.		£	s.
Capper, Sons, & Co.	1	1	John Corbett	1	1
Cassell, Petter, and Galpin	3	3	Arthur H. Cox, Son, and Co.	1	1
F. Cox and Son	1	1	John Shields	0	10
Dunn, Square & Co.	1	1	W. F. Stanley	0	5
Eugene Rimmel	1	1	Thresher & Glenny	3	3
George Rowney and Co.	1	1	Travers & Sons	2	2
			Vyse & Sons	5	5

The following firms have also promised their support and co-operation:—

Leaf, Sin, and Co.
J. and R. Morley (promised donation, £5 5s.)
Foster, Porter, and Co.
Francis Bennoch (promised donation, £1 10s.)

The Council of the Royal Horticultural Society have appointed Mr. William Marshall and Mr. George F. Wilson, F.R.S., and the Seeds Trade Committee have appointed Dr. Maxwell T. Masters, F.R.S., and Mr. Peter Barr (Barr and Sugden), to represent the interests of their respective bodies upon the Postal Committee of the Society.

The Gardeners' Chronicle says:—"The committee appointed at a public meeting of representatives of the seed and nursery trades to take steps to restore the old sample post, or to induce the authorities to adopt a parcel post, has resolved, while maintaining independent action, to act, so far as possible, in concert with the Society of Arts and Manchester Trade Association. We may remark that, as we ventured to predict would be the case, the revenue of the Post-office has materially diminished during the last quarter. If this diminution be really traceable, as we have no doubt it is, to a large extent, to recent unwise restrictions, we may speedily hope for the adoption of a more liberal policy."

Extension of the use of Postal Cards.—It is thought probable that the postal card system will be extended to the Continent. Already the Prussian government has entered into arrangements with several other Continental governments, and is also negociating with our own in order to diffuse the benefits of this invention.

The Postal-card Grievance.—A letter in the *Times*, from Messrs. Chipperfield, and Co., of Southampton, says:—"Sir,—One side of a Postal-card may be written on all over, or printed all over, or partly written or partly printed. To obviate the necessity for writing names and addresses by having them printed is an immense saving of time and trouble; but printing, to be done cheaply, must be done in long numbers, Twenty thousand cards could possibly be printed for 40s., but the purchase of 20,000 cards would necessitate an immediate outlay of nearly £42. In order to avoid the trouble on the one hand, and the outlay of over £40 on the other, we had 20,000 small address labels printed at a cost of £1, intending to stick one on each card, but on essaying to so employ them we had the vexation to find that all our correspondents were charged 1d. additional postage on their delivery. If this be in accordance with the letter it can hardly be with the spirit of the new regulations, and appears a monstrous absurdity.

A Three-halfpenny Postage.

Sir,—The halfpenny stamps have come so much into use that two are often placed on an ordinary letter instead of one penny one. This suggests a three-halfpenny postage. Often a letter is only just over a penny, the mere affixing the stamp perhaps turning the scale, and then one has to pay twopence; that is, one has to put on another stamp. A three-halfpenny postage would, I should think, be very acceptable to the public.—I am, &c., Epsilon.

[A three-halfpenny stamp is actually in use, but is not available for letters.—Ed. *J. S. A.*]

ANNUAL INTERNATIONAL EXHIBITIONS.

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The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel. Scott, R.E., secretary.

Class 10.—Educational Works and Appliances.—The following committees have met, and appointed the Committees of Selection in their respective divisions:—

Section A.—*School Buildings, Fittings, Fixtures, &c.*
Section B.—*Books, Maps, Globes, Instruments, &c.*
Section C.—*Appliances for Physical Training, including Toys, Games, &c.*
Section D.—*Specimens and illustrations of Modes of Teaching Fine Arts, Natural History, and Physical Science.*
Sub-section Fine Art.
Sub-section Music.
Sub-section Natural History.

The Special Committee having charge of all matters connected with the education of the blind, has also met during the week.

Refreshments.—The tender of Messrs. Spiers and Pond has been accepted.

Albert Hall.—The inner glass roof is being rapidly proceeded with, and the scaffolding that has hitherto shut out a great portion of the daylight has been removed. This inner roof is of rolled glass, treated in a novel manner. It has from below all the appearance of being of stained glass; in reality the design is simply stencilled upon it in transparent colour. This stencilling is done in the building. A selection of music was performed by the band of the 1st Life Guards on Saturday last, in the presence of a distinguished company. A similar performance will take place to-morrow.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

WRECKS, CASUALTIES, AND LIFE-BOAT SERVICES.

The annual abstract of the disasters by shipwreck around our coasts has appeared, with its usual collection of illustrated charts. Upon some parts of the coast, where the sea has claimed its heaviest tribute of misfortunes, it is scarcely possible to place a pin's head, so thickly are the maps dotted over with wrecks and casualties. By a careful study of these markings, it is easy to distinguish the causes of loss, either partial or total, or accidents by collision, whether between steamers or sailing vessels. Other distinctive marks indicate that the means for saving life are at hand, such as the life-boat station, the rocket and mortar apparatus, and the volunteer brigades. These are very numerous along the north-eastern and eastern coasts, and well they may be, for the depths of the ocean off Yarmouth and Lowestoft, and again at the mouth of the Thames, must be thickly strewn with the *debris* of the storms.

From the remarks which accompany the return, prepared by the Marine Department of the Board of Trade, the number of wrecks, casualties, and collisions from all causes, on the coasts of the United Kingdom and in the surrounding seas, in 1869, is 2,114, or 367 more than the number reported in 1868, and 24 in excess of any previous year. Upon a retrospective review of five years, it will be seen also there is an excess of 221 over the average during that period. This number includes both British and foreign vessels, but not the numerous wrecks and casualties to British shipping occurring in all parts of the world. Of such, a separate record is given in the foreign wreck register, published at the same time. The number of vessels lost is necessarily larger then the figures given, as it must be borne in mind that in collisions two ships are often involved in damage, and, therefore, we find of the 2,114 stated, there were 2,594 ships, representing a registered tonnage of upwards of 537,000 tons. Of these, 2,163 are known to have been British ships, 1,500 being engaged in the coasting trade, and 663 employed in more distant voyages. Of the 2,114 reported, 461 were collisions, and 1,653 were wrecks and casualties other than collisions. Of the latter, 606 were wrecks, &c., resulting in total loss, and 1,047 were casualties resulting in partial damage, more or less serious. The numbers were distributed on the east coast, 1,190; south coast, 213; west coast, 495; north-west coast of Scotland, 39; Irish coast, 148; other parts, 29. From a table of the direction of the winds for the past ten years, it appears that westerly gales are far more destructive than the easterly gales, the most destructive by far being the south-west.

As regards the loss of life, the returns show that the number in 1869 was 933; this is 109 more than in 1868, and in excess of all other years, excepting 1867 and 1859, notable as the *Royal Charter* year, when the number reached 1,647. For the saving of life, the returns give a table, showing the expenses incurred since 1855 in providing apparatus, which sum has been paid by the Board of Trade out of the Mercantile Marine Fund. Of this, £43,306 was paid to the Royal National Lifeboat Institution; £10,175 for rewards, &c.; £60,707 as expenses of mortars; £1,182 for life-belts; making a total of £115,369 expended. A similar table gives gratifying results in the lives saved. There were 5,881 by lifeboats; 5,135 by rocket and mortars; 8,363 by luggers; 12,596 by ships' steamers; 18,251 escaped in ships' boats; 201 by their own exertions; 4,669 by various other means; thus making a total saved of 55,096. Against this is placed the number lost, namely, 11,476.

While the disasters will probably increase from year to year, owing to the number of ships frequenting our coast and narrow adjoining seas, it is well to know that, at the end of the year 1869, there were on the coasts of the United Kingdom 282 sets of rocket and mortar apparatus, wholly provided by the Board of Trade; there were at the same time 254 lifeboats. Of these lifeboats, 213 belong to the National Institution, and 41 to harbour authorities, beach-men, &c. There were only 559 stations supplied with Captain Ward's cork life-jackets. These are to be worn by the Coast Guard, with a view to giving them more confidence when going off to a wreck in the coast-guard boats. A list of the brigades and companies, showing the strength of each, will be found also by reference to another portion of the tables.

In the rewards that have been granted for distinguished and gallant conduct, we learn that in April, 1867, her Majesty was pleased to institute two new decorations, to be styled respectively, "The Albert Medal of the First Class," and "The Albert Medal of the Second Class," in lieu of former decorations. Since the date of this warrant, five medals of the first class, and nine medals of the second class, have been awarded. In addition to pecuniary rewards, presentations also have been made of gold and silver medals, gold and silver watches, telescopes, binocular glasses, barometers, and sextants. During the same period, seventeen rewards from foreign governments have been received by masters of British vessels and others for saving the lives of foreigners.

PENMANSHIP.

It may assist competitors for the prizes offered by the Society, and its individual members, to see the views which were announced by Mr. Grant in a lecture* on the subject, given during the Educational Exhibition of the Society, in 1855:—

"We have now arrived at the main part of the subject, namely, legibility of penmanship. Every one can tell at a glance whether a piece of writing be legible or not; but few take the trouble to inquire why some hands can be read with ease and pleasure, and other hands not without pain and difficulty. We must, therefore, discover the qualities on which legibility of writing depends.

"Writing is, of course, most legible when it can be best seen; that is, when the separate marks of which it is composed can be most readily apprehended.

"A round hand is more legible than an angular hand, because the marks of each letter in the former are kept more together when both hands occupy the same space, height, and width. The school-boy hand is, therefore, in point of legibility, much preferable to the ladies' hand, or to any other acute or angular penmanship. A single example will make this principle clear. See Figure 1.

"An upright hand is more legible than a slanting hand. The peculiar formation of the right hand, and its attachment to the body allow it to draw lines inclining to the right more easily than any others. For a similar reason, the left hand prefers lines slanting to the left. The highest degree of legibility demands a series of upright lines, like the Roman printed letters; and if to ease the hand we indulge its predilections for a slanting line, the inclination should be as small as possible. A glance at the diagram (Figure 2), in which the same word is written upright, and with three degrees of inclination, but similarly in other respects, will prove the truth of this principle. The diagram also shows that a hand which slants greatly must be written very wide if we desire it to be legible. The third example in the series can be made more legible by considerable expansion, as is shown in the fourth line. A very slanting hand, therefore, to be legible, must occupy greater space than a more upright hand; it is more sprawling, and more wasteful of room and paper. The eye has to travel farther in reading it, and the hand in writing it.

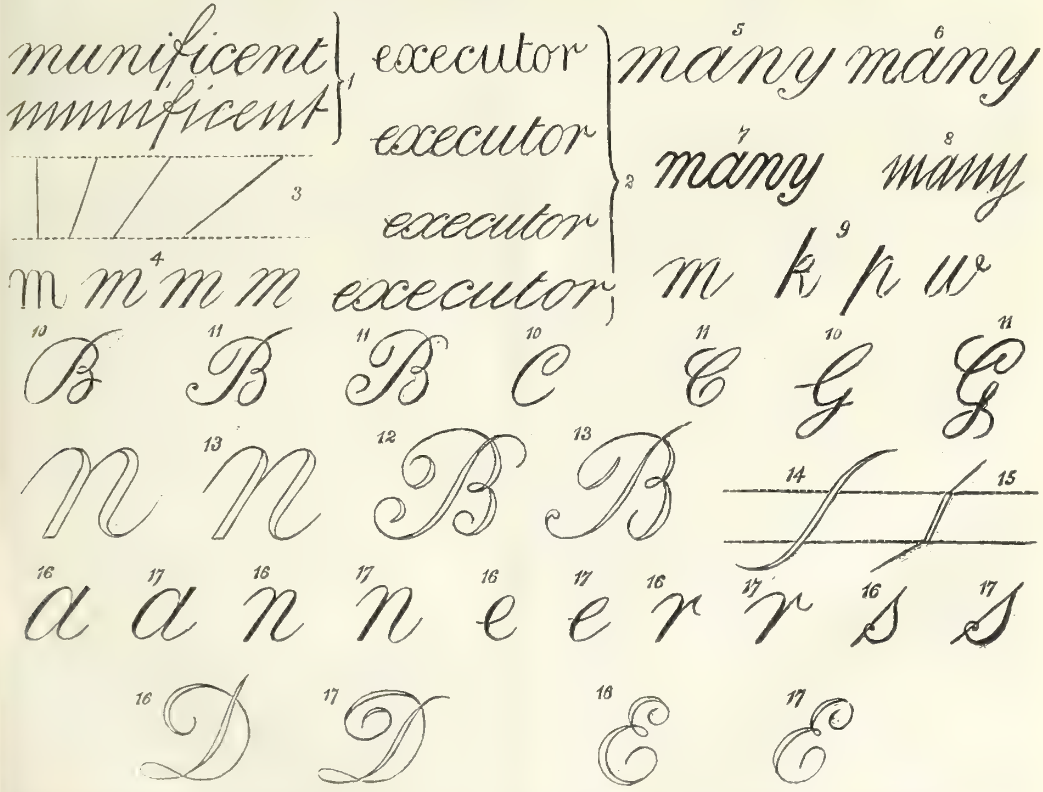
"If an upright line or letter be drawn between the same parallels, and also three lines or letters of different degrees of inclination by the side of it, we shall see still more distinctly that the highly inclined lines and letters become exceedingly long, and the letters less distinct, although the spaces between the parts of each letter be kept precisely equal. See Figures 3 and 4.

"Having examined the two principal causes of legibility in writing, namely, roundness and uprightness, we shall advert more briefly to some of the subsidiary causes which come in aid of the principal ones.

"A wide, sprawling hand is difficult to read.

"An excessively close, narrow hand fails for the opposite reason.

"Whatever other good qualities a hand may have, it may be too minute to be read with ease by the ordinary



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* Published by Routledge and Co., London, 1855.

eye, or it may be so large as to disturb the eye and the attention by frequent change of lines and pages, especially if the paper be small.

"Perfect regularity and straightness of line, and equality of space between lines, are conducive to legibility.

"The spaces between the words should be sufficiently large to keep each word distinctly separate; if these spaces be too narrow or too wide, the writing is less easily read.

"The spaces between the letters should be greater than the spaces between the parts of a letter, in order that the letters may not run into each other and create confusion. This habit, when once acquired, is attended to unconsciously, even in the most rapid hands. It is completely unknown to, or neglected by many teachers. A single example will illustrate this point. See Figures 5 and 6.

"Very long loops and tails confuse writing, for the eye not only wanders up and down in search of these stray members, but the heads and tails of one line interfere with the line above and below it. Such writing is troublesome to read, however good it may be in other respects.

"Excessively short loops and tails are also unfavourable to distinctness.

"An extraordinary difference in the thickness of the component lines of writing is unfavourable to distinctness.

"Lines very thin or very thick, in proportion to the size of the writing, are unfavourable to distinctness. In common parlance, a scratchy hand and an excessively heavy hand are comparatively illegible. See Figures 7 and 8."

THE CONDITION OF THE EXCHEQUER STANDARDS.

The fourth report of the Standards Commission gives the result of their inquiries, made in pursuance of the instructions contained in the Royal Warrant, dated 4th May, 1868. In order to fulfil the duties satisfactorily, it has been indispensable to make a searching investigation into the whole subject of the existing system of weights and measures, with the view of ascertaining any defects in the law of inspection, and of recommending alterations if needed. In the former report, dated 1st February, 1870, it was stated that the inquiries into this subject had been completed, and, in addition to the evidence then given, fuller and further information has since been collected by the Warden of the Standards.

Such a searching investigation would appear to be especially called for at the present time, in consequence of the numerous petitions complaining of the defects in the law and its administration. Much detailed evidence has been received, illustrating the practical working of the laws, and showing the various defects in the present system of inspection. As a further and important reason for making improvements at this time, the Commissioners point out that it must be considered highly desirable to establish the most efficient machinery for carrying out advantageously the changes which have been recommended in the former reports. These relate to the permissive introduction of metric weights and measures, to the abolition of the troy scale, and the substitution of either imperial or metric weights in all cases in which troy weights are now used.

In framing the recommendations, the Commissioners have kept steadily in view the great object of increasing the efficiency of the system, both of verification and of inspection, without any serious addition to the expenditure to be defrayed by the ratepayers. It is thought that a well conducted system can be carried out, that will be nearly if not quite self-supporting. The trading community in general, by whom the fees will have to be paid in the first instance, will be benefited by being less exposed to the penal consequences of the law, except in cases of fraud or culpable negligence. Conclusive evidence has been produced of the great advantages arising to the public, and particularly to the poorer classes, from the vigilant inspection of weights and measures, acting as a preventative of fraudulent and negligent practices. It appears to be of much importance that, amongst other extensions of the duties of the verifying officers, should be included the verification and stamping of all balancing and weighing machines used for trading purposes, and that such verification and stamping should be imperatively required before these instruments are legalised for use. Such a system has already been established in France and the North German Confederation, and has also been adopted in the Netherlands.

The inquiries have been extended to the discharge of other and analogous duties performed by the inspectors, some of which are of an important character. Such relate to the sale and adulteration of bread, of hay and straw, the weighing of goods and carts in markets, the sale and delivery of coals, and the testing of petroleum kept for sale.

The subject of the inspection of gas meters engaged the attention of the Commission. The system is of recent origin, having been established under an Act passed in 1859. This Act provides that inspectors should be appointed in every county, city, borough, and town supplied with gas, their duty being similar to the inspectors of weights and measures. Many complaints have since been made on the part of gas companies and the makers of gas meters, but no proposal for altering the Act has since been brought under the consideration of Parliament. A short emendatory Act was, however, passed in 1860, giving certain powers to magistrates, which have frustrated the intentions of the original Act. It is now proposed to reconsider and amend throughout, with a view of acquiring a more general and uniform mode of inspection of gas meters, such as is now established in the metropolitan district. To effect this object, it is requisite that further provisions should be made for the purpose of securing the exercise of the duties by duly competent persons, and that the appointment of the officers, and the execution of their duties, should be placed under the control and supervision of the Board of Trade, as in the case of verifiers of weights and measures.

The Commissioners propose in the next report to give the result of inquiries into the business of the Standards Department, and the duties of its officers, and more particularly into the condition of the official standards and their verification, and the efficiency of the departmental apparatus and equipments, including also the scientific comparison of standards. Under their sanction and supervision, many new standards have been constructed, and, amongst others, is a complete series of weights and measures of the metric system, the verification of all of which, in relation to the primary standards at Paris, is now nearly completed. The Commissioners confidently express a hope that the Standards Department will soon be placed in a complete condition of efficiency, for the most accurate comparisons of all weights and measures required both for commercial and general use, and for chemical and scientific purposes.

EDUCATIONAL NOTES.

The London School Board.—The third meeting of the Board was held on the 5th inst., Lord Lawrence in the chair. After a discussion on certain questions of little general interest, Mr. S. Morley, M.P., moved that a committee be appointed to inquire into the course to be adopted to obtain the returns required by the Act. These returns would have to be complete by the 15th of April, and it was deeply important to be able to accomplish the work in that period. Mr. Tresidder seconded the motion.

Canon Cromwell moved, as an amendment, that the members for the various school divisions of the metropolis be formed into local committees, for the purpose of superintending in their several divisions the inquiry, and of furnishing the returns required by the Act. The Rev. John Rodgers seconded the amendment, which was opposed by Mr. M'Cullagh Torrens, M.P., on the ground that he thought Parliament was induced to constitute this new Board because the collective intelligence of the metropolis was the proper judicature for this question, and now they proposed to go back to the vestries. They proposed, in fact, to erect the very worst species of vestry out of their own Board; in other words, to call in the aid of the vestries to obtain the required information, when it was to take it out of such hands that the Education Act was passed. Eventually, on a division, the motion of Mr. Morley was carried by a majority of 24, and a committee of 13 members was appointed, consisting of Lord Lawrence, Mr. Reed, Mr. Morley, Lord Sandon, Mr. Torrens, Mr. Stiff, the Rev. William Rogers, Canon Cromwell, Miss Davies, Dr. Angus, Mr. Langdale, Dr, Barry, and Dr. Rigg. Professor Huxley moved that a committee be appointed to consider the scheme of education to be adopted in the public elementary schools. It would be necessary to take into careful consideration the plans of education at present pursued not only in this country but abroad. They might have to consider the half-time system in schools, and whether it would be proper or not to adopt such measures in primary schools as were now practised in Germany, and how far it might be expedient to introduce into the elementary schools that kind of elementary teaching in science which had been the practice in foreign countries for some time. Mr. Alderman Cotton seconded the motion. Mr. Lafone said the time for this proposition had not yet arrived; and Mr. Hepworth Dixon objected to it on the ground that a committee would work with closed doors, while he thought this was a question which should be discussed by the whole Board, with the representatives of the press present, and under the direct influence of public opinion. At the end of a long discussion, the amendment was put, and lost by 24 votes against 21; but ultimately, at a very general suggestion, Professor Huxley consented to consider his motion postponed to a future occasion. Mr. W. H. Smith moved that it be an instruction to the Officers' Committee to consider the advisability of providing a private secretary to the chairman, and this was agreed to.

The committee of Mrs. Grey, one of the candidates for the Chelsea division, has determined to continue its labours, and to devote itself to watching the education of girls, and the promotion of the study of domestic economy, needlework, &c.

Provincial School Boards.—Orders were issued by the Department, on the 6th inst., for the election of a school board in each of the following boroughs, besides the district of the Local Board of Oxford,—Ashton-under-Lyne, Barnsley, Bath, Batley, Bodwin, Brecon, Carlisle, Chesterfield, Dartmouth, Devonport, Exeter, Huddersfield, Ipswich, Kingston-upon-Hull, Newark, Newcastle-on-Tyne, Newport (Monmouthshire), Plymouth, Pwllheli, Scarborough, South Shields, Totnes, Wakefield, Walsall, and Worcester. What promised to be a severe struggle between Church and Dissent for the election of a School Board for Canterbury has been avoided by a compromise, according to the terms of which the Church party have a majority of one. The Dissenters are represented by two Baptists (one the working men's candidate), one Wesleyan, and one member of the Jewish persuasion. Twenty-six candidates were originally nominated for the Blackburn School Board, but, as these have now been reduced to thirteen, the requisite number, there will be no contest. The Board consists of six Conservatives and Churchmen, two Roman Catholics (clergymen), and five unsectarians. The Hastings Town Council have resolved to memorialise the Department for a School Board. At Leicester, for the thirteen seats, forty-seven candidates were nominated, but only twenty-two went to the poll—namely, eight Churchmen, three Independents, two working men, one Quaker, one Unitarian, one Wesleyan, four Baptists, one Roman Catholic, and one Primitive Methodist. The election took place on the 11th inst., the polling being conducted in twenty-one polling-booths, which were opened at 9 o'clock in the morning, closing at 4 o'clock in the afternoon. A special meeting of the Bradford School Board was held on Wednesday, when a clerk, at a salary of £200 a-year, was appointed. There were 62 candidates for the office, an Independent minister being selected.

School Buildings.—A suggestion has been made that it would tend greatly to the economical and satisfactory working of the Education Act in rural parishes, if the Department were to issue a series of plans suitable for rural schools, accompanied by specifications and bills of quantities on which tenders could be invited. The supply of such plans would, it is suggested, greatly reduce architects' charges, and would also save both the Department and school boards much vexatious correspondence, now often required before imperfect plans sent up from country places can be accepted and passed. Approximate calculations, based on the ascertained cost of buildings already erected, might be appended to the plans, as a guide, in some measure, to members of school boards, against excessive charges, or the too probable temptation to accept too low tenders. Each plan would, of course, be so arranged as to meet all the requirements of the Department for the class of school for which it was intended; and as, now that we are about to establish a national system of education, the time seems propitious for the introduction of a national style of school architecture, the elevations should be designed with that object, and should be in good, if simple taste, and characteristic of the uses of the building. Promoters of schools in towns and affluent districts might still employ their own architects. The Exeter Diocesan Education Board has received applications from 60 parishes for grants towards school buildings, to accommodate 9,000 children, the entire cost being estimated at £26,000. The Board has decided to make the grants forthwith.

School Boards and Compulsion.—Mr. Matthew Arnold in a paper in the *Educational Review* (a publication the first number of which was noticed in last week's *Journal*), expresses his regret that so much of what is done, said, and written about the Education Act has, and will continue to have, no real relation at all to the design of getting the people of this country better educated, but turns, and will turn, entirely on certain points of political, social, and religious contention, interesting to the contenders, but not to the genuine educationist, who, careless of these points, will be disposed to take the Act as it stands for his given instrument towards the work which he has at heart, and to ask what use he can best make of it. The writer thinks that the dislike to rates, and to a type of school new and unfamiliar, will cause great efforts to be made to supplement the existing school-provision, where it is defective, with schools of the old kind, rather than have recourse to a school board and rate-school. Even in London, the necessity for rate-schools is being much reduced, and in country districts the necessity for such schools will, he thinks, be, by the efforts now making, done away almost entirely. In the great majority of places, therefore, the educationist will find that the case necessitating a school board and rate-schools does not arise, but the great difficulty, that of non-attendance and irregular attendance, remains in full force, and a school board can alone introduce compulsion, and this can be done without rates and rate-schools. If parents know that the power of compulsion exists ready to be put in force, they will, in most cases, send their children to school without waiting for the law to be applied against them; but it is essential they should see that the power exists. It is, therefore, desirable to get boards appointed, and to make existing school managers work cordially with them. The school board in any parish will have the power to compel attendance at some public elementary school in the place, even though the school be one not provided by the board, a school of the old type and with a private body of managers. In the cases where compulsion involves free schooling, this likewise can easily be arranged with the managers, without having recourse to a rate.

CORRESPONDENCE.

THE NAVY.

Sir,—In *Macmillan's Magazine*, of November last, is an interesting and instructive article upon the state of our navy, by Mr. Reed, the late Chief Constructor. Mr. Reed has thus rendered a great service to his country, by the unreserved expression of his sentiments upon a subject in which great diversity, if not hostility, unhappily prevails.

I should not venture to intrude in a matter that is beyond my ability, but, confidently believing as I do in the warning Mr. Reed has so ably expressed of what will come to pass, by reason of the altered conditions of naval warfare, I am induced to offer what aid I can in promulgating no thoughtless alarm.

Turning from monster war vessels armed with monstrous cannon, Mr. Reed alludes to a comparatively new naval arm that now engages our attention—the torpedo. This arm completely overturns long-established notions of naval armament and tactics in relation to naval supremacy upon the ocean. But, undesirable as the advent of such an arm may be, it is nevertheless one that we shall most undoubtedly have to deal with. Supremacy upon the ocean will not depend upon large war vessels armed with cannon, nor upon vessels for the purpose of ramming; it will depend upon small vessels of great speed and handiness, such vessels being adapted to the service of and armed with torpedoes. These vessels would not attack the top-sides of hostile vessels, they would attack their bottoms, under conditions the best suited to their mode of operation. To such a state of perfection are torpedoes for sea service now brought, that we may reasonably be assured that practicable torpedoes can be rendered so destructive as to bilge or destroy any navigable vessel that can be constructed. For, in the absence of experiment, it appears to be impossible that a vessel, large and strongly built as she may be, can withstand repeated shocks upon various parts of her hull of properly charged torpedoes applied effectively, as they would be by squadrons of torpedo craft, fighting with advantages great, indeed, when opposed to large, unwieldy vessels, and fighting, too, under the probable conditions most favourable to their system of tactics in their modes of attack.

Mr. Reed alludes to the cost of one of our monster war vessels as being equal to that of a squadron of ships —ships of the line—in Nelson's time. The cost of four torpedo craft for ocean service,* with their equipments, would not exceed that of one monster vessel; nor would the requirements of the four torpedo vessels be greater than that of one monster. But, when we come to consider the question of docking and repairing monster vessels in relation to the small torpedo craft, the difficulties of the one compared with the facilities of the other are so obvious as not to be misunderstood.

In conclusion, I would say that I have not exhausted the subject, but my letter is long enough. Should it find a place in your *Journal*, it may gain attention to a matter of vital importance—that of the protection of England's shores and her maritime commerce, depending as both do upon a navy that the progress of invention has necessitated.—I am, &c.,

John Harvey, Retired Captain, R.N.

5, Keynsham-parade, Cheltenham,
January 4th, 1871.

THE PERMANENCE OF FRESCO IN ENGLAND.

Sir,—The prominence given to the subject of the durability of fresco in this country, in the discussion of Wednesday, December 14th, 1870, and the mention of my name in connection therewith, will, I trust, be deemed an ample justification for the addition of a few useful facts which have come to my knowledge within the last few months.

With respect to my method of preserving new frescoes from, and of restoring those already damaged by, atmospheric influences, I have nothing to add to the judicious remarks of Mr. C. W. Cope, R.A., and Mr. E. M. Ward, R.A., except that, while fully concurring that nothing but the crucial test of time will finally settle its merits, it may even now be claimed for it that the principle upon which it proceeds is theoretically perfect, and that each succeeding year has increasingly established its success in practice. Before the application of the solution to the Dyce frescoes, each year, nay, each month, brought to light some fresh disaster to these great works; but since then, and after three years' additional exposure to a London atmosphere, a close and systematic inspection has failed to detect a renewal of the mischief.

With respect to the durability of fresco, it is a fact which has not yet been sufficiently recognised, that this country exhibits as many illustrations of success as of failure of the fresco method of painting; and a careful study of both has brought me to the conclusion that, if British artists will fairly learn the lessons which these failures and successes teach, the future of the art is in the highest degree encouraging. Of complete works, without flaw or sign of decay, there are, unfortunately, but few. Still, there are enough, I think, to vindicate the theoretic perfection of the process, and to show us what materials and what methods may be relied upon in future work. Moreover, the instances in which the art has succeeded in portions of a work are as numerous as the failures, and quite as striking. It would be premature to set down here in detail conclusions from an investigation which is still proceeding, but it will be encouraging to artists to know—1st. That the simple exclusion of two pigments, and a more scientific use of a third, would have prevented at least three-fourths of the failures which British artists are now regretting. 2nd. That there remains a long schedule of pigments of the failure of which no illustrations have yet been discovered. Time, and a wider investigation will probably enlarge the list, but it is already ample for all artistic purposes.

In conclusion, I would suggest to gentlemen inclined to a desponding view of the subject to remember that, though commonly spoken of as "an art," fresco-painting, in this country at least, can hardly be said to have travelled out of the region of experiment, and that, though it requires for its successful prosecution a rigid observance of important chemical conditions, the aid of the chemist has been but sparingly invoked. Under such circumstances, failures were matters of course, and the only wonder is that so many successes remain to encourage us to further effort.—I am, &c., F. Wright.

38, High-street, Kensington.

PATENT LAWS.

Sir,—I venture to trouble you with another letter on this subject. A great deal of confusion appears to exist in the minds of many of those who would abolish

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* There should be three classes of torpedo craft. One for ocean service, wooden, with coppered bottoms; one of small size, of iron, for service in the narrow seas; one still smaller, of iron, for river and harbour service.

"patent right," without even a substitute, as to what our system of patents is, and as to how it works. This is apparent from the nature of the arguments they bring forward, and from the manner in which they deal with them afterwards. If not taking up too much of your space, permit me to point out where some of them appear to lack force, and so assist in discussing this question.

It is argued, for instance, that as "necessity is the mother of invention," therefore, as soon as the necessity is felt the want will be supplied, whether patents exist or not; and, of course, as a sequence, that it is this, and not any system of patents, which brings so much inventive talent into play. Had we to deal with first principles only, the argument might have some force. In the present advanced state of the community, however, we have to deal with something vastly different from first principles. Not only do simple cause and effect, in all their different forms, come into play, but a series of final causes, as diversified as they are numerous, confront us at every turn. If, therefore, we are content to wait till dire necessity suggests improvements, we shall wait long enough. For example, in these days of railway-travelling at the rate of sixty miles an hour, where lies the necessity of communicating faster with our fellows? Again, what with gas, mineral oils, and paraffin lamps and candles, where is the necessity for having our houses more brilliantly illuminated? We may wish a greater speed, and a more brilliant light, but where is the necessity for them? And so on throughout all departments of industry. Had waiting till dire necessity suggested improvements been the order of the day, we should not now have had the electric telegraph, nor should we ever think of looking forward to the electric light.

There is, however, a necessity at work in our midst, and its influence is felt keenly by many—the necessity to live, if I may so express it. Truly, of this necessity it may be well said that it is the mother of invention. If a man is starving, there is no necessity for his taking a bow and arrow to shoot game, as there is plenty to eat within his reach, only he dare not touch it. What he wants is money, and he feels sure that, if he could only introduce some useful idea, and secure it by a patent, his object would be obtained. He sets about at once to try, and if he succeeds, it is the patent which has called the invention into existence. If, therefore, you view the argument under consideration as referring to dire necessity. it is not applicable to the circumstances of the case. If you view it as referring to those necessities at work in our midst, then it proves the very reverse of what it is brought forward to do. It proves that patents do call inventive talent into existence, and that, therefore, instead of being destroyed, the system should be fostered and improved.—I am, &c.,

H. F. ALEXANDER.

Edinburgh, December 29th, 1870.

MR. SILBER'S PAPER ON LIGHTING.

SIR,—When looking, after Mr. Silber's lecture, at his model for lighting towns, factories, houses, &c., by vegetable and mineral oils, it seemed to me, and I fancied there was a general impression, that a tank or reservoir was requisite for each separate light. Now, if this were the case, although charmed by the flame produced, I should not have attributed any very great importance to Mr. Silber's system. The matter, however, is one of such general interest, that I took the liberty of going to Wood-street, where Mr. Silber kindly showed me the system in operation, when I found the impression I had formed was erroneous. The system, as shown by Mr. Silber, in Wood-street, is this:—The pipes, &c., are disposed as for gas, and, but for the greatly superior light shown at the burners, any one might fancy that gas was being consumed. What is most essential is, that any number of lights, from one to one thousand or more can be supplied from one distributing chamber, only a few inches in length, breadth, and depth. A very perfect stop-cock and valve regulated the supply with such undeviating exactness, that if, for instance, there be one inch of oil in the distributor, there is the same depth of oil in every burner, and this depth is renewed drop by drop as consumption goes on. This seems to be one of the great causes of so undeviating a brilliancy of light, which can be produced at any moment with the same facility as with gas.

I know of many attempts having been made, during the last fifty years, to obtain the same results, but I believe they were abandoned.

I should not have troubled you with this but that, as I before said, I thought others as well as myself had erroneous impressions relative to that vital point of supply to the burners, and that I think it right to remove those impressions from the minds of other men, as they have been dispelled from my own.—I am, &c.,

P. W. P.

GENERAL NOTES.

Metric System.—The Council of the International Decimal Association, anxious to promote the teaching of the metric decimal system of weights and measures in the elementary schools of the United Kingdom, have sent the following memorandum to the Right Hon. W. E. Forster, M.P.:—"It is the impression of the Council that considerable portions of the tables of weights and measures now required to be learnt at schools are unnecessary, and that, if these be omitted, ample space and time will remain for the teaching of the metric system. Thus, troy weight will probably be abolished, in accordance with the recommendation of the Standards Commissioners, and this weight includes five denominations and four factors. Apothecaries' weight is abolished, and a modification of avoirdupois has been substituted in its place; whilst all pharmaceutical chemists are required to learn the metric system. Cloth measure is only used by drapers, yet it contains five denominations and as many factors. Wine and spirit measure differs according to the kind of wine and the country from which it comes. Then there are ale and beer measure and wool weight, each with many denominations and factors, which depend on custom rather than law or authority. Let the teachers be free to omit these altogether, and they will have ample time for the metric system, which may be taught so as to be remembered in probably a tenth part of the time. The weights and measures which are now in use, as they appear in table-books and works on arithmetic, are so needlessly multiplied and complex, and so ill-defined, that it is very desirable that, on the revision of the Revised Code, some alteration should be made with respect to the arithmetic of standard 5. The weights and measures to be taught should be distinctly stated, so that the teacher should know exactly what he has to teach, and the inspector what he has to examine. The metric system may easily be taught in all elementary schools in connection with standard 5, by altogether discarding from it such weights and measures as are not absolutely required in the ordinary transactions of life, together with those which have fractions for multipliers and divisors. The Council is further of opinion that the use of the decimal point should be taught as a part of numeration, and that it would be easier to introduce the knowledge of decimals at this early stage than to teach vulgar fractions in the usual manner. In some modern works on arithmetic, decimals follow immediately after simple addition and other rules of simple arithmetic. Compound arithmetic comes after decimals and vulgar fractions last of all.

Balloons in War.—A committee has been appointed, with Captain Beaumont, R.E., M.P., as president, and Lieutenant Grove, R.E., and Mr. Abel, F.R.S., as members, to carry out experiments on the utilisation of balloons for reconnoitering purposes.

Mining Records.—The annual return prepared by Mr. Robert Hunt shows that there were, in 1869, 245 iron-works in operation in Great Britain, with 6,243 puddling-furnaces; the number of rolling mills returned is 859. This shows two fewer iron-works than in 1868, but 340 more puddling-furnaces than in that year, and twenty-eight more rolling-mills.

Is Mechanical Stoking Possible?—The *Gentleman's Magazine* says:—"It is excusable to dwell upon painful scenes only when the pain is faced with a view to proposing remedies. We recall the loss of the turret-ship *Captain*, to excite sympathy for a class of men whose bread is earned by labours which it is scarcely fit that civilised beings should be compelled to perform. These men are stokers. We dare declare that the first exclamation which the news of the *Captain's* submersion brought to the lips of nine out of ten men familiar with steam navigation in great ships was, 'God help the poor stokers!' The aggregate sufferings of the few men of this class—probably eight or ten—who were on duty at the time must have been worse than those of all the rest of the ship's company put together. None but those who have seen the stoke-holes of our largest iron ships can know what unbearable places at the best they are. A black alley, some 60 feet long and nine or ten wide, in the lowest available part of the vessel, lighted only by a grating high up at the deck level, and walled by furnaces near the floor, and boilers nearly meeting overhead—such an outline embraces the main features of any one of them. The furnaces that line the alley will be 40 or 50 in number, their portals large enough to admit a stooping man. The floor is heaped with coal that is crashed and tumbled about till the atmosphere is a fog of coal-dust. The heat, to an ordinary man, is absolutely unbearable; how the stokers endure it is a mystery. Clothes they cannot wear; if they could stand the burden of them, the heat that comes from the fires when the doors are open for coaling would almost scorch them off their backs. The labour is incessant; no sooner is one fiery mouth satisfied than another gapes for food. Sweltering under a temperature that man was never organised to withstand—half-stifled with coal-dust; the skin's respiration choked with soot and grime; breathing an atmosphere unfit to sustain human life—these poor blackened slaves lead a harder life than many for whom, in days gone by, our sympathies were tearfully enlisted. Fear of accident is doubtless happily unknown to them, or the thoughts of what would follow from even a slight explosion in such a place would make their lives unendurable. The effects of that awful calamity upon the *Captain's* stokers are horrible to contemplate. The beam-ending of the vessel would either dislodge the boilers and furnaces, and the poor fellows would be crushed between the fiery walls of their prison, or the steam and boiler water would escape, and the fires belch from their confines, and the stoke-hole would become a chaos of burning coals and scalding-steam, and men writhing under their influence. The scene is too terrible to be dwelt upon. But to prevent the possibility of its recurrence, and to rid the stoke-hole of its normal evils—which are bad enough to call for remedy—would it not be worth while for engineers and naval architects to consider whether some plan of automatic furnace-feeding could not be devised for great marine engines? This ought to be practicable; we feel sure it could be made so. Let the ingenious men who stick at nothing in the shape of mechanical obstacles set their wits to work. Let 'another job' be found for the stokers; and let the designs for future fortresses afloat be free from that ugly black spot which indicates the stoke-hole.

Trade with Russia.—It appears, from an official report just published at St. Petersburg, that the value of the articles in which Russia traded with England, during the year 1870, was 220,000,000 roubles (£30,000,000). Her trade with other countries is much less extensive—thus, with Prussia it amounts to 165,000,000 roubles; France, 45,000,000 roubles; Austria, 21,000,000 roubles; the Hanse Towns, 17,000,000 roubles; Turkey, 17,000,000 roubles; Belgium, 12,000,000 roubles; Italy, 12,000,000 roubles; the German States, 9,000,000 roubles; Moldo-Wallachia, 9,000,000 roubles; Greece, 8,000,000 roubles; Norway and Sweden, 6,000,000 roubles.

Indian Cotton.—The second batch of six well-trained gardeners, from the Royal Gardens, Kew, for the cotton plantation in India, sailed last month; the terms granted by the Indian government are highly favourable. These men received £40 each for outfit, a free passage, and will start on a salary of £250 per annum. The term of engagement is five years, with an annual advance, from the beginning, of £50, and a free passage back at the end of it, if desired. The services of the first batch are highly spoken of, so that for the improvement of the quality, as well as for increased produce from the land, great things are now being done for Indian cotton. At the present time there are about 50 men, in different parts of India, in government and private employ, engaged in cultivating tea, cinchona, and cotton, who have been trained at Kew, and who owe their advancement to the unremitting interest taken by the authorities at that establishment in improving the vegetable products of India. By recent accounts from Calcutta, it is said that "Cotton is coming down from the country much better in quality, and in much larger quantities."

Microphotography. — "Microphotography" is the word employed to signify the manner of taking photographs of microscopic objects as they appear when magnified. The process, or at least a modification of it, was known as long ago as 1840, when daguerreotypes were taken in this manner, and the plates afterwards engraved for printing. There are two methods used at present, namely, with the microscope itself brought into a horizontal position, and the eyepiece fitted into the camera box; or by using, instead of a compound microscope, an instrument consisting of the table and stage of the microscope, so arranged as to carry the objective and necessary focussing apparatus, at the same time screwing into the flange of an ordinary camera. The most ingenious apparatus has been contrived by Dr. Woodward, of the Army Medical Bureau, in Washington, and he has found the magnesium and electric lights to yield the best results. Some of the specimens of infusoria were magnified 2,500 diameters. So much for the microphotography or photomicrography. We have now the information of the practical use of the reverse process, in reducing large objects to very minute ones, and thus obtaining a microscopic photograph. One side of the London *Times* has been reduced to the size of the finger-nail, and photographed so sharply as to be legible with the microscope. The apparatus for producing this effect is the opposite of the one just described, and it is now proposed to use it for the conveyance of intelligence into Paris, by means of carrier pigeons. Telegrams, news items, and intelligence from all parts of the world is pasted on a wall, and a microscopic photograph taken, a print of which is made upon tissue paper less than an inch square. If, by good luck, this message should reach Paris, it is enlarged according to Dr. Woodward's process, and becomes legible to the naked eye, and copies can be taken for distribution. It is curious to see a department of scientific research thus suddenly appropriated for carrying information on the common affairs of life. We certainly can never predict to what uses a scientific discovery may some day be applied.—*Scientific American.*

Silk.—The *Echo* says:—"Though the war has given a check to the silk manufacture of France, and the interruption to that branch of commerce will be felt long and painfully, there is no reason why the silk trade should be paralysed in this country. On the contrary, the English have an advantage which they did not possess heretofore, and there is reason to believe that our manufacturers will not be slow to avail themselves of the opportunity. It cannot be denied that, for a long time past, some British silks have been equal to those of Lyons, but it must also be acknowledged that they have more frequently been decidedly inferior. The difficulty has, however, been great to convince the silk-buying public of the possibility of producing from English looms a fabric as soft, brilliant, and beautiful as the deservedly celebrated silks of France; and, so strong is the prejudice, that tradesmen know it to be to their interest to say that all the silks sold by them are French, even though some have been woven in Spitalfields. We do not see why Spitalfields' weavers cannot equal French weavers, and not only those of Spitalfields, but the weavers of Derby, Macclesfield, and of all other places where silk is manufactured in England. This country can manufacture silks as good as those of any other land, and, though it has not often done so, this is probably rather due to the small encouragement our manufacturers have received than to their want of ability. Their weaving has always been able to compare favourably with that of any other country, the deficiency being rather in the quality of the raw silk than in the manufacture of the article. Any-one may see in the South Kensington Museum specimens of silk from different parts of the world, and may form the opinion that those of Valencia were the finest, though too long in the reel to suit English machines. The manufacturers of Lyons took care to suit their machines to the Spanish reel, thus having the benefit of the best raw material. Latterly, they have reeled their own silk, a very material part of the manufacture, which is never done in England. Now, much of the beauty and softness of silk depends on careful reeling, and it is only reasonable to suppose that those reelers who are also manufacturers will give more attention to this important branch of the business than those who reel for others to manufacture. Silk-reeling is light and delicate work, well suited to women and children, many of whom, unhappily, find it so difficult to find employment. And when we bear in mind that silk reeling has been going on in foreign lands for 3,000 years, it is surprising that it is not yet attempted in this country. People generally suppose the cocoons would be injured in the carriage, but that is a fallacy. The worms are first carefully destroyed, and the cocoons are then packed in perfect safety. So that our manufacturers have not only the prejudice against English silks to contend with—a prejudice frequently well founded—but the real difficulty of procuring carefully reeled silk. No doubt they sometimes obtain it; but their best efforts are too often foiled by rough and careless reeling. Notwithstanding this difficulty, some London firms have certainly succeeded in weaving moire antiques of the most delicate shades—especially the evening primrose, hitherto thought unattainable in England—which for delicacy of finish, softness, and brilliancy of colour have never been surpassed. In the time when the silk trade especially loses by the retirement of the Sovereign, it is pleasing to remark that her Majesty has always given her personal patronage to the looms of East London. It is likely that this disastrous war will force English ladies, for the first time, to purchase English silks. Now there is a fair opportunity for our English manufacturers to exercise their taste and talents. It is true that one result of the war has been greatly to increase the import of French silks, as manufacturers have been glad to sell at low prices, uncertain how long they would be able to keep their looms in action. Thus, in October, we received from France 317,359 lbs., against 174,994 lbs. last year; in November, 246,300 lbs., against 163,494 lbs. in the same month of last year; and for the eleven months ending 30th November last, 2,475,771 lbs., against 1,895,269 lbs. in 1869. But such large exports will be impossible in any near future, and it will not be ungenerous if our trade does its utmost to keep the ground it will obtain. The rich and splendid brocades which adorn some of the Spanish royal palaces, and of which the colours are fresh as if lately woven, were made many of them a hundred years ago in Spanish looms. Looms and factories were broken up and demolished during the Peninsular war, and have never since been reconstructed and rebuilt. That war caused, in fact, the total annihilation of the silk trade in Spain—for the little woven in Valencia is scarce worthy of the name—and was the cause of much improvement in French manufacture."

China Cotton Manufacture.—The *China Mail* points out that "an element in Eastern trade, not usually taken into account, is the rapidly increasing shipment of raw cotton from India to China for manufacture by the Chinese. Very large quantities arrive at Galle by British India steamers, and are trans-shipped here for the far East, a process which gives a fictitious importance to both the import and the export trade of Galle. In this way as much 1,000 bales of cotton have passed metaphorically through the Galle customs accounts in a week."

Jute—By far the most remarkable feature of Calcutta trade is, that in jute the trade has set in almost entirely to Dundee, where alone the manufacture of jute seems to have taken root. Previous to 1866, the supplies were sent almost exclusively to London and Liverpool; now the shipments are made direct to Dundee. In 1866, the shipments direct to Dundee in 300lb. bales, were 38,922; in 1867, 70,237; in 1868, 142,134; 1869, 180,002; and 1870 to date, 192,769; but as 18 large vessels are loading, the year will close with something over 300,000, and the season (end of July) with perhaps 400,000 bales, representing, in round figures, a million sterling, or close on half both the value and out-turn of this season's crop. It is not to be wondered at, with such a position, that Dundee actually at this time rules the Calcutta freight market, on which, a very few years ago, it had no perceptible influence, when, indeed, London and Liverpool struck the key-note.

Important Improvement in the Manufacture of Pig Iron.—The *Scotsman* points out that the new hot blast which has just been completed at Calderbank, and now in full blast, seems destined to revolutionise the entire future of the Scotch iron trade. The principle on which the furnace is constructed consists in raising the ordinary furnace to a height of 83 feet, covering it completely at the summit by a bell and cone appliance. This additional superstructure of 30 feet upon the old surface is divided longitudinally into four chambers or compartments, which act as retorts. There are several other arrangements, the whole resulting in great advantages in the manufacture of iron. In the ordinary hot blast furnace it requires, for the production of every ton of iron, 48 to 50 cwt. of coal; and it is now an ascertained fact that, by the Ferrie process, 30 to 35 cwt. of coal will produce a ton of rich No. 1 iron, thus effecting a saving of about 17 cwt. on every ton of iron made. This is at first a clear saving of 4s. 8d. in coal alone. Nor is this all. It is estimated that the production of every ton of pig iron necessitates the consumption of about 10 cwt. of dross, wherewith to fire the heaters, which in money value may be said to represent 1s. on the ton of iron, exclusive of firemen's wages, &c., which may be estimated at about 6d. on the ton—1s. 6d. per ton in the manufacture of iron; and if it is further estimated that the producing power of the new furnace is 32 tons in the 24 hours, we have thus a saving in coal of 4s. 8d.; in heaters, &c., 1s. 6d.—altogether 6s. 2d. on every ton of iron produced, or equal to a saving on one furnace of £3,552 a year. This is exclusive of the 1s. 6d. per ton chargeable to the producing capacity of the other three furnaces so supplied with gas, which, if reckoned by the production in tonnage at 98 tons a day, yields an additional saving of something like £1,852 a year. Such results must certainly mark a new era in the manufacture of pig iron.

Railway Accidents, their Causes and Remedy.—A correspondent of the *Manchester Courier* suggests the conveyance of goods inland by water *viâ* the canals. He says—"If we allow for the wear of rails and apparatus, the extravagant *personnel* required, the waste of power, and the losses by accident, most assuredly the railway companies are positive losers by the heavy traffic. In America they have become so satisfied of this, that they have raised the charges, although they were before higher than a large portion of the goods charges here. But if it is asked what is to be done with the goods, the answer is, that there is every possible reason for carrying them by steam-boat canals. How strange it seems, that while steam has been applied to almost every other operation, it has not yet been brought into use effectually on inland water carriage, and yet it is actually at this moment successfully used on many canals, though they were not made for it, and are in many respects unfitted for it. But if a canal were constructed or altered, so as to make it really suited for steam, the goods could be carried at ample speeds, and at a cost which is impossible on land. Even without steam, several lines of canals are carrying from a million to a million and a quarter tons a year, with the expense of animal draught, of extremely small boats, and of endless delays from the imperfection of the locks, and this in the midst of railways with all the power of steam at their back. The actual cost of transit with steam, including all items excepting the profits, on the canal, with small boats on short trips, is at this moment about 1-10th of a penny a ton per mile, even on these unsuitable lines. Were the locks sufficiently long to admit boats of two or three hundred tons burden, and provided with sluices to fill and empty in less than a minute, the cost of transit in distances of one or two hundred miles certainly would not be more than 1-20th of a penny a ton per mile, and the charge for interest, &c., on a capital of £15,000 per mile, at seven per cent for a million tons, would be only a farthing a ton; and the traffic on all the principal lines would be far above a million tons, so that a total charge of a farthing a ton would be ample, and at this low charge, the traffic would increase far beyond anything we now see, for it depends wholly upon the cost, and if that is diminished, it may expand to any extent. The city of London alone would be saved at least two millions sterling if the heavy mineral and other traffic were brought to her by steam-boat canals at a farthing a ton a mile, including everything, and the saving to the whole country would be enormous if the present main lines of canal were thus fitted for steam power; and most assuredly the railways would be no losers by the loss of their heavy traffic. Now what objection can be found to this change? The danger to life makes it imperative to look this matter in the face. If a thousandth part of the thought that has been expended on railways, and one-tenth of the capital, were bestowed on steamboat canals, the goods traffic of the country would be carried on at a cost that is now not thought of, and passenger traffic would be carried on at any speed, without one accident for a hundred that now occur. It seems wonderful that the great centres of business in England, Manchester, the Potteries, Birmingham, the great coalfields, and especially London itself, should quietly submit to the present absurd cost of transit for their goods, and danger to their persons, with so palpable and unobjectionable a remedy within their reach.

The American Cotton Crop.—The American Commissioner of Agriculture says that the increase in breadth of cotton was estimated, in July, at 12 per cent. Combining the elements of increased acreage planted, and the condition of the crop on October 1, the natural expectation—other circumstances being equal—leads to a comparison with 1869, showing that there will be 15 per cent. increase in North Carolina, 9 in South Carolina and Florida, 5 in Georgia, 8 in Alabama, 10 in Mississippi and Louisiana, 15 in Arkansas, 1 in Tennessee, and 30 in Texas. This would give a crop for 1870-71 exceeding 3,500,000 bales. The indications of the season, thus far, since October 1, and the probabilities of a favourable autumn for maturing and picking the "top crop," do not indicate a return of the remarkably favourable experience of last season. The present crop was vigorous in early growth, running to wood rather than to boll; was burnt with drought in August, and afterwards flooded with rain in September; has endured vicissitudes unfavourable to continued fruitfulness, such as a general shedding of forms and an occasional rotting of the bolls attest. The army worm and the boll worm have been at work in places, and rust is more or less prevalent in all the cotton States. In most sections the opening of the later bolls is usually well advanced, and indications are that the last picking will be light. All these things, the Commissioner says, instead of pointing to an increase of a third of a million of bales, render it possible that the crop of 1870 will be no larger than that of 1869; and if the remainder of the season should be very unpropitious, a reduction of a quarter of million bales might result. Another month or two will be necessary to determine whether the present crop shall be limited to 3,000,000 bales, or rise to 3,500,000 bales, as was predicted early in the season. The present area in cultivation has reduced the price to 15c. per pound, or to the very verge of profitable cultivation, and correspondents are already reporting the ruin of planters who grow cotton exclusively, and buy all their agricultural supplies.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

January 18.—On "How Meat is Preserved." By Richard Jones, Esq. On this evening Professor Huxley, F.R.S., will preside.

January 25.—On "New Paper-making Materials, and the Progress of the Paper Manufacture." By P. L. Simmonds, Esq.

February 1.—On "The Preservation of Vegetables." By Geo. Buchanan, Esq.

February 8.—On "Ornamentation considered as a 'High Art.'" By Dr. Christopher Dresser, F.L.S.

February 15.—On "The Commerce of India." By Dadabhai Naoroji, Esq. On this evening Sir Bartle Frere, K.C.B., G.C.S.I., will preside.

February 22.—On "Water Meters." By Frederick C. Bodkin, Esq.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Medical, 8.
Asiatic, 3.
Victoria Institute, 8.
Tues. ...Civil Engineers, 8. Mr. W. R. Browne, Assoc. Inst. C.E., "On the Strength of Lock Gates."
Statistical, 7¾. Mr. R. Dudley Carter, M.A., "On the Comparative Taxation on Real Property, Personalty, and Income."
Pathological, 8.
Zoological, 9.
Anthropological, 4.
Wed. ...**SOCIETY OF ARTS, 8.** Mr. Richard Jones, "How Meat is Preserved." Professor Huxley will preside.
Meteorological, 7.
Royal Society of Literature, 8½.
Thurs...Royal, 8½
Antiquaries, 8½.
Linnean, 8.
Chemical, 8.
Numismatic, 7.
Royal Society Club, 6.
Artists and Amateurs, 8.
Fri.......Philological, 8¼.
Royal Institution, 8.

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FRIDAY, JANUARY 20, 1871.

PROCEEDINGS OF THE SOCIETY.

MUSICAL EDUCATION COMMITTEE.

This Committee met on Saturday last, at the Royal Albert Hall, South Kensington, present—Lord Gerald Fitzgerald in the chair; the Hon. Seymour Egerton, Messrs. Henry Cole, C.B., Alan S. Cole, Frank Morrison, S. Redgrave, S. Teulon, and E. Carlton Tufnell. The Committee had under their consideration the prices of the seats, and other arrangements for the Society's concerts. A musical performance took place for trying the acoustic properties of the Hall.

SEVENTH ORDINARY MEETING.

Wednesday, 18th January, 1871; Sir Antonio Brady in the chair.

The following candidates were proposed for election as members of the Society:—

Birch, John, 9, John-street, Adelphi, W.C.
Blyth, James Nisbet, 4, Chiswell-street, E.C.
Bowron, John, 14, Churton-street, Pimlico, S.W., and Brooke-house, Trowbridge.
Cooke, Philip, Uxbridge-road, W.
Drinkwater, J. Handford, Red-hill, Surrey, and Messrs. Carr and Co., Bread-street, E.C.
Fulton, Robert, Saracen-foundery, 84, Upper Thames-street, E.C.
Gibson, John, 13, Great Queen-street, Westminster, S.W.
Hall, C. Hall, 72, Oxford-terrace, W.
Harsant, Frederick May, Linden-villa, Lewisham-park, S.E.
Hesse, Imanuel, Messrs. Loewenthal and Hesse, 11, London-wall, E.C.
Price, Kynaston, 36, Great Ormond-street, W.C.
Rotton, R., 3, Boltons, West Brompton, S.W.
Routh, Chas. H. F., M.D., 52, Montagu-square, W.
Safe, James W., 2, Inverness-road, W.
Soper, Francis L., 146, Adelaide-road, N.W.
Tredcroft, Edward, 3, Morpeth-terrace, Pimlico, S.W.
Vaughan, Rev. D. J., St. Martin's-vicarage, Leicester.
Waugh, John, Derby.

The following candidates were balloted for and duly elected members of the Society:—

Catmur, T., 13, Sidney-terrace, Grove-road, Victoria-park, E.
Crossley, Edward, Park-road, Halifax.
Noad, Henry M., Ph.D., F.R.S., 72, Hereford-road, W.
Penny, Henry, Wincanton, Somerset.
Porter, Frederick William, 16, Russell-square, W.C.
Roberts, Thomas Nicolls, 2, Torrington-street, W.C.
Rosher, Edward, 23, Upper Hamilton-terrace, N.W.
Saunders, Richard Charles, 17a, Great George-street, S.W.
Waldram, John, 38, Kingsland-road, N., and Sunnyside, corner of Manor-road, Stamford-hill, N.

The Paper read was—

HOW MEAT IS PRESERVED.

By Richard Jones, Esq.

The question of obtaining from distant countries a large and continuous supply of animal food is attracting much public attention, and growing, year by year, of greater importance. It is but a few years since the privilege was granted of admitting live stock from the Continent into the United Kingdom duty free; and, from the fact of our own rapidly-increasing population, and the vast consumption by the inhabitants of those continental countries from which we have hitherto obtained our supplies, the price of every description of animal food has grown gradually but steadily higher and higher. We are now compelled to look to more distant countries, such as Australia and South America. The question arises, how can we best import animal food, at such a price and in such a condition as to bring it within the reach of all. A most praiseworthy attempt has been made to import live cattle from South America, but I fear that its signal failure, in consequence of the long sea voyage and its drawbacks, renders any further efforts in the same direction extremely doubtful of success for some time to come. Recourse must therefore be had to some means of obtaining food otherwise than by the importation of the living animal. This brings me to the object of my paper, namely, "How Meat is Preserved."

It is a well known fact, to all going on long sea voyages in our larger class of vessels, that meat can be kept for an indefinite period surrounded by ice; the misfortune is that ice itself cannot be preserved. At present, the expense of keeping up a constant supply is so great, that it is useless to expect we shall be enabled by such a medium to get meat from distant lands for commercial purposes. An effort is now being made to manufacture ice on a large and cheap scale, which, if successful, it is possible that vessels loaded with carcases of bullocks and sheep from the colonies may yet be seen in our ports, ice-houses being prepared to receive their cargoes. The freezing process is the only means by which meat can be preserved in its raw state, without having some addition which deteriorates it in a greater or lesser degree. Although it must be a matter of congratulation to all who have grappled with this important question that this plan is one by which meat can be kept, yet I am compelled to deny it a place in the category of means by which meat is preserved commercially.

The long-continued use of meats cured by common salt is a well-known producer of scurvy, which is a deteriorated condition of the blood; also, the ill results following long-continued courses of alkaline remedies, and the interference that lime, soda, and potash salts would be likely to produce in the animal economy, are great arguments against the curing and preserving of meat by their employment. I cannot but feel assured that the chief object to be attained is the avoidance of any addition to the meat that could even bear the semblance of injuring the processes of digestion and assimilation, which the salts of lime, magnesia, &c., would certainly do.

For the purpose of explaining in detail the different modes of preserving food, I will divide them into—

The salting process.
The drying or desiccating process.
The chemical process.
The tinned cooked meat process.

The process of salting is the oldest and best understood mode of preserving, and has been applied to all articles of food. Salted beef and pork form the chief diet of the seafaring population of the world, while salted fish is used largely in almost every clime, and forms a large branch of industry, not only in this country, but in Norway, Denmark, Holland, &c. It has been also applied to vegetables, but with less success, if we except the much-coveted sauer-kraut of the Germans. The charqui, or jerked beef of South America, is a combination of this principle and the succeeding one, namely, drying or desiccating. Although the value of the salting process cannot be over-estimated, yet it will be readily admitted that we cannot expect it will lessen the price of animal food, and may, therefore, be set aside as one which we can neither take advantage of in its entirety or even in a modified form. The drying or desiccating process has received a great amount of attention during the last thirty years, and has formed the subject-matter of numerous patents. Its success in vegetables has been, I may say, complete; also, large quantities of milk are prepared by it, both in this country, in Switzerland, and America, though this is rather a process of concentration than of desiccation. For animal food it is so far perfect that, in combination with vegetables, it is extensively used as the basis of soups, yet it cannot for a moment be expected to have any important effect in supplying food for the masses.

A variety of agents have been, and still are, employed to prepare the raw material, such as bisulphite of lime and magnesia, sulphurous acid gas, sulphites and nitrites, each and all of which have effectually attained the object in the laboratory and the larder, as well as by the carcase salesman, for the transport of meat from one part of the kingdom to the other, or even from Continental countries under favourable circumstances; but when the delay is lengthened, the risk becomes great, in consequence of the necessity for close packing, the moisture, and contact with the air. A patent, which bears the names of Messrs. Bailey and Medlock, of Wolverhampton, has been largely used by our retail salesmen, but I do not suppose that the patentees claim for it the successful importation of meat from distant countries. Bisulphite of lime is the principal agent employed. Another patented process, known as Morgan's, has been practised to some extent in Australia with great success, so far as the preservation is concerned, but the flavour imparted to the meat from the chemicals used, as well as from their action on the tins, is such as to preclude the hope that any modified form of this process can be made available so as to satisfy the palate. Nitre, alum, and common salt are the more active agents of this system. Mr. Robert Caldwell, of Melbourne, obtained a patent for a chemical process, which has been more largely used than any other. The meat, in large pieces, is subjected (chiefly without bone) to the action of a solution of bisulphite of lime, and being then closely packed in casks or tanks, is surrounded with melted fat. The process has been carried on by the Victoria Meat-Preserving Company with varied success, and large shipments have regularly arrived for the last two or three years. This meat has formed the staple of the Norton Folgate cheap dinners, and although it has met with the support of names well known in the philanthropic world, and has been largely distributed gratis among the poor, yet it has failed to commend itself to the working population, for whom alone it is intended, although sold at extraordinarily low prices. There is a manifest flavour imparted, more perceptible to some people than to others less fastidious. Should any of us have to live for many weeks upon food so prepared, however varied the dishes and mode of dressing, I much doubt if we should not turn a wistful eye to the "Roast Beef of Old England," although cooked to rags, or dry as a chip. The indefatigable Professor Gamgee has patented a process to feed cattle on cinchona, mimosa bark, or tannic acid, with a view to the preservation of their flesh and hides. For my own part, I prefer the old method of taking bitters in another form. He has also introduced a process by which the animal is made to inhale carbonic oxide, and, after slaughter, the flesh is exposed to the action of sulphurous acid gas. Meat thus acted upon has been brought, under favourable circumstances, from America by steamer, and forwarded to the Food Committee of this Society in a perfectly fresh condition, though not quite so palatable as could be wished; but samples that have been sent from England to Australia, by way of experiment, have hitherto failed; and I presume it will be readily granted that this is one of the things that will not stand the test of heat, moisture, and time. If we go a step further, and place the meat so chemically treated in tin vessels, the deterioration is increased; the meat, in every instance, has been found to have a distinct metallic flavour, and the longer it is kept the worse the result. Before closing this branch of my subject, I will briefly refer to the sulphurous acid process as a preservative. This agent is unsurpassed, but requires to be so largely employed to ensure success, that it imparts a flavour, and so destroys the fat as to render the meat not only offensive to the taste, but also to the sight. It will, I think, be admitted by all disinterested parties that although the chemical process has been extensively practised, not only experimentally but commercially, and, notwithstanding the success which has so far attended the endeavours made, we cannot hope that the food supplies of our country will be materially affected through such agency.

I will now speak of the much used, albeit much abused, tinned cooked meats, the business in which is assuming dimensions of so gigantic a character. Their introduction, some fifty years since, was hailed as a boon of no little value in every part of the world, particularly by our navy; doubtless it was, and is so still. The addition of fresh meat and vegetables to the salt pork and junk usually served to poor Jack, helps, with the assistance of lime-juice, to keep away that foe to his class, the scurvy. The process now so extensively used both at home and in the colonies, called Appert's process, is that by which the meat is prepared, and which is supplied in such large quantities to the commissariats of the French and German armies. All that can be imported finds a ready sale at highly remunerative prices. In Australia, new companies have been formed, and every exertion made to increase the supplies forwarded, but as yet they are not equal to the demand, in consequence of the enormous exports to the Continent. It is, however, but reasonable to suppose that, when the war is at an end, our markets will be overstocked with these cooked meats, and as they do not find much favour with the English public, they will accumulate in our stores until gradually cleared away by the requirements of our navy and mercantile marine. It must, however, be admitted that this class of preserved food is finding greater favour, not only with our seafaring passengers and emigrants, but also (although as yet to a limited extent) with the people of this country, and I gladly avail myself of this opportunity of saying that I do not believe that, at the present day, anything save good, wholesome meat is ever preserved in tins. The method by which they are prepared explains at once their defects, and the consequent distaste shown for them, and if improvements can be suggested, it will be readily admitted that the responsibility of preserving meat in a sound and palatable condition lies with the manufacturer. While granting him the full advantage of the quality of the article of food put up, I think it is a matter of fact that little or no improvement has been made in the mode of preserving for the last fifty years, showing that the manufacturer has not only ignored all scientific investigation into the subject, but has been unable to take advantage of the facts so freely brought to light by others. Can this be said of any other branch of industry in the kingdom?

At the present time there is an exceedingly interesting discussion going on in the scientific world; the partisan of each particular theory quotes the method by which meat is preserved to support his own views. The hypothesis which has been almost exclusively maintained until recently, that oxygen is the sole cause of decomposition or putrefaction, does not find much support at the present moment. The germ theory, on the other hand, which has been patiently investigated and ably treated by Schwann and Pasteur, has taken a great hold on scientific people, more especially from the able support and elucidation of Professor Huxley. This theory is, that putrefaction arises from a living microscropic germ, which exists in the air and in all animal and vegetable substances, and that until that germ is destroyed you cannot have thorough preservation. By a perusal of the September number of the publication *Nature*, which also contains Professor Huxley's address to the British Association at Liverpool, in which he refers to this subject, it will be seen that Dr. Charlton Bastian has vigorously attacked this latter theory. I am bound to say that, after experimenting now for nearly two years in the preservation of cooked meats, I have never found anything contrary to it, and I frankly confess that, by acting up to it, I have overcome what at one time appeared to be insurmountable difficulties. To any one who has read and studied the articles in *Nature* by Dr. Bastian, it will be seen that, while he explains one process of meat preservation, that by means of the bath of chloride of calcium, which we shall presently notice, he utterly ignores that by which more than three-fourths of the meat preserved in the kingdom is prepared, viz., the Aberdeen system. Tinned cooked meats may be said to be preserved by two different modes. The older, and that which is almost entirely used in Scotland, is termed the water or Aberdeen process. By this the raw meat, fish, or vegetables, as the case may be, is placed in tin vessels, and soldered up perfectly air-tight. The tins are then placed in a bath of boiling water, 212° F. or 100° C., in which they are kept for a time regulated by the size and weight of the tins, say two hours and a half for 6 lbs. They are then withdrawn from the bath, and a small aperture made, from which the expanded air rushes. The hole is then immediately closed, and the tins replaced in the bath, and after the expiration of about a similar space of time they are taken out, and the same operation of opening and closing repeated; being placed in the bath for a third time, and for another period of about two and a half hours, they are finally withdrawn and allowed to cool. After being carefully examined, and any faulty tins removed, they are painted, to preserve the tinplate, and then, as occasion may require, forwarded to China, Japan, or Australia, without the slightest risk of any gases being evolved, or any fear of spontaneous generation ensuing. It is well known that meats so preserved have been kept for over twenty years; and, I doubt not, some of the old manufacturers could oblige any one interested in the question with specimens they have had in store for at least that time. I believe there are varied forms of this process, such as slightly increasing the temperature, cooking the meat before tinning, &c.; the principle is, however, the same. The other plan of preserving tinned cooked meats is generally termed the chloride of calcium process. In this, as in the last described, the meat is placed raw in the tins, which are soldered, leaving, however, a very small aperture. They are then placed in a solution of chloride of calcium, the boiling point of which is from 260° to 270°, the solution reaching about halfway up the tins. This being gradually raised, say from 180° to about 230°, the steam is allowed to escape for about four hours, during which time the meat of course becomes cooked. The aperature is then closed by means of a drop of solder skilfully laid on. The bath is raised to a temperature of about 260° F. for half an hour or so, when the operation is concluded. The tins are withdrawn, cooled, and painted, as before described. I am not aware that this process has any advantages over the other save the lesser space of time necessary for the operation, and it is, therefore, better adapted for warm climates and for hot weather. Both are effectual to preservation; nothing is abstracted from the tins or added to the meat. The question, therefore, naturally arises, why does not the system meet the desired end, and, by large importations from Australia and South America, reduce what may be called the famine price of the markets in our metropolis? The fact is, that the water exuding from the meat, and collected in the tins during ebullition, extracts its nutriment, and forms a jelly surrounding it, giving the meat itself every appearance of being over-cooked. The food is so broken down as to offend the eye; it requires little or no mastication; and, on the authority of medical men of experience, if taken for any length of time, produces diarrhœa. As an occasional substitute for fresh meat, or as an adjunct to salt beef and pork, it has done good service, but in its present state it can never be expected to supply the wants of the English public, or be a means of reducing the high price of meat in the home markets.

To preserve food, retaining its nutritive properties and the same flavour and appearance as that cooked by ordinary domestic means, the same laws must be observed. Thus, a piece of beef, when placed before the fire, loses from 20 to 25 per cent. of its weight by evaporation, the increasing temperature coagulating the albumen, and sealing up its nutritive properties; if the same conditions be applied to a piece of beef in a tin case, and evaporation is allowed to take place, commencing at a low temperature, say 90 Fahr., increasing until the greater part of the moisture contained in the meat passes off, and kept up for a certain time, varying according to the size and weight contained, the contents must be both properly cooked and preserved. A higher degree of temperature, or a longer time than that required for ordinary cooking, is essential to preservation.

I will proceed to lay before you the particulars of a system upon which I have been engaged for the last few years, which, having now been taken up by some manufacturers, may be said to be fairly launched before the public. Before going into these details, I wish to say one word relative to a process recently attempted of cooking meat by the chloride of calcium process, and preserving it by chemical agency. It is simply a modified form of the applications previously described, and partakes of their drawbacks. The advantages which I claim for meat preserved by my system are—

1. That it is not overcooked, and loses none of its nutritive qualities.

2. That when turned out of the tins it is not to be distinguished from that cooked in the ordinary mode, by the kitchen fire or in the oven, is pleasing to the eye, and cannot offend the most delicate palate.

3. That the system is exceedingly simple, and entirely free from any foreign agents.

4. That it is in accordance with scientific knowledge, and founded on well-known natural laws; and can only fail through the neglect or incapacity of the operator.

5. That it is equally applicable to all kinds of food products of every country, being quite unaffected by climate.

Having stated these advantages, I must endeavour to make you acquainted, in detail, with the means adopted in preserving by my system. The tins are filled with the raw material and placed in a bath, either of boiling water or of chloride of calcium, as may be desired Before being immersed in the liquid, they are attached by means of a tube soldered to the cover, and joined to a tap communicating with a vacuum chamber. In my first experiments I used a Torrecellian vacuum. I, however, find that Messrs. Forbes, of Aberdeen, who have adopted my system for greater convenience, prefer creating their vacuum by means of steam, condensing the same by jets of cold water. On the tins being attached, as described, to the tap, so that, with their contents, they are in immediate communication with the chamber, all the air being drawn into it, they are then immersed in the liquid, at a low temperature, which is gradually raised to 270° Fahr. The operation then going on resembles as nearly as possible the cooking in an ordinary kitchen oven. The tins form the oven, the liquid is the heating medium used instead of the fire, and in consequence of the vacuum applied, the steam and moisture ascends into the chamber, where it is condensed. The vacuum is used to remove the moisture, and any germs and decomposing gases which might be prejudicial to preservation; but it must be used after the first half-hour very sparingly, otherwise too much heat may be abstracted, or the food may be too much dried, and would, consequently, burn in the oven. The time necessary to cook and preserve a duck in this manner is about two hours. It will be seen that nothing escapes from the tin save the air and water.

As to the appearance of the food when turned out, I can only refer you to the specimens on the table, some of which I think you would be at a loss to distinguish from food prepared in the usual manner.

My third claim does not require any further proof than the short description of the operation which I have given; and I regret it has not been in my power to show its actual working, when I doubt not that its simplicity would be admitted, as it has already been by those who have inspected it.

The system is in accordance with scientific knowledge, and founded on well-known natural laws. I have already explained one of the theories of the cause of putrefaction, namely, the living microscopic germ theory, and should that be correct, it will be easily seen that two hours in a temperature of 230°, advanced to 270°, is sufficient to destroy any germs which may be assumed to exist. Should it be asserted that oxygen is the sole cause of putrefaction, it will be equally apparent that all the air in the food is removed before and during the process of cooking, when the vacuum chamber is in direct communication with the tins. With regard to what I may term the negative theory, advanced by Dr. Charlton Bastian, of spontaneous generation, all I can say is, that tins of meat preserved on this principle have been round the globe without any one becoming decomposed, and of many sent out to Australia (all of which were good) one obtained the highest prize medal at the Sydney Exhibition, New South Wales. In alluding to the water process, by which Dr. Charlton Bastian denies the possibility of meats being preserved, I have not seen it noticed by anyone in this controversy, although a fact worthy of consideration, that enormous quantities of bottled tart fruits (unripe) are preserved by simply placing the corked bottles in a bath of water raised to a temperature of 180° for three hours.

It will be perceived that the great objection to preserving meat in hot weather, and which, even by the chloride of calcium process, is impracticable in some parts of Australia for about one-fourth of the year, is entirely obviated by this system, as air, with its microscopic germs, is withdrawn into the vacuum before preserving begins, and the operation may be repeated several times, before cooking is far advanced, without any detrimental results. In order to explain what may appear to be a most unnecessary length of time in cooking by the ordinary water or chloride of calcium process, it is undoubtedly true that it takes over seven hours before the centre of the meat in a 6 lb. tin of beef is raised to a temperature of 210 deg., and, by the chloride of calcium process, at a temperature of 240 deg., it takes four and a half hours to arrive at a similar result.

The time required for effecting preservation by the system I advocate can be regulated at the will of the operator, for, by withdrawing the moisture, he is enabled effectually to roast the meat at any temperature, even up to 300° F.

A special characteristic, although I do not claim it as an entire novelty, of my system is, that meat can be as easily preserved with bone as without, and, as far as appearances go in articles of diet, it will be admitted that this is an important point. The expense of preserving is rather lessened than increased in consequence of the shorter period taken in effecting the object. The only additional expense is the soldering the small tube on to the tins.

Aberdeen Process—Time and Temperature.

Time.	Temperature of bath.	Temperature of meat.	
	deg.	deg.	
7.20	cold.	60	
8.20	212	75	
9.20	212	123	
10.20	212	162	
11.20	212	192	
12.20	212	202	
1.20	212	204	
2.20	212	210	Taken out.

Chloride of Calcium Process.

Time.	Temperature of bath.	Temperature of meat.	
	deg.	deg.	
10.15	220	40	
11.15	230	112	
12.15	230	192	
1.15	242	218	
2. 0	254	220	Hermetically sealed.
2.15	258	230	Taken out.

After having seen the specimens which now lie on the table, the question is, will food so cooked and preserved, and possessing all the nutritive properties of fresh meat, if brought here at a low price, supply the want existing for cheap and wholesome nourishment for the masses, and will large quantities of such food visibly affect the present high price of provisions? That is a question I must leave the public to decide.

The Central Queensland Meat Company have, after much investigation, adopted the system, and are now about commencing operations; a few months hence they will be in full work, when I anticipate the goods they forward will be superior to any hitherto obtained from Australia.

In conclusion I have but to offer my best thanks for your patient hearing of my imperfect exposition of a subject in which although I have laboured earnestly for some years, many present are, I am aware, more versed than myself. I have only yielded reluctantly to urgent request that I should undertake the responsibility of bringing the subject before the public through the medium of this Society, because of its importance to the world at large and because the interest felt in it has been growing larger every year. My efforts will be rewarded if they serve to stimulate that interest still further; and I look with confidence to the result of the discussion that will now follow, and which will have the advantage of the experience of some of the most eminent investigators in this branch of social science.

DISCUSSION.

The Secretary stated that there were specimens on the table of meat preserved, not only by Mr. Jones's process, but also in the usual mode, by Messrs. M'Call, Hogarth, and others. There were also some samples of Australian beef, sent over uncooked from Melbourne, by the Victoria Meat Preserving Company. The bones and sinews had been first extracted, and the meat slightly corned; it had then been packed in its own fat, which is refined and fit for cooking purposes. The agent in London was Mr. Huxtable, of 24, Lawrence Pountney-lane, who would be happy to show samples to any one who called upon him. The company present would have an opportunity of examining and tasting the various specimens at the conclusion of the discussion.

Mr. M'Call desired to render his testimony to the ability displayed by Mr. Jones, in his paper on this most interesting subject, which was of considerable importance at the present time, particularly when the supply of meat from the Continent was interrupted, and seemed likely to remain so for some time to come. He could not, however, agree with the observation that there had been very little improvement, if any, in the art of preserving meat for the last 50 years. His own opinion was that the introduction of the chloride of calcium bath, which was not more than 25 years old, was a very great improvement on the hot water, or Aberdeen process. The original mode of preservation was that of M. Appert, which was simply enclosing the meat hermetically in tins, and then boiling it for a length of time. According to the old theory, the object was to destroy the oxygen; and according to the modern theory, to destroy the germ of decomposition. That original process was improved upon by taking the tin out of the bath after a certain time, and piercing it with a small hole, then closing that hole up again, and putting it back, thus getting rid of a portion of the oxygen. The introduction of the muriate of lime bath was again an improvement on that, and it was not quite as Mr. Jones had described. The tin was placed in the bath to about half its depth, and the temperature was then raised to over 230°, when the steam issued out of the hole, and a very much larger per-centage of the oxygen was got rid of than by simply stopping the process for a minute after it had begun, and much less was absorbed by the meat. Almost all the Australian colonies adopted this method in preference to the Aberdeen mode, which was a strong testimony in its favour. Mr. Jones had rather understated the time used by the Aberdeen process, and overstated it in the muriate of lime process, the economy in point of time being much larger than he had stated, and not only so, but the object which he sought to obtain by means of the vacuum was in a great measure obtained by the muriate of lime bath, inasmuch as the heat in the tin certainly resembled, to some extent, the outlet into the vacuum. No doubt, instead of being connected with the vacuum chamber, the steam was merely allowed to escape into the atmosphere, but it appeared to him that all the difference in that respect was that of 12 or 15 lbs. weight of pressure, which could easily be got by raising the muriate of lime bath to a higher temperature. For instance, the pressure inside the tin was about 10 lbs., and the moisture was blown into the vacuum at a pressure of 12 lbs., making a difference between the pressure in the tin and that in the vacuum chamber of 22 lbs., and he thought there was no particular advantage in that method over raising the pressure in the tin to 22 lbs. above the atmospheric pressure. It was something like a condensing engine, the condenser helped to save fuel; but, inasmuch as fuel was a very small consideration in preserving meat, he did not see much advantage, whilst it certainly involved a considerable amount of detail.

Mr. Fordred asked what was the pressure in Mr. Jones's vacuum chamber.

Mr. Jones said he got nearly 30 inches, 28 at any rate; it was nearly a complete vacuum.

The Secretary said there was one modification of this process which Mr. Jones had not alluded to. The calcium-bath had been spoken of, which gave a greater amount of heat than the ordinary one, but the modification he referred to was that carried out in Deptford Dock-yard by Mr. Hogarth. The meat was put into tins in the same way as in other cases; it was soldered down, with the exception of a small pin-hole, and then the tins, instead of being put into a calcium bath and the heat in that way applied, were put into what might be called a steam-tight retort, into which steam was allowed to pass, producing a pressure of something like 230 degrees. The meat was kept in that condition for an hour and a-half or two hours; it was then brought out, and, while the steam was issuing from the small hole, it was soldered down. It was then replaced in the steam-tight retort for an hour or an hour and a-half, at a temperature of about 240 degrees, and then taken out and cooled. That was the process now used by Mr. Hogarth in preserving meat for the Navy, a sample of which was on the table.

Mr. M'Call said the effect of that, as compared with the muriate of lime bath was this, that when put into the steam bath there would be as much, or more, pressure outside the canister as inside, and the tendency would be for the steam to enter the canister rather than to come from it, and therefore, practically, it was very much the same as putting a canister hermetically closed into a bath, inasmuch as it did not set up a jet of steam carrying out the oxygen, but rather took in some steam from the heating medium. In the chloride of calcium bath it was the other way, the steam issuing from the pin-hole during the whole time it remained in the bath.

Captain Selwyn, R.N., said he had had the honour to belong to the navy for something like 36 years, and during that time he had had the opportunity of living principally on salt meat and also on preserved meats, and, therefore, he was in a position, which probably not many in the meeting were, to speak of the real effects of that kind of food. He had also had the misfortune to be obliged to assist in condemning very large quantities of preserved meats, from their gradual decay in hot countries; and gentlemen who advocated the adoption of such a system in place of salt junk, would do well to consider that, whereas a certain number of months' provisions were carried on board ship, it would be a most serious thing if it were to be suddenly found out that a large proportion of a ship's stores were unfit for human food. He did not wish in the slightest degree to discourage the efforts being made to produce a reliable and sound form of preserved meats; and though he had spoken of some being condemned, a very great proportion was excellent, and had been very useful in restoring health to sick persons, whose digestive organs were not sufficiently strong to enable them to assimilate salt food; and it was at all times a very grateful relief for a short time from the use of salt food, and had largely contributed to reduce the ravages of scurvy in the royal navy. These processes, however, should be tried carefully, and brought forward in places where the requisite chemical knowledge was at hand to test them, and no projector ought to be surprised if his first experiments were received with some degree of caution. He had recently returned from the River Plate, where any number of sheep might be bought for 3s. each, and where, consequently, if any process were discovered for preserving food properly, it might be preserved very cheaply. But common sense would ask, why preserve salt meat in England, where there was always a sale for fresh meat, whilst salt meat could be preserved abroad where there was no sale for fresh. He thought it would be well to turn attention to the old and well understood and well-established process of preserving meat in this way, before going largely into the question of preserving meat abroad under difficulties, and bringing it home under intensified difficulties. Nobody who had passed through the tropics would doubt the severe test to which meat preserved in a moderate climate had to submit before reaching the market in this country. Their object was, not to encourage any particular form or process, but to encourage that which might cheapen the food of the million, and it was most important not to begin at the wrong end. He should, therefore, suggest that supplies of salt meat should be sought from abroad, although, at the same time, he would encourage every process that promised well for preserving it in a fresh state, and he must say that, at the Cannon-street Hotel, he had partaken of some mutton preserved in Australia which equalled anything he had ever tasted in the way of mutton brawn in England, if it did not surpass it. They must go cautiously, however, into this process, whilst they might go confidently into the salting, and there were certain requirements not yet fulfilled which might be profitably considered discussing the broad question. Every person who came forward with a proposal for cheapening that food which had been found to give results in human labour which enabled English workmen to do more work than those of any other nation not so nourished, was worthy of the deepest consideration; but for that reason they should not forsake the simple process which every one knew, and which would produce an immediate effect on the meat market.

Mr. J. A. Franklin asked if there were any tabulated statements of the loss in weight sustained by the meat in the different processes. He could not quite reconcile what had been said with reference to the process at Deptford with what was said by Mr. McCall, that it was necessary to have an escape of steam from the tin at all times. He presumed that, the pressure being greater without, the meat would be cooked in the steam, and that thus the juice of the meat would be forced inwards instead of being dissipated outwards. He should like to know if it was essential that there should be a large escape of the boiled products from the tin, or whether there was any tabulated statement of the loss incurred by the respective processes?

The Chairman said the loss of weight in cooking meat depended very much on the food of the animals from which the meat was obtained. From his official position in connection with the navy, he might say that it was well known that the loss on pork was greater than on any other meat; and they did not dare to buy salt pork in the United States, because, by reason of the mode of feeding the hogs in that country, the loss in the cooking was nearly 50 per cent., whereas the salt pork prepared in Denmark, Holstein, and particularly in Ireland, where the feeding was the best, lost an average from 25 to 30 per cent. With regard to beef, it was exactly the reverse, the very finest coming from the United States. He had had the pleasure of submitting to the Food Committee two joints killed and cured at Deptford, and meat imported from the United States; and although the meat was unfortunately not cooked so well as it might have been, being done at an hotel, where they were not accustomed to cook salt meat of that description, it was yet most excellent; and some which he had had cooked for his own table was equal to anything he had ever tasted. It could be imported at a very considerable reduction in price, and very large supplies were now being received from the United States. He also desired to mention one process, that of Mr. Morgan, which had only been incidentally alluded to in Mr. Jones' paper. Those who had walked down Fleet-street had no doubt seen a pig hanging up, which was called a "perfect cure," and it might be interesting to hear how that had been done. The process was simply making use of the natural circulation of the animal to inject the preserving fluid, whatever it might be. The animal was killed in the usual way, but before the blood had coagulated or the heart had ceased to beat, a tube was inserted into the right auricle communicating with a vessel on a higher level, in which was placed the preserving fluid. The left ventricle was then tapped, the tap turned on, and as the blood oozed out on the left side the preserving fluid went in at the right. The effect of this was that, in the course of about three minutes, the whole of the tissues of the animal, even the hair and hoofs, and the hard portions of the bone, were completely permeated with the preserving fluid. That was, however, a disadvantage. The curing was too complete, and they had not yet been able to find a preserving fluid which did not spoil the meat when so saturated. Some ten or twelve oxen were cured on this plan some time ago, and sent out on distant voyages, and, at the end of the commissions, reports would be received from the officers of those ships whether the meat was in any way preferable or otherwise to that salted in the ordinary way. It must also be remembered that they had now got so skilful in salting meat that what was termed in the old war time "salt junk" did not exist. Meat was seldom used more than two years old, and in three years it was certainly all consumed. With regard to preserved meats it would be very difficult, until absolute certainty was arrived at, to supply ships from that source only; and he had in his mind a most painful remembrance of a circumstance which caused a deep impression on the British public not many years ago, he alluded to the loss of Sir John Franklin in the Arctic regions. He was, unfortunately, supplied with Hungarian preserved meats, and he was almost afraid that the loss of that expedition might be traced to the failure of that meat supply, which was sent out at great cost. The difficulty was, that it was possible the same thing might happen again as happened in that case. These meats were not only not perfectly preserved, but, unfortunately, many of the tins contained materials which were absolutely nauseous. It was an absolute fraud; and the difficulty was how to examine these goods when they were received. Of course, every tin that was opened was spoilt, and, therefore, only a certain proportion could be tested. For this reason the government were obliged to be very diffident of introducing such an article of diet on a large scale. With regard to the muriate of lime, there was no doubt it raised the temperature much higher than the old method, which was a great advantage; and he must say that the vacuum process seemed to go a step further in the same direction. A high temperature being employed, it naturally required a shorter time to cook, and a greater portion of the watery particles and gases were driven off. The way in which the tin was sealed up was most ingenious. Of course, when the steam was issuing from the hole the solder would not unite, but this was effected in a most beautiful way, as he had the pleasure of seeing, when he officially visited Mr. McCall's establishment some two or three years ago. The workman had a soldering-iron, with a little solder on the point in one hand, and he stopped the steam at the right instant by a sponge with cold water placed on his little finger, with which he touched the tin. The steam instantly condensed, and at the same moment, before any air could get in, the hole was hermetically sealed. In this way most of the water particles were driven off. There was, however, a difficulty in getting pork free from what was called measles, which was a very serious matter, for measles in pork were simply the germ of the tapeworm. Several German chemists had very accurately described these objects, and experiments had been made on the vitality of these germs. If taken up by the capillaries into the system, they formed what was termed measles, not being developed into tapeworms, because of the circumstances not being favourable. If, however, they got into the stomach and intestines, they were under favourable circumstances, and developed into tapeworms. In this way much mischief had arisen in the navy from the occasional use of measly pork. The devastation which was occasioned a few years ago by trichinæ was, no doubt, known to most persons present, and when he was in Denmark he had seen some anatomical preparations of patients who had died in the hospitals from the effects of these creatures. They were a very curious entozoa, being covered with a cyst of silex; and if they once got into the system nothing could touch them which did not prove fatal to the patient. Therefore, when they were once introduced it was certain death, and they went on multiplying until the system was destroyed, their vitality being very great. It took something like six hours to get the interior of a 6 lb. tin of meat to the temperature of 210 degrees, and you could not get it to 212 except under pressure; and it was of immense importance in order to kill these cysts or trichinæ, or any other germs which might be in the meat, to get it for a short time to a higher temperature than boiling water. Meat might be cooked at 175 degrees, but if there were any suspicion of its containing entozoa of any kind, it was better to cook it by roasting than boiling, as a higher temperature could be obtained. It was an interesting fact, that these germs had only been known to be mischievous when people had eaten their food not sufficiently cooked, or partially raw, which the Germans sometimes did. In Norway and Sweden, and all the northern parts of Europe, it was the usual practice to take what was called schnaps before a meal, which consisted of a little bit of ham, or something of that kind, and a little glass of spirit. This was dangerous, however, because it was only smoked and not cooked, and therefore any germs which it might contain would be more likely to be developed in the system. It was perfectly clear that we did not yet know what the ultimate form of life was. Several eminent men were trying, by means of the microscope, and in other ways, to investigate the matter; and there was reason to believe that even the sources of fever might be traced to a little entozoa floating about, which became developed under favourable circumstances. If, therefore, any system could be devised by which meat could be cooked and preserved at such a temperature as would eliminate all these germs, which might prove dangerous, it was of great importance; and he certainly thought Mr. Jones's system had the advantage over those previously in use, inasmuch as he used mechanical force to draw out, by creating a vacuum, the watery particles, the gases that were generated by the heat, and, with them, anything which might be floating about.

Admiral Ommaney said he must differ from what his friend Captain Selwyn had said with regard to preserved meats, for he should not like to throw any discouragement on the endeavours which were made to introduce such a great boon into the navy. He had had great experience in the matter, having been three Arctic voyages. When he commanded a ship which wintered in the Arctic regions, his men lived principally on preserved meat; they scarcely ever opened a bad tin supplied by the Admiralty, and he never had a man down with the scurvy, and he brought home every man he took out. With regard to the shrinkage of meat, they always found that much more shrinkage took place in salt beef than in salt pork. He should like to ask if the use of preserved soup had been discontinued; and, if so, what was the cause; because he had always been accustomed to look forward with pleasure to the day for preserved soup, and had derived even more nourishment from it than from preserved meat.

The Chairman said he had himself tasted preserved meat and vegetables which had been three times to the Arctic regions, and which were yet as if they had only been put up the day before.

Captain Selwyn said Admiral Ommanney had referred to the Arctic regions, whilst he had referred to the tropics; and no chemist, at any rate, would fail to understand the enormous difference in the conditions when the thermometer stood at 120° or 150° on deck, and when the temperature was below zero.

The Chairman said no system of preserving meat had hitherto reached perfection, but he must say that Mr. Jones's plan seemed to go very far towards it. In the case of the navy, the great difficulty in inducing Jack to take to this preserved meat was that it was unpalatable from being over-cooked, the juices, fibre, and albumen being separated, but that prepared by Mr. Jones seemed superior in this respect to any other which he had seen.

Mr. Pearsall said, after the observations which had been made on the advantages of a high temperature in insuring the destruction of the trichinæ and other parasites, he thought it was not unimportant to call attention to the well-known fact that, where a vacuum was employed, the boiling point was reduced to about 120°, and consequently it would seem as if in such a case longer time and more care would be requisite. He should imagine that much more detail was required in the operation than had been stated, in order to secure an agreeable temperature through such a mass, as say 7lbs. of meat, and that there was not the same certainty as in a muriate of lime bath of securing an absolutely high temperature.

The Chairman remarked that he understood Mr. Jones only applied the vacuum chamber during a short period of time; it would be quite clear that reducing the temperature would be fatal to the idea of destroying the germs of decomposition, which Mr. Jones had referred to.

Mr. Jones said he merely made use of the vacuum to draw off the water at a low temperature, and then the bath was heated to 250 deg. or whatever temperature was desired. By drawing off the liquid at a low temperature, none of the nutriment of the meat escaped with it, and when the liquid was gone, by turning the tap all communication with the vacuum chamber was cut off; the heat was then increased until there was an accumulation of fluid in the tin, when by turning the tap on again for a second, the moisture was removed, but it did not reduce the temperature, a second being quite sufficient to prime off the moisture, and the cooking then went on as before. He had used a temperature of 300 deg. on some occasions.

Mr. P. L. Simmonds said it was very satisfactory to find that suggestions thrown out before meetings of the Society, from time to time, led to important discussions and experiments, and to the improvement of many of the great industries of the country, and the benefit of the public at large. The important question of introducing fresh supplies of animal food from different quarters of the world had been discussed in that room, and improvements had certainly been effected in the different processes. He did not think they ought to go back to salted provisions, because in the countries where animal food was abundant he did not think there were the same facilities for salting, as in South America and some other places, and there was not an unlimited demand for salted meat as there was for fresh. The cheaper and more abundant the supply of fresh meat, the better would it be for the general public both here and on the Continent. This subject had occupied his attention as a juror at different International Exhibitions, and he had had many opportunities of noticing what were the objections to preserved provisions as generally supplied. The main difficulty had hitherto been that they were in too sodden a form to well undergo a fresh process of cooking. At the Paris Exhibition, the form in which the meat was turned out from the tins was not liked, although the Australian Meat Company had sent some very good specimens. In this respect, the samples now exhibited showed a great improvement, being more solid, and not over-cooked; they could be used either as they were, or made up into various dishes in more palatable forms than had hitherto been the case. From some experience in the matter, he did not think it was possible to import live cattle profitably from long distances, so as to compete with continental supplies; and, therefore, if the plan of Mr. Jones proved commercially successful, it would be of immense public benefit.

Mr. Hyde Clarke said the various samples on the table close to him had evidently a very tempting flavour, and having likewise tasted it, he was able to say that it was free from the theoretical objections raised by Mr. Pearsall; the meat had been thoroughly penetrated by the heat, and therefore they might assume that any obnoxious germs had been destroyed. It was very gratifying to find how, in such a case as the present, the extreme of theory and the extreme of practice were connected together for the benefit of mankind. He regretted that Professor Huxley had not been able to preside over them on that occasion, as the meeting would certainly have learned something practical from his observations, even if they were founded on theory, but in his absence it was very gratifying to have had the practical experience of Sir Antonio Brady brought to bear on a question with which he had had to deal on a large scale for the public service. He must say he agreed rather with the gallant admiral than with Captain Selwyn, as to the way in which this subject should be received, not receiving any experiment with distrust, but rather with every encouragement, for it would be far better to be led astray by the promise of an inventor, rather than that on a subject of so much importance to the whole nation, any judicious attempt should be discouraged. Again, with regard to the proposition that they had encouraged the old-fashioned process of salting meat rather than seeking to preserve it fresh, he thought it was questionable whether in some of those countries where amimal food was abundant, the salting process could be properly carried on. Looking to the great extent of country which would be brought into communication with England, not only for the purposes of food supply, but also for those of commerce, he must say that some of them seemed rather adapted for the supply of fresh meat than for the preparation of salt provisions. What had been hitherto seen of this subject was but a small example of what was available. At the present moment small supplies were coming from Australia, but when the same enterprise was applied in South America, not only to the River Plate, but to the vast basin in the interior, to those countries which were on the upper waters of the Amazon and the Plate River, New Grenada, Peru, Bolivia, and the interior of Brazil—countries as yet scarcely touched, but on which cattle roamed in millions—most important results would be obtained, not only for trade and commerce, but for the supply of food to the people. Reference had been made to various scientific theories, but when meat was cooked and placed before them, everyone ought to be able to say whether it was suitable for them, and he would here repeat what he had said on former occasions, that they must not limit themselves to the expectation of producing the choicest quality of food, but if only one palatable article could be added to the resources of the country, a great deal would have been done. For instance, in the provision trade there were certain articles which were only consumed to a limited extent, such as hams and bacon; but although the whole population did not feed upon these things, they were not rejected on that account. In the same way, if by means of Mr. Jones' process, or any other, only one supplemental article of food could be obtained, a great step would have been gained. In conclusion, he begged leave to propose a hearty vote of thanks to Mr. Jones for the manner in which he had brought forward the subject.

Mr. Witham, in seconding the proposition, said that both in Australia and South America attempts had been made to prepare salt meat, but in each case without success, owing to the warmth of the climate. With reference to the uncertainty attaching to the results of preserving fresh meat, it was now pretty well ascertained that, out of all the shipments by the Melbourne Meat Preserving Company, not more than about one per cent. turned out bad, and as these had had the advantage of coming through the tropics, it might be supposed that, having stood the test once, they would do so again if necessary.

Captain Selwyn said, as he had been somewhat misunderstood, he wished to say that he neither advocated the use of salt meat as a rule, nor did he desire to take any exception to the preservation of fresh meat. He merely said it was absurd to salt meat in Ireland, where you had it fresh, and try to bring it fresh from Australia, whence it might as well come salted. He had not only eaten, but had himself preserved meat with salt in every part of the tropics, with perfect success, simply by resorting to a proper mode of injection.

Mr. Fordred believed the difficulty of salting meat in hot climates arose from the fact that in hot weather the salt would not penetrate the tissues before decomposition set in. What was wanted was some means of preserving the meat immediately after it was killed, in a cool place, and the solution of this problem rested with those who were engaged in the production of an ice machine. Directly there was a cheap mode of maintaining a low temperature, no doubt meat would be extensively preserved both for the navy and other purposes, and he believed that this would be attained before long.

The vote of thanks was carried unanimously.

CANTOR LECTURES.

ON ARTISTS' COLOURS AND PIGMENTS.

By Frederick S. Barff, Esq., M.A., F.C.S.,

Assistant Professor of Chemistry, University College, London.

Lecture IV.—Delivered Monday, December 12, 1870.

Vehicles and Media used in Painting, and Fresco and Silicious Painting.

Ladies and Gentlemen,—I have had one great difficulty to contend with in these lectures, which is, that I have had too many subjects to select from. It has been mentioned to me by several gentlemen that I ought to have noticed this particular colour and that particular colour, the behaviour of this particular pigment with that particular pigment; but you will all see that it is impossible for me, in so short a space of time as is allotted to me, to deal with all these subjects. I am placed somewhat in the position of the civic dignitary spoken of in "Bombastes Furioso":—

> "As when two feasts, at which there's nought to pay,
> Fall unpropitious on the self-same day;
> The anxious Cit each invitation views,
> And ponders which to take or which refuse
> To keep away from this or that is loth,
> And sighs to think he cannot dine at both."

I, like the Cit, have many invitations before me, and like him I grieve that I am not able to comply with my desire of accepting them all.

In my last lecture, I made one or two assertions with respect to colour which I would wish to repeat in a somewhat modified way. First of all, with respect to King's yellow. I do not know whether I gave any one here the impression that King's yellow is a colour which I recommended as a pigment; I think not, for I believe I said that I merely selected it as a very good illustration of how, in a short time, the analysis of a simple colour might be conducted. It was for that reason that I took King's yellow. It is, in fact, a pigment which is hardly ever used now. Sometimes it is employed in water-colours, but as a pigment it is worthless. If it comes in contact with white-lead it is decomposed in time, and a brown or black sulphide of lead is formed.

Then another colour, about which I spoke, and which I made in a rough experimental way, aureolin yellow. If you remember, I precipitated carbonate of cobalt from a solution of a cobalt salt with carbonate of potash; this precipitate I dissolved in acetic acid, and to it I added nitrite of sodium; nitrite of potassium and cobalt was thrown down as a yellow powder. This I asserted was decomposed by caustic potash. In experiments which I have made on the freshly-precipitated colour prepared in this way, I have found that it has been invariably destroyed by caustic potash; but a gentleman who was present at my lecture, Mr. Salter, who has given much of his time to the preparation of colours, has sent me a specimen of aureolin yellow prepared in another way, which I put into a flask with some caustic soda; it has remained unchanged for several days. Unfortunately, it has been left behind at the laboratory; you will, however, take my word for it that the colour is perfectly stable under this treatment. I have here some samples of the same yellow, which have been exposed to the action of ammonia, soda, and potash for a considerable length of time, and they have not changed. There is one, bearing date December 6th, in ammonia, and another in potash, and the colour remains perfectly stable. Now, this is really a most important fact, because aureolin yellow is so beautiful a pigment that one wishes it would stand for ever. It is, as you will see when we come to speak of fresco and silicious painting, a great desideratum to have colours that will stand the action of lime and caustic alkalies. Our colours for fresco-painting are very limited, and if aureolin will stand the action of caustic alkalies, it may be safely used both for fresco and silicious painting.

I was also presented with a copy of Field's "Chromatography," edited by Mr. Salter.* I have since read it through carefully, and would earnestly recommend it to your attention, for, in a very plain and clear manner, it states the behaviour of colour with those re-agents with which they are likely to meet in practice, and gives also the composition of the colours. In order to make up for the deficiencies which occur in these lectures—deficiencies from want of time, and deficiencies, also, which have been pointed out to me, sometimes from rapidity of utterance, when one is desirous of getting through one's work in less time than ought to be given to it, at the end of the lectures I propose to make a short syllabus of colours—of course I mean those generally used, not such as we may term fancy colours—stating their general composition, and, as far as one is able to do so, their behaviour to one another, and also those re-agents which effect them most energetically. This will be printed, together with the lectures, in the *Journal of the Society of Arts.*

On the table you see three groups of colours. I mentioned the other day, that those in the centre were sent by Messrs. Winsor and Newton, and those on the right and left by Messrs. Berger, and Messrs. Blundell and Spence, of Hull. Of the colours which these last gentlemen prepare, I have had but little to say, for, somehow or other, my attention has been turned almost entirely in the direction of high art; and yet one ought not to omit to notice those colours which are in everyday use for common purposes, and which certainly minister very much to our pleasure, I mean those which are used in outside painting, and in ordinary decoration. You have before you on the table a series of colours which are carefully and well prepared, and from experience in their use years ago, I found that they were exceedingly effective and enduring. Some of them, of course, will not stand the tests to which we are obliged to submit colours; for instance, Brunswick greens, which are used for painting gate-posts, garden gates, &c., which are extremely good as greens, and which are often used for interior decoration, are very good in oil, and will stand the action of disintegrating agents perhaps as well as most colours, but they are perfectly worthless when you come to use them as water-colours, mixed with lime, or carbonate of lime, chalk. Then, again the chrome greens which you see there, are made, I believe, by the admixture of some blue with one of the chromates of lead. These, for anything like artistic purposes, could hardly be employed. The chrome greens of which I shall have to speak to you to-night are not the same chrome greens, but are oxides of chromium. I have here in these papers a series of these colours, which were brought to me this evening. They are extremely beautiful in tint, and comprise, I believe, a list of greens as extensive as any artist would wish to use in his art.

One experiment which I performed last Monday evening was not clear to you all, and I should like to repeat it, because it refers to a very important colour, viz., Prussian blue. I have put into this glass some ferrocyanide of potassium, and added a few drops of ferric chloride; you see we have got a beautifully blue colour. The liquid is at present transparent, but if it were allowed to remain, it would throw down a precipitate, and we should get it in the form of a blue powder. I will add to this a solution of caustic soda, and you see the colour will disappear. On neutralising this again with some muriatic acid, the colour will reappear. From this it is plain that Prussian blue will not bear the action of alkalies, and is, therefore, absolutely unfit for use in fresco-painting, or in silicious painting.

The oxide of cobalt is black. When fused with some silicate, it imparts an intense blue colour to that silicate. I cannot, with the heat at my disposal, fuse a silicate here, but I can fuse some borax, and for our present purpose that will do equally well. I have got here some of the oxide of cobalt precipitated. I will add this to the borax, and fuse it. You will see that an extremely deep blue glass will be formed, and that blue glass, when ground to a powder, is similar to the cobalt blue, known under the name of smalt. It is prepared largely in Saxony. This smalt is a permanent colour; it will stand the action of most disintegrating agents, but, as artists know very well, it is a difficult colour to work with. When reduced to an extremely fine powder, the brilliancy of the blue somewhat disappears, and therefore it is not desirable to use it in such a medium as oil. But for fresco-painting and silicious painting, it is an excellent blue, because it is enduring, and also because it has in it that with which the silicates will unite, and form indestructible compounds. Other blues are also prepared from cobalt, they are very stable and permanent. One which is called Thénard's blue, is made by the action of a cobalt salt on alumina, the oxide of aluminium. There are two ways of making it. I will show you presently the experiment by precipitating some common alum with some chloride of cobalt. We will afterwards heat the powder, and you will see that, from a dirty, pinkish, grey colour, it will become a beautiful blue.

Then, again, there is another cobalt colour, which is good and useful, and very permanent—the cobalt green—but, from what reason I do not know, it has not found much favour with artists. It is made by precipitating a salt of cobalt with a salt of zinc. Then, if they be heated together, a green colour will appear. These two experiments Mr. Taylor will be kind enough to perform presently.

Now I will leave the consideration of colours, having selected those which I believe best illustrate the points which I wished to speak about, and pass on to the consideration of the destructive agencies to which colours are submitted. I have already alluded to one destructive agency, which plays great havoc with artists' pictures—sulphuretted hydrogen; and I need hardly refer to it further. We, therefore, pass on to others, and there is one which causes destruction, not so much of the colours as of the picture itself. I mean that agent without which we could not live; that agent which supports our lives by continually burning away the substance of our bodies—I mean oxygen gas. There is continually going on within us a slow, steady combustion. Our bodies would waste away, as do the bodies of those who are attacked by fevers, who have not the power of replacing those constituents which are destroyed by the active influences of the oxygen gas, were it not for the power of reproduction which they possess, and oxygen gas, which supports our life, at last becomes our death. Oxygen gas goes on destroying organic matters steadily and unceasingly. Let us, therefore, consider the circumstances under which it may be and is most deleterious to pictures. In the gas burner yonder we have oxygen gas combining chemically with the carbon and hydrogen in the coal gas which is burning. That is a rapid combustion; and here, again, in this Bunsen burner on the table, we have a much more rapid combustion going on, because the carbon is being more perfectly oxidised than it is in the ordinary burner. If you notice, in the spring, a heap of leaves which have been piled up in your garden in the autumn, and if you place your hand within the heap, you will find the temperature is much higher than that of the surrounding air; if you turn the leaves over, you will find them blackened, as if charred, and charred they are; they are burnt by the action of the oxygen in the air. There is a slow combustion going on, as perfect and as real as that which is going on now in this lamp. Certain things are necessary, however, to promote this oxidation. If you take a piece of clean iron and put it into a bottle of perfectly dry oxygen gas, the iron will not become oxidised. No oxidation will take place; but if you admit moisture it takes place very rapidly. Again, sodium, a most oxidisable metal, will not oxidise in absolutely dry air, or dry oxygen. Now, if pictures are exposed to damp, the oxygen will destroy them in time. First of all, the canvas they are painted on is attacked, and you know that pictures frequently get so bad in this respect, that it is necessary to take off the painting from the canvas, and replace it again on other canvas. What I want to suggest to you is this, that if you protect pictures from damp you do a great deal to preserve them. But the other destructible influences which I shall have to mention to you do not perform their work of destruction provided the pictures are kept dry, at least not to the extent which they do if the pictures are damp. There is a very evil practice often adopted, of hanging oil paintings close to the wall, and behind them moisture collects, for the air is always more or less charged with aqueous vapour, and this aqueous vapour, in cold weather, condenses behind the pictures, and so keeps the back of them moist, and assists in causing the destruction of the canvas upon which they are painted. It is absolutely necessary, therefore, that pictures should be kept perfectly dry, otherwise we may be sure that, in a not very long space of time, the material upon which they are painted will be destroyed. Now, inasmuch as we are not all careful, and inasmuch as works of art are constantly passing from one hand to another, it is a great pity that, in the course of their career, they should be destroyed. Why, then, should we not take the means which are at our disposal for rendering them tolerably safe from these disintegrating influences? It always appeared to me strange that we should paint one side of canvas with oil, and leave the other side totally unprotected. But what protection can we give? I know of no better than steeping the canvas, before painting, in a solution of silicate of potash. If the canvas is steeped in this solution, and carefully dried, and then stretched and painted, it will preserve its soundness for many years, the silicate acting as a protective covering to the fibres of the hemp of which the canvas is made.

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* Published by Messrs. Winsor and Newton.

There is another destructive agent which is being continually evolved in rooms, in London and large towns all over the kingdom, which comes from the gas we burn. Fortunately for us, in London the gas is very free from sulphuretted hydrogen, but there is a substance called bisulphide of carbon which is not taken from the gas, and usually remains in it, and this bi-sulphide of carbon, when it burns, forms with the oxygen of the air two compounds, one called sulphurous acid, and the other carbonic acid. Now, sulphurous acid has a directly bad effect upon some colours, especially on vegetable colours, many of which it bleaches. The action is too slow upon ordinary pigments for me to show it to you in the course of the lecture, but I have a flower here, a scarlet geranium, which I will put into some sulphurous acid, and you will find that, in the course of a short time, it will almost entirely lose its colour. But first, in order to show you that sulphurous acid is evolved by the combustion of this bisulphide of carbon, I will burn a small quantity of it in this jar. Having done so, I will shake up the products of combustion with the water which is in the jar, and you will see that we shall get sulphurous acid in the water. The sulphurous acid, on being shaken up with the water, is dissolved by it, and thus a vacuum is formed, which, as you see, causes my hand to be sucked into the mouth of the jar, so that it is suspended from it, and does not fall. In order to test the presence of sulphurous acid, we usually form a precipitate with a soluble salt of barium, and then dissolve that salt up in hydrochloric acid, for the sulphite of barium as well as the carbonate which will be formed here most likely, is soluble in hydrochloric acid; but if we add an oxidising agent to the liquid, then the sulphite of barium is converted into sulphate, and the sulphate is not soluble in hydrochloric acid, but will be thrown down as a white precipitate. Here is some chloride of barium; I will put a little ammonia to the liquid, to neutralise any free acid, and you see we have a white precipitate thrown down, and on adding some hydrochloric acid the precipitate will dissolve altogether, or nearly so. On the addition of some chlorine water it will be thrown down again. That is the way to prove that sulphurous acid is evolved in the combustion of bisulphide of carbon. That sulphurous acid has a bleaching action on vegetable colours will be shown by putting this scarlet geranium into a bottle with a little sulphuric acid and sulphite of sodium, and we will then introduce the flower, and see whether the colour does not gradually disappear. The same agent is equally effective in destroying certain vegetable pigments, although more time is required for the process than we can afford to give this evening.

Again, sulphurous acid, when it meets with oxygen, becomes oxidised into sulphuric acid, and with moisture you get a substance formed, commonly called oil of vitriol, in a dilute state, and this is a most disintegrating agent; acting on the surface of a picture, it tends to destroy the materials on which it is painted, and also to discharge many of the colours. One colour which successfully resists the action of almost everything else with which it has to meet, will not resist the action of sulphuric acid. I refer to the beautiful colour, ultramarine. Whether it be artificially prepared, or whether it be prepared from the natural lapis lazuli, it will not resist the action of a dilute solution of this acid salt. Here is some ultramarine, mixed with water; we will add to it a very dilute solution of sulphuric acid, and you will see that in a very short time the colour of the ultramarine will disappear.

These disintegrating and destructive agents are the principal ones with which pictures have to contend. It is, however, of little use for us to know the dangers which threaten us, unless we are armed with knowledge that is able to overcome them. Now, then, what is the remedy which we have in our hands to prevent, as far as possible, the destruction of our works of art? In the first place, we must attend to our painting grounds. Many years ago, I prepared painting-grounds for some time with a mixture of whitening and size, trusting that the oil which was to be put upon them would protect them from the action of the damp. I do not know whether whitening and size are used now-a-days in the preparation of canvas; it may be, for the surface obtained is so extremely good that it would be a great inducement to artists to make use of it. But the size softens with moisture, and it takes up moisture very readily; and in a short time—a year or two—pictures painted upon such a ground usually come to grief, as I discovered to my cost, some fifteen or sixteen years ago. Again, there is another objection to using such a preparation, viz., that the colours painted frequently crack, owing to the unequal contraction of the colour, and the ground upon which it is placed.

Some grounds are prepared with white-lead, and, from what we have already said about this material, I think you will agree with me that it may be, and is, a very good material for preparing canvas with in the first grounding, but that it is not a good material for the surface which is to be painted upon. It has a destructive action upon some colours when it comes in contact with them, and we know that it has this destructive influence upon several pigments which are used—some sulphides are decomposed by it—sulphides of lead being formed—and other colours also are injuriously acted upon by it, the lakes, for instance, which, I believe, are injured materially by contact with white-lead; and, therefore, if the canvas is prepared in the first instance with white-lead, I can see no reason why it should not be finished off with that substance which we know is innoxious, namely, zinc-white. I think I need hardly speak on the subject of wall-painting till we come to fresco and silicious painting, for I hardly imagine that any one would attempt to paint a large picture upon a wall with oil-colour, the objections to its use being so many. You must protect it with a varnish, and if you do you can only see the picture from certain points of view, owing to the almost regular reflection of the light from the surface of the part of the painting upon which it falls. You want a surface for a picture which is to decorate a room or a public building to reflect a light irregularly, and send it back to your eyes in all directions, so that the picture may be seen from all points of view. I would hardly allude, therefore, to the preparing of walls for oil-painting.

The next thing I have to speak about is vehicles for painting. Oils are compound bodies, containing what we term an acid or acids and a base. Some oils oxidise very rapidly, whilst others do not oxidise at all. Amongst the oxidisable oils which are used by artists, are poppy oil and linseed oils. These oils, when they oxidise, lose their colour, and however white they may be at first, after oxidation they get first of all yellow, and eventually brown, and this change of colour is persistent, and, in fact, it continues to get worse, unless you expose these oxidisable oils to the bleaching action of light. If, however, you expose a picture to the bleaching action of light, and if you have painted it with lakes and certain other colours—for instance, even cobalts are affected somewhat, turning green—these colours disappear or change. So, then, if we can find a substitute for oil which will not oxidise as readily as oil, and which will not oxidise appreciably under ordinary influences, I think you will agree with me it is a substance which at least ought to have a trial. The advantages of using oil are these. First of all, that it mixes kindly with most colours, not with all, for there are some which will not mix with oil well, but precipitate from it, and leave the oil floating on the top. With most colours, however, it mixes kindly, and it is a pleasant and agreeable vehicle to use. It can be dissolved by turpentine, and can be used in almost any state of fluidity that can be desired. All these advantages certainly are not equal to the disadvantages that occur from the oxidation of the oil, to which oxidation the use of oil as a preservative of colours is entirely owing. If you take some wax and dissolve it in turpentine you get a clear liquid. If you take some of the beautiful white gum, as white as mastic, called gum dammar, you will find it will give you a clear and nearly colourless solution with turpentine. If you mix these together, the wax will prevent the cracking of the gum, and you will find, I think, that you will have a painting vehicle which is extremely pleasant to use after you become accustomed to it. The colours which you employ of course cannot be ground in oil, but must be ground in turpentine. A great advantage in the use of this is, that after painting you may paint again in a quarter of an hour or twenty minutes, when your work becomes sufficiently dry to stand the putting of another coat over it. Again, you can, from an old painting, rub out any portion with turpentine. For instance, if you have painted and wish to carry out some afterthought, you can rub out, if you do it carefully, with turpentine, and can paint in again, and your work will not be liable to the disadvantages arising from the underground colours striking through the lighter ones which you use. However, this mixture of gum dammar and wax and oil, although a useful one, is also liable to objections. The wax oxidises, and the turpentine oxidises. If you leave turpentine standing for some time, it oxidises readily, and resinous bodies are formed. Fresh distilled turpentine does not contain these resinous bodies, but if the turpentine with which you paint contains them, they will have the same effect upon your colours as oxidised oil. Turpentine, then, is objectionable, and the question is, can you find a substitute for it? Here we have the same gum and wax together, dissolved in benzole. Now, benzole is not liable to this objection. It evaporates, and leaves the substance which it held in solution behind it. The smell is objectionable, but no doubt the smell of turpentine is equally objectionable to those not accustomed to it. Use is second nature, and one might as easily get accustomed to the smell of benzole as to the smell of turpentine. Then, if benzole is carefully prepared, it has very little smell. The specimen I have here has a very slight smell indeed. These vehicles I speak of from actual practice, and I can recommend them, because I have seen them used for a space of fifteen years, and I know that artists who have employed them at my suggestion, and have got accustomed to their use, have been quite satisfied with them, and that the paintings which have been executed in them, when the grounds were carefully prepared, have stood well against the disintegrating action to which paintings are liable. I am not now giving you simply a scientific opinion, but I am giving you a practical one, and I would simply ask those who have never used these materials to give them a fair trial, and see whether they will not bear out the encomiums I have passed upon them.

I will now speak to you about another substance which may be used in place of wax, which I have never tried, but I am going to suggest to you that it deserves a trial. Paraffin, that beautifully white substance of which candles are made, is, one may say, almost absolutely inoxidisable in air; it requires the action of very strong oxidising agents to oxidise it. In this bottle I have some paraffin dissolved in turpentine, and here is some dissolved in benzole. You see they are both perfectly clear liquids. When these are mixed with gum dammar, they will give sufficient elasticity to the gum to prevent cracking, and I believe the mixture, used with benzole, will be unalterable by time, and that pictures painted with it will not lose the brilliancy of their colours or the purity of their tints.

It is the custom to make drying oils, and I may just mention that they are usually made by the action of oxide of lead upon the oil. Linseed oil is boiled with, I think, about one-twentieth of its weight of oxide of lead, and this gives it the property of drying rapidly. How the oxide of lead acts is rather disputed about by chemists. I think Professor Liebig says it merely gets rid of the impurities, and so allows the oil to oxidise more freely. I do not know whether that is the case or not; it is not, however, a matter to be entered upon here, but it is of importance that we should know how to tell whether the oils we use are drying oils or not, whether they are pure or impure, and whether they are adulterated or not with non-drying oils. Non-drying oils, when acted upon by a substance which is termed peroxide of hydrogen, solidify, the oleic acid solidifies, and a substance called elaidin is formed. This is not the case with the drying oils, so that if you have a sample of oil that you thought did not dry properly, and which you suspected was adulterated with some non-drying oil, if you add to it a solution of a salt called sub-nitrate of mercury, which has exactly the same effect as the peroxide of nitrogen, then if you get no solidification, you may be sure that your oil has not been adulterated with non-drying oil. This is an experiment easily performed, and one which may be found of use.

Now we pass on to a consideration of a system of painting, which we know in many instances has been used with good effect, and that paintings executed in it have stood well the test of time, I mean fresco-painting. Experiments in fresco-painting have been made in this country, and from the result of these experiments I am very much afraid that many of us have formed wrong impressions about fresco-painting. We have seen that, in really advantageous situations, fresco-paintings have become disintegrated, the colours have gone, and the surfaces have come off, either in flakes or in powder. If you visit the city of Munich, and go to the church of St. Bonifacio, you will see that it has been decorated by Professor Hesse with fresco-paintings, which were executed 30 years ago, or more than that. The paintings there are standing well, and have stood well, except where moisture has come in from behind, and has thrown off the painted surface from the front. Now, no painting, whether it be executed in silicious colours or in fresco colours, can stand the action of damp affecting it from behind; that is simply impossible. But I may speak with confidence about fresco-painting, because some 20 years ago, a large public building was decorated in fresco-painting, and pictures in it were painted in fresco by Munich artists, and also some by English artists, who had learned the method from the Munich artists. That building I have not seen myself for many years now, but I have been told by many gentlemen, one of whom was here present, I believe, last Monday evening, that it is still in a state of perfect preservation, and the fresco has not in any way disintegrated either in the ornamental part or in the picture subjects. I can, therefore, speak with confidence of fresco-painting when executed in the way in which it is performed by those gentlemen who have made it their study, since the revival of art, in Munich.

I will, to the best of my ability, describe to you the method in which I was taught fresco-painting in Munich, and speak of those influences which are likely to interfere with the permanence of pictures painted in it. But, first of all, I must take you aside, for a few moments, to another subject, although one intimately connected with fresco-painting. When lime is mixed with sand, and used for building purposes, it is called mortar; but how is it that mortar, which is soft when first laid, becomes hard in the course of time? You have lime, some of which has absorbed carbonic acid from the air, and has become carbonate of lime, which is equivalent to chalk; it is, in fact, chalk. You have also sand, for without the sand the lime will not harden, it will break and crumble away; but with the sand it makes a hard compost. The lime, in the presence of water, acts upon the sand, dissolves and unites with some of the silica of which the sand is composed, and so a silicate of lime is formed, and this silicate of lime forms, I believe, the binding power in mortar.

The ground upon which fresco is painted is a lime ground; and in order to have a permanent picture, it is clear we must have a firm and stable ground. In order to prepare that ground, first of all the wall must be absolutely dry; there must be no leakage of moisture from behind. Lime which has been run (as it is, I believe, technically called by builders) for a year or a year and a half is best to be employed, for in proportion as the lime has been carbonated (though it must not be so to too great an extent) by the action of the carbonic acid of the air it makes a better and a harder mortar. With this lime must be mixed sand, and a great deal depends on the selection of the sand. It must be river sand, and it should be of even grain; the sand should be mixed with water, and allowed to pass along down a small stream, so that in the centre of the stream you would have sand the grains of which would be pretty nearly equal in size. This is a point of considerable importance. The reason why new lime cannot and ought not to be used is because it blisters; small blisters appear on the surface, and that of course would be ruinous to a picture. A well-plastered wall should not have a blister or a crack in it, and this is secured by having your lime run for some time, of good quality to start with, and mixed with good sand. There is no chemical process that I know of that takes place in fresco-painting other than this, that silicates are formed by the action of the lime upon the sand, and carbonates by the action of the carbonic acid of the air upon the lime.

In painting a fresco picture, inasmuch as there is no re-touching the work when it is finished, the artist must make his drawing very carefully. The cartoon is made upon ordinary paper, then it is fixed against the wall, where the picture is to be painted. The part where the artist decides to begin his work is uncovered, that is to say, a portion of the paper is turned down and cut away, but in such a manner that it may be replaced. Then the plasterer puts fresh plaster, about an eighth of an inch thick, upon the uncovered portion of the wall, and the plasterer's work is of the utmost importance in fresco-painting. The workman ought to practise it well before he attempts to prepare the ground for a large picture, and I have found it of the greatest importance to allow the man to practice for several weeks before he was allowed to prepare any portion of the ground, even for decorative painting. In this way he becomes accustomed to the suction of the wall, and upon the suction of the wall depends the soundness of the ground and the success of fresco-painting. When the plaster is first put on, of course it is very soft; the piece of the cartoon is replaced upon it, and the lines of the picture are gone over with a bone point, so that an indentation is made, and then the artist begins his painting. At first, he finds his colours work greasy; you cannot get the tint to lie on, it works streaky; but you must not mind that, you must paint on, but you must only paint on for a certain time, for if you go on painting too long you will interfere with the satisfactory suction of the ground, which is so necessary to produce a good fresco-painting. Of course, nothing but practice can tell anyone the period at which he ought to stop. I cannot describe it, because I should be simply trying to describe a sensation, which I cannot do. After some practice, you know perfectly well by the feel when you ought to stop. If you feel your colour flowing from your brush too readily, you ought to stop at this period. You must then leave your work for a time, and go back to it again. And then you will find, as the plaster sucks in the colour which you have first laid on, that there will be—it may be in the course of half-an-hour, it may be an hour, that depends upon the temperature of the atmosphere—a pleasant suction from your brush, the colour going from it agreeably, and you will find that it will cover better. Now is the time to paint rapidly, and complete the work you have in hand. When the colour leaves your brush as though the wall was thirsty for moisture, you should cease painting; every touch that is applied after that will turn out grey when it dries, and the colour will not be fast upon the wall. You will see, then, how impossible it is, with such materials, to paint in the same style in which you paint a picture in oil-colour. Fresco-painting involves the adoption of an entirely different style from oil-painting. The frescoes of the old masters are not highly wrought up, highly-finished works. They depend for their effect upon the juxta-position of tints, the shadows being intensified by lines and cross-hatching. If you look at those reproductions of some of the most valuable fresco-paintings of the old masters which are brought before us so well by the Arundel Society—I may particularly mention "The Presentation," in which there are three or four beautiful heads, which are executed life-size—and if you examine those—and I believe every line has been copied from the original fresco—you will see the method adopted by the fresco-painters. They depended upon the juxtaposition of tints, not upon covering over, and over, and over again. That juxtaposition of tints I think we alluded to in an earlier lecture, when speaking of the effect of light upon the retina, then we saw that it produces roundness, transparency, and has a very pleasing effect upon the eye. If two tints are put against one another, they do not appear to us as if they were single, but each adds something to the effect of the other, and together they produce a pleasurable and agreeable effect, if they have been properly selected. I do not know that it is possible for me by word of mouth to give you any better description than I have done, of the method to be employed in the actual laying on of the colours. I know well how tempting it is to go back to a piece of painting and do something to it that ought to have been done before. We think that a touch will improve it, and we go and make it; but in fresco-painting the temptation must be resisted, for it will be absolutely fatal to the permanency of the work.

It is not for me to find any fault with the works of great artists who have painted in fresco in this country. As to their works, their merits are too great for so humble an individual as I am to speak about; but as regards the mechanical work of some of their fresco-painting, I believe that I am at liberty to speak. This work cannot have been done properly, or the paintings would not have become so rapidly disintegrated as some of them have, for most of them are in situations the most excellent for fresco-painting, on inner walls, in dry places, where they are not acted upon by damp from behind, or by accumulated moisture from condensed vapour in front.

As to the colours that can be used in fresco-paintings, I have dwelt very considerably upon the action of potash and alkalies upon colours, and I dare say many asked yourselves why I did so. The reason was, that I had in view this subject of fresco-painting, and that of silicious-painting, the consideration of which will occupy us at our next lecture. Colours that will not stand the action of alkalies or lime cannot be used in fresco-painting. Here are a number of colours taken haphazard by Mr. Taylor, and they have been all mixed with lime. Here is aureolin yellow, which I am happy to say is keeping its colour. Here is King's yellow, which has absolutely lost its colour. Here is the green oxide of chromium, which is keeping its colour. Here is Verona brown, the colour of which has absolutely disappeared. Here, again, is some of the best French ultramarine, which has kept its colour. Here is cobalt blue. The colour must have been mixed light, but it has kept its colour, and is still a pure blue. There are others here, vermilion, and so on. The pigments which can be used in fresco-painting are these:—For blues, ultramarine and cobalt; of course you must take the best ultramarine, for there are many ultramarines sold which will not stand the action of lime at all; but the best ultramarine, prepared in France, or that which I was in the habit of using years ago, obtained from Nuremberg, will stand very well. Cobalt blue also stands well, but Prussian blue will not stand at all. For reds, you may have various tints of iron reds, and these tints can now be obtained, of great brilliancy, from oxide of iron. The ordinary oxide of iron, ferric oxide, as chemists term it, can be obtained of a very bright colour, but it is not of the same character, of course, as vermillion, and tints varying from it down to the purple of that substance, which is known as colcothar, may be obtained by different treatments of the oxide of iron. These colours may be got, I believe, in this country; but if all the tints cannot, and if any one requires them, there are those who I am sure will be most willing to meet their wishes, and try to prepare them of sufficient brilliancy and purity. Vermillion, provided it is good—the best vermillion, prepared by such a firm as Messrs. Berger and Co., or the equally good vermillion which is contained in those bottles of Messrs. Winsor and Newton, and also some of the foreign vermillion—will stand on lime, and can be used for fresco-painting. But the pure tint of the vermillion becomes changed, just as it does in oil painting. It gets gradually browner, and I think I threw out a hint why this is so, the other night. Then, again, there is a very beautiful red, called cadmium red, a sample of which I have here in a piece of paper, which any one can see after the lecture, which is also very brilliant. All the cadmiums, from red down to yellow, can be used in fresco-painting, but they must be carefully prepared. If they are not, if there be any sulphur left in them, as there often is, or if there be any of the substance left in them from which they have been precipitated, then I will not say that they would stand; but I know, from practice and from experiments, that cadmium sulphides, well prepared, whether they be dark red or pale yellow, will stand well. Then for greens. You have first, terra-vert. This is an unsatisfactory colour altogether, but it is very useful in fresco-painting. I mentioned, if you remember, that first of all, when you begin to paint, your colours work streaky, and you have not proper suction. That is the time, if you are painting green, to prepare your ground with terra-vert, afterwards you may finish with oxides of chromium. I have already alluded to them. There are on the table some oxides of chromium, of various tints, which are absolutely unchangeable. These colours stand the action of lime and of the disintegrating agents that are met with in the air and elsewhere. Then, with regard to yellows, of course there is cadmium yellow; and, from the experiments which we have performed, I think I may with confidence recommend this aureolin yellow. It has stood the action both of the lime and caustic potash. By-the-bye, I must mention that the action of caustic soda on aureolin yellow seems to be more energetic, in fact, the potash seems to have no action, but the soda does in some way change the tint. In our next lecture I shall have to refer to that, because there is a system of silicious painting, one that was recommended by Professor Fuchs, of Munich, which has been followed by Kaulbach, and which has been employed, I believe, by Mr. Herbert, in his magnificent painting in the House of Parliament, and in that system silicate of soda is used, combined with silicate of potash. Of that I shall have to speak on Monday next, when I shall also have to mention another system of silicious painting, in which silicate of soda is not employed. For browns, all the earths, the umbers, and sienna, and so forth, may all be used.

If you are preparing to execute a large fresco work, you will see that, inasmuch as there is no touching up to be done afterwards, all the colours that are necessary for the work must be prepared before you commence. Therefore you will have to arrange, in proper gradations, all the tints which you mean to use. Of course, they must be ground and mixed in water, and you may then put them into pots, where they will be ready for use, keeping them moist with a piece of moistened rag or flannel on the top. The method to be adopted for deciding the tint that the colour will have when dried is this. A good sized piece of umber unburnt is taken, and the surface of it is dressed off, and then, when the tints are mixed, they are dashed with the brush upon the umber one after the other in succession. The umber takes away the water instantaneously from the colour, and you get the tint nearly as it will appear when dry. Properly painted frescoes will stand well in our climate on inside walls; on outside walls they will not. Frescoes will not stand in a smoky city like London. In an atmosphere like ours, where it is one day raining and another day freezing, frescoes for exteriors will not last. They will not stand well outside in Munich. The picture over the gateway in that city, which was painted 25 or 30 years back, has all been destroyed, or nearly so, and it had to be restored, I believe, by the silicious mode of painting.

Though fresco-painting is interesting and extremely delightful, when by practice one is able to perform it successfully, yet, I think, ladies and gentlemen, on Monday I shall be able to explain and recommend to you a better system of painting than fresco—one which will endure longer, as, from the nature of the materials used, it will be much more indestructible, and one which has not the objection of fresco-painting, particularly for those who have been all their lives accustomed to oil-painting, viz., that you can touch up your work, put in any after-thoughts, and bring your picture to any height of finish that you may desire. On Monday evening next I will give you an account of the various methods employed in silicious painting, and I will also mention to you a method of my own, which I devised and employed some years ago, the nature of which I will endeavour to the best of my power to explain to you.

Mr. Barff concluded his lecture by exhibiting to the audience the scarlet geranium which had been put into sulphurous acid, and had become bleached to a pale yellow, and also the blue pigments resulting from the experiments mentioned earlier in the lecture.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The following report from the Musical Committee has been laid before the Council and adopted:—

1. In order to carry on the work already begun by the Society of Arts, with the view of establishing a National Training School for Music, the Committee recommend the Council to make music—as one of the Fine Arts—an object of the Society's attention.

2. For promoting this purpose, the Committee recommend that a musical section of the Society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall.

3. These concerts to consist of performances of vocal and instrumental music of the highest character.

4. After paying the expenses of the concerts, the profits to be applied to the establishment of a National Training School for Music.

5. Members of the Society, for every subscription of one guinea paid to the musical fund, to have the privilege of obtaining a transferable ticket for six evening concerts in the arena and balcony without further payment, provided that no member as such shall have the privilege of receiving more than five tickets on these terms. Each seat will be numbered and reserved.

6. Persons not members of the Society shall have the liberty to purchase tickets on such terms as the Council may from time to time determine.

7. That the Musical Committee of this Society, consisting of:—

The Lord Henry G. Lennox, M.P., Chairman of the Council, or the Chairman of Council for the time being, and
S. Redgrave, Esq.,* and Seymour Teulon, Esq., Vice-Chairmen of the Council, or Vice-Chairmen of Council for the time being
Lord Gerald FitzGerald *
The Right Hon. Sir J. Pakington, Bart., M.P.*
Sir John E. Harington, Bart.*
Sir. Francis Sandford *
E. A. Bowring, Esq., C.B., M.P.*
Henry Cole, C.B.*
A. S. Cole, Esq.
Capt. Donnelly, R.E.*
The Honourable Seymour Egerton
W. Hawes, Esq.*
C. Wren Hoskyns, Esq.
Frank Morrison, Esq.
J. Puttick, Esq.*
Lieutenant-Colonel Scott, R.E.*
E. C. Tufnell, Esq.

be authorised to carry out the arrangements for the six concerts, as soon as a guarantee fund for not less than two thousand pounds has been obtained, and one thousand subscriptions of one guinea.

That Sir Michael Costa be asked to meet the Committee, to discuss the necessary details.

A guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed, announced in last week's *Journal*, was £2,307 10s.

The following gentlemen have since guaranteed the amount set opposite their names respectively:—

	£	s.		£	s.
W. Baker........	10	0	Daniel Howard ..	25	0
Charles Critchett..	10	0	A. M. Silber......	25	0

The number of tickets taken, as announced in last *Journal*, 241.

T. Borrett	2	Major Pratt	4
Maj.-Gen. Croggan, R.A.	2	Alfred H. Rixon	2
Thomas Harrison	2	A. M. Silber	2
Daniel Howard	3	Robert Silk	2
J. W. Hart	2	John Taylor..........	2
Admiral Ommanney ..	2	L. Van Oven	1
Philip Palmer	3	F. M. Williams	2

The first concert will be given on April 12th, and it will be the first public performance in the hall after the opening ceremonial by Her Majesty the Queen. The dates of the other Concerts are April 19th, July 5th, 12th, 19th, and 26th.

The Council earnestly hope that the members of the Society will support, and co-operate with them in, this important public undertaking, and by joining in the proposed guarantee, and by availing themselves of the privilege of subscribing for tickets at the reduced rate, aid in securing the establishment of a National Training School for Music.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

INDIA COMMITTEE.

A conference on the "Utilisation of Peat in Indian Locomotives, and for other purposes," will be held on Friday, January 27th, at 8 o'clock. The opening paper will be read by Lieut.-Colonel Romaine Wragge.

ART WORKMANSHIP COMPETITION.

Articles in competition for the prizes offered by the Council have been received from forty-two competitors. A list, with the awards of the judges, will shortly appear in the *Journal*.

CANTOR LECTURES.

The second course of Cantor Lectures for the session will be delivered by Dr. CRACE CALVERT, F.R.S., and will treat of "Dyes and Dye-stuffs Another than iline." The course will consist of five lectures, and will commence on Tuesday evening, the 7th of February, and be continued the subsequent Tuesday evenings till completed. These lectures are open to members, each of whom has the privilege of admitting two friends to each lecture.

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* These signed the Report on Musical Education, 1866.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

Amount of subscriptions received, £21 15s.

County Courts and Postage Cards.—A few days ago one of the county court judges ordered a case to be adjourned, and appended to his order the addition that notice should be sent to the party interested by post-card, instead of on the usual printed form, so as to save half the expense. One of the officers of the court pointed out that as the postages of the court are paid out of the Consolidated Fund by the Treasury, nothing would be saved to the parties, though the Consolidated Fund would save a halfpenny at the expense of the Post-office. Everyone agrees that to send on post-card any communication which, from its nature, the receiver would prefer keeping to himself, is an improper, as being a rude and unmannerly proceeding. In a country place, for instance, in which the village shop is the post-office, what an unpleasant amount of gossip-breeding publicity the post-card service might give rise to. It may be said that litigation is a public matter already, because the courts are open to the public, and cases are reported by the press; but the fact that trials and hearings are, as they should be, conducted in public, is no reason why the litigants should be annoyed by having the preliminary particulars of their litigation fluttered about in an open missive. To publish pleadings in a case *adhuc sub judice* has been held a contempt of court. It seems that a good many registrars have been forwarding county court process to each other by book-post. The Treasury, however, have just ordered registrars to send all documents in closed envelopes.—*Solicitors' Journal.*

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel. Scott, R.E., secretary.

Scotch Fleece.—The Scotch wool staplers will show the skins with tapes sewn on, to distinguish the different qualities of wool on each fleece.

Brick and Tile Machines.—These machines, the exhibition of which would cause dirt in the buildings, will be placed in a large corrugated iron shed, which is about to be constructed by Messrs. F. Morton and Co., of Liverpool, on the eastern or Exhibition-road side.

Royal Albert Hall.—A meeting of the Executive Committee of the Royal Albert Hall was held on Monday at the Hall, to settle the preliminaries for the opening by the Queen on the 29th of March. Present—The Right Hon. H. A. Bruce in the chair; Sir Thomas Biddulph, Mr. Bowring, Mr. Cole, Mr. Thring, and Lieut.-Col. Scott, Secretary. It was resolved to give the proprietors of seats and season ticket holders for the Annual International Exhibitions special privileges in obtaining tickets of admission.

Class 10, Educational Works and Appliances.—The following Committees met on Friday last, the 11th inst., and appointed the Committees of Selection in their respective divisions:—

Section D.—*Specimens and Illustrations of Modes of Teaching Fine Art, Natural History, and Physical Science* (Sub-section Physical Science).

Section E.—*Specimens of School Work serving as Examples of the Results of Teaching.*

The names of the judges appointed on these and other Committees of Selection in Class 10 will be given in a subsequent number of the *Journal.*

Spain and the Annual International Exhibitions.—The influence of these exhibitions is making itself felt on the Continent. A despatch has been forwarded from Madrid, announcing the appointment, by special "decree," of a commissioner, under the authority of the Minister of Works and Education, charged with forwarding the interests of Spain in these Exhibitions in London; the nomination of a 'Commissioner-General' in London, to act in union with Her Majesty's Commissioners; and a preliminary Spanish exhibition every year in Madrid, from which choice specimens "of the fine art and manufactures" of Spain can be selected and forwarded to the London Exhibition at the expense of the Spanish government. This seems exactly the sort of action that will best turn to account these international comparative tests of progress.

Delivery of Exhibits.—In accordance with the general rules and regulations laid down by Her Majesty's Commissioners, all productions intended for the approaching International Exhibition must be delivered at the Exhibition Buildings, South Kensington, for the inspection of the Committees of Selection, punctually on the days specified. The objects must be delivered to the officers appointed to receive them, unpacked and ready for immediate inspection, and free from all charges for carriage, &c. To every object, to which the label (form 64*a*, 64*b*, or 64*c*) cannot be attached, an adhesive label must be securely affixed, bearing the exhibitor's name and a number corresponding with the number of the object in the list (form 65*a*, 65*b*, or 65*c*) sent with it. A supply of adhesive labels may be had on application. Objects not accepted for exhibition by the Committees of Selection must be removed from the building immediately on the receipt of a notice to that effect, but those productions which the Committees may select for the Exhibition cannot be removed before its close. Messrs. Chaplin and Horne, of the "Swan-with-Two-Necks," Gresham-street, London, have entered into an arrangement for the conveyance of foreign goods to the Exhibition, and arrangements can be made for the carriage, unpacking, and delivery, at the Exhibition Buildings, of goods transmitted from various parts of the United Kingdom. Her Majesty's Commissioners wish it to be understood that they are not to be considered as specially recommending Messrs. Chaplin and Horne, or as in any way responsible for any steps taken by that firm. All objects must be delivered at the Exhibition Building, at the entrances specified, on the days named below:—

		Entrances.
Feb. 1 ” 2	Machinery for pottery..	Exhibition-road.
” 3 ” 4	Machinery for woollen and worsted fabrics	Prince Albert's-road.
” 6 ” 7	Scientific inventions	Prince Albert's-road.
” 8 ” 9	Educational works and appliances (except Section E, Results of Teaching, which must be delivered at the house of the Society of Arts)	Royal Albert Hall.
” 10 ” 11	Pottery and raw materials	Exhibition-road.
” 13 ” 14	Woollen and worsted fabrics and raw materials	Royal Albert Hall.
” 15 ” 16	Sculpture not applied to works of utility	Prince Albert's-road.
” 17	Painting applied to works of utility	Prince Albert's-road.
” 18 ” 20	Sculpture applied to works of utility	Prince Albert's-road.
” 21	Engraving, lithography, photography, &c.	Royal Albert Hall.
” 22	Architectural designs, drawings, and models	Royal Albert Hall.
” 23	Tapestries, carpets, embroideries, &c.	Prince Albert's-road.
” 24	Designs for all kinds of decorative manufactures	Royal Albert Hall.
” 25	Copies of pictures, mosaics, enamels, &c.	Prince Albert's-road.
” 27 ” 28	Painting not applied to works of utility	Prince Albert's-road.

THE MARTINI-HENRY RIFLE.

The Martini-Henry breech-loading rifle (says the *Standard*) is founded on the block system, introduced originally in the Peabody rifle, and, on the whole, presents as simple a combination of parts as could well be arrived at, considering the amount of work which it is intended to perform. At the first glance, its appearance is not pleasing; but this is, no doubt, due to the squareness and stiffness presented, and want of projections, such as the hammer, which custom has made so familiar to the eye, when examining a rifle of the old sort. On a closer examination, however, attention is attracted to its great simplicity, durability, and general fitness for the service; and if a little more grace, or, more properly speaking, finish, was given to it, it might be made as attractive to the eye of the casual as it now is to that of the close observer.

The first innovation to be observed is in the woodwork or stock, which is made in two parts, being connected by a metal case, in which are secreted all the machinery for working the breech. The butt of the rifle is attached to this case by a strong metal bolt, about six inches long, which is inserted through a hole in the heel plate, and screwed into the rear part of the case or chamber; the space left in the butt behind the head of the screw being turned to account as a repository for cleaning implements, &c., which are kept in a trap in the heel plate, closing by a spring. The block, which presses against the base of the cartridge when the breech is closed, rests loosely in this case, and radiates on a pin passing through on its rear end, and fixed in the sides of the case above the end of the bolt before mentioned as fastening the butt to the breech-case. The end of the block is rounded off so as to form with the rear end of the case, which is hallowed out to correspond exactly, a perfect knuckle-joint. It is on this place the whole force of the recoil is received, and, as it is a component part of the whole weapon, the force of the recoil is consequently distributed over its entire length, and not received on the axis pin or any other separate part of the mechanism. This arrangement is admirable, as it not only does away with the possibility of wear on any one part through the effects of the recoil, but, on the other hand, it lightens the kick or blow on the shoulder by expending the force on the inertia of the arm. This knuckle-joint is slightly above the direct action of the recoil, which permits the block, when being lowered, to fall as if from a higher elevation than it would do if it were placed in a line with the axis of the arm, which would, theoretically speaking, appear to be its proper place. Immediately behind the trigger-guard, there is a level handle, working on a pin, fitted in the lower part of the case, immediately below the block axis pin. To this level is attached a short arm, which projects into the case, and acts as a support to the block, which it raises or lowers according as the lever-handle outside is opened or shut. The movement of this lever backward or forward completes every operation required, viz., cocking the rifle, raising and lowering the breech-block, and extracting the cartridge. On being moved forward, that is, from the firer, the short arm becomes disengaged from a notch in the lower part of the block, thereby allowing it to fall. In the fore part of the breech-case, the extractor is situated; it works on a pin fitted through the sides of the case. It has two arms pointing straight upwards, which are pressed by the rim of the cartridge, when pushed home, into two grooves, cut for the purpose at the sides of the barrel to a height with its axis. It has also another arm, which is slightly bent upwards, and points towards the centre of the case, at about an angle of 80 deg. with the upright arms before mentioned. When the fore part of the block falls, on the removal of its lower support, viz., the short arm of the lever, it strikes the bent arm of the extractor in two places, first, on its point, causing the two upright arms to overcome the inertia of the cartridge-case, and extract it a little, and then somewhat further in on the arm, causing a more rapid though continuous motion to be given to the upright arms, which, being still pressed against the rim of the cartridge-case, causes its entire ejectment from the barrel. To prevent the possibility of failure in the extraction of the cartridge-case through want of sufficient power, the inner arm of the lever, on becoming released from the notch on the block, comes in contact with a crook or arm projecting downwards from the rear end of the block, thereby ensuring a smart blow being given by the falling part of the block to the bent arm of the extractor; and, as the force applied by this inner arm to the crook depends on the movement of the outward lever, the power of the extraction rests with the firer, and not with any spring or other part of the mechanism.

The breech-lock is hollowed out on its upper surface, so as to permit the insertion of the cartridge into the chamber with ease. Its centre is likewise bored out, and contains within it the life of the machine, viz., a spiral spring coiled round a piece of metal, armed with a point which protrudes beyond it, and passes through a hole in the front face of the block, exactly behind the percussion-cap in the centre of the cartridge. When the lever handle is moved forward, as before described, to extract the cartridge-case, it causes the tumbler, which works on the same pin, to revolve, and an arm attached thereto draws back the striker, which lies within the coil spring, compressing the spring considerably in so doing. When the lever handle is closed after loading, its inner arm again raises the block, keeping it steady in its place by wedging itself into the notch before mentioned, and causing in the action a further compression of the spring, so that when the block reaches its proper place, the action of full-cock is completed. The spring is retained in this compressed, *i.e.*, at full-cock, by the arm of the tumbler, which is prevented from revolving by an ingeniously-constructed piece of mechanism, which answers to the sear in the old lock, and which is acted upon by a small flat spring, causing its nose to enter the upper bent in the tumbler. The action is released to fire the rifle by pressing a trigger, which works loosely on a pin, so that, when pressed, it rises higher in the lock, and, entering a lower vent in the tumbler, takes the weight off the nose of the sear, and then, slipping from its vent, which is cut at an obtuse angle, permits the tumbler to revolve, so giving freedom to the bottled up strength of the spring. The striker, which is encased in the spring, and therefore works with it, is thus shut forward against the cap in the cartridge, the action being direct, or end on, and not oblique, as in the Snider. The head of the lever axis pin is fitted with a plated finger, which works with the inner mechanism, but on the outside of the case, and shows infallibly when the rifle is at full-cock. There is also a small locking-bolt adjusted in the trigger-plate, which enables the rifle to be carried with safety when loaded, and presents, perhaps, the only useless piece in the mechanism of the breech.

The cartridge used with the Martini-Henry rifle is of the Boxer pattern, and is termed bottle-necked, on account of its shape, the part containing the powder being of larger diameter than the fore part, which holds the bullet. The breech end of the barrel is, of course, bored to suit it, and by this means a much shorter and more handy cartridge can be used.

THE INTERNATIONAL DECIMAL SYSTEM OF WEIGHTS, MEASURES, AND COINS.

At the present time, when the Dominion of Canada is about to follow and adopt the system of weights, measures, and coins proposed for the United Kingdom, it may be useful to attempt some *resumé* of what has occurred in connection with the whole subject, and such we gather from the report of the Select Committee of the Canadian Senate.

The origin of the metric system in Europe dates as far back as the reign of Louis XIV., when the inconvenience and confusion arising from the variety of weights and measures in France were so strongly felt, that a Royal Commission was appointed to investigate the question, and report on some suitable standard. In 1790, M. Talleyrand presented a report on the uniformity of weights and measures, and it was decided that the co-operation of England should be invited in establishing an international system. Political complications however arose, and nine years elapsed before a standard metre and standard kilogram were approved by the Corps Legislatif, and they have ever since been preserved in the archives of the State at Paris. Not until 1837 was the metric system conclusively adopted in France. Again ten years had elapsed when, consequent on the establishment of universal exhibitions—inaugurated by that of London in 1851, which was followed by that of Paris in 1855—the attention of scientific, as well as practical men of business, was directed to this matter. Action was also taken by the statistical congresses assembled in Brussels and in Paris in 1853 and 1855, in favour of international uniformity; and subsequently an international association was formed, composed of members chosen from different countries, who should devote themselves to the establishment of the desired uniformity.

In the year 1835, the imperial system of weights and measures was established by law in England. Since then, no other system was legalised until 1864, when, by Act of Parliament, the use of the metric system was made permissive, and it is now, conjointly with the imperial system, in use throughout the United Kingdom. Since the passing of this Act there has not been any further legislation on this subject, but a Royal Commission has borne testimony to the progress of public opinion in favour of the metric system of weights and measures, and to its increasing use in scientific researches, and in the practice of accurate chemistry and engineering construction. There has been a subsequent report, dated 1st February, 1870, but this has reference solely to troy weight, still partially in use, but the abolition of which is strongly recommended. In their report of the 3rd April, 1869, the Royal Commissioners base their conclusions in favour of the metric system upon several considerations, one of which is the general adoption of this system in many countries both in Europe and other parts of the world. In support of this statement, it has been ascertained that the countries where the metric system has been wholly adopted contain a population of 146 millions; the countries in which partly adopted, 183 millions; and countries—viz., United Kingdom, United States, Prussia, and North Germany—where it is permissive, contain 90 millions; making a total of upwards of 400 millions.

In view of all these circumstances, the committee are of opinion that no time should be lost in establishing by law a uniform system of weights and measures throughout the Dominion of Canada. As, however, so large a proportion of the trade is carried on with Great Britain, it is suggested that the example of England may be safely followed, and that the metric system may, in like manner, be made at first permissive, and be adopted, as there, conjointly with the system of imperial weights and measures.

The attention of the committee was next directed to the subject of a uniform international system of coins. From this we gather that, in 1867, the British government was invited by the French government to depute commissioners to attend a conference at Paris of representatives of various States, for the purpose of deliberating on the best means of securing a common basis for the adoption of a general international coinage. Since that time, some progress has been made by the respective governments towards obtaining the much desired object, by establishing complete equality of value between the sovereign and the 25-franc gold piece which it is proposed to coin in France. The following extracts from a speech of the present Chancellor of the Exchequer, on the 6th of August, 1869, which are given, will best explain how the question then stood:—"The French are proposing to coin a 25-franc gold piece—five francs more than the Napoleon. That would be less in value than the sovereign by 22 centimes, or about 2d. If we were to impose a seignorage of about 1 per cent., and take gold to that amount from the coin, our sovereign would be identical with the 25-franc piece. It would still remain as a current coin in this country, of exactly the same value as now, and it would have the additional advantage that it would be identical with the 25-franc piece. It is singular to remark what a number of coins in the world approach one another in value—the Spanish doubloon, the Prussian Frederick, the half-eagle of America—and it appears to me that, by a single measure, as proposed, we may secure the great benefit of saving all expenses on our own gold coinage, and, at the same time, of striking a coin which would have the advantage of an international circulation."

EDUCATIONAL NOTES.

The London School Board, at its last meeting, elected, as Clerk to the Board, Mr. George Hector Croad, Secretary to the Bishop of London's Fund.

The National Society.—Since the 3rd of August, this society has made grants towards the building and enlargement of schools to the extent of £49,593, assisting thereby in providing additional accommodation for 153,589 children. At the last meeting of the Finance

Committee, on the 11th of January, grants to the amount of £23,593 were voted to more than 500 places.

The Supply of Teachers.—Sir James Kay-Shuttleworth, in reply to a correspondent who objected that in the letter referred to in a recent number of the *Journal* (No. 946, p. 129), he had overstated the requirements under the New Act, gives the following grounds for his estimate that teachers should be provided for 3,500,000 scholars in England and Wales:—"The Duke of Newcastle's Commission reported in 1861 that the proportion of scholars to the population actually instructed in elementary schools was, in 1858, 1 in 7·7, as reported by the education societies, and 1 in 7·83, as estimated by the Commission. All estimates made prior to 1870, of the proportion of the population which either was or ought to be in elementary schools, must obviously now undergo great modification. The Education Act, regarded as an emphatic declaration of the opinion of the Legislature on the duties of parents of the manual labour class, cannot fail to have great influence on all of them who are intelligent and conscientious. The example of such parents will affect public opinion among their more apathetic and less provident neighbours. That opinion will be powerfully reinforced by the reports of discussions in the School Boards, by the exertions of the religious communions, and by the influence of the Press. The reckless classes, who still remain insensible to such motives, and the pauperised, who are too poor to provide for their children's education, will be gradually brought under the operation of the compulsory clauses. Some in receipt of outdoor relief will be required, as a condition of such aid, to keep their children at school. Vagrant children will be gathered into the industrial schools. Criminals will be sent to reformatories. School pence will be paid for another class. Parents who waste ample earnings improvidently and neglect their children's education will be compelled to provide for it. From all, regularity of school attendance will be required by the law. The increase of elementary scholars from 1 in 7·7, reported in 1858, to 1 in 6, is not, therefore, so great as to render extravagant the hope that it may be attained by the operation of the Act."

Public School Committee.—At the meeting of head masters of schools, held at Sherborne, on the 28th and and 29th ult., it was resolved to appoint a committee of head masters to carry out the resolutions of the meeting, and generally to represent school views, principles, and interests for the year. The committee is now complete, and was to hold its first meeting this day, January 20th. It consists of the head masters of Winchester (chairman), Eton, Clifton, and Cheltenham Colleges, Harrow School, the City of London School, Repton, Uppingham, and Sherborne.

The Cambridge Examinations for Women.—A conference of local secretaries and others interested in the higher education of women, in connexion with the Cambridge University Examinations for Women, was held at Leeds, on the 12th and 13th inst. Various matters of detail were discussed, and steps were taken for the formation of libraries of books for the use of candidates. It is hoped that lectures will be established at various centres for systematic instruction in some of the subjects of examination.

Mr. Forster on the Education Act.—In the course of an address made to his constituents at Bradford, on the 16th inst., Mr. Forster explained the Education Bill, and stated that 77 of the most important boroughs had adopted the Act, and that before Parliament met not less than a population of eight millions would be under its operation. There were a vast number of places where there had been great promises of expenditure of money, in order to make a provision which should not make it necessary to have a rate, and, probably for the first time, that objection to a rate, which had hitherto been an obstructive feeling against progress, had been in this case enlisted in favour of progress by providing the means of education. With regard to building grants, he wished to state, in order to remove a prevalent false impression, that the government really, taking one case with another, give about one-fifth of the cost of the schools. Upon the question of compulsion, Mr. Forster said that the principle was admitted in the Act. It had established that provision should be made for children, whether they attend or not. That would, he thought, lead to their attendance. When persons would be compelled, if they did not do it by voluntary exertion, to pay rates to provide school accommodation for all the children, whether they attended or not, he trusted to their common sense, even to their love of their pockets, to see that their money was not wasted, and that the schools were attended. If, after this provision was made, and they had schools throughout the country, it was still found that, to any considerable extent, children did not go to school, then we must have a general measure for compulsion. In reference to what he described as the "great difficulty," the objection that the Act is retrogressive because it is denominational, because it is sectarian, he said he believed that this Act was a great blow to sectarianism. He believed that bringing men of different sects together upon the School Boards, as had been the case throughout the country, wherever they had been elected, and telling them, somehow or other, to get this education work done, would oblige them to drop their sectarian feelings, and make them less sectarian. In conclusion, he touched upon other matters connected with the Act, such as the ballot and cumulative voting, and expressed his opinion that the introduction of women as members of the School Boards was likely to prove a success.

Women on School Boards.—At Oxford, it has been determined to bring forward Miss Smith, sister of the distinguished mathematician, Professor Henry Smith, as a candidate for the Board; and at Bath, Miss Ashworth, niece of Mr. John Bright, M.P., has expressed her willingness to stand, and will probably be put in nomination. At Ipswich another lady, Miss Grimwade, has been nominated.

School Fees.—A committee of the Manchester School Board has recommended the adoption of the following bye-laws in relation to the payment of school fees by the board:—"That the whole of the school fees be paid in the following cases—Where the family consists of two persons, and the weekly income does not exceed 4s. per head, exclusive of rent; where the family consists of three or four persons, and the weekly income does not exceed 3s. 6d. per head; where the family consists of five or six persons, and the weekly income does not exceed 3s. per head. All applications not included in the above rules to be considered as special cases. The school fee allowed is not to exceed in any case 6d. per head per week." The following scale of fees was also recommended:—Boys in boys' school under a master, 4d. per week; in mixed schools ditto, 3d.; under a mistress, 3d.; girls in girls' school under a mistress, 3d.; in mixed schools ditto, 3d.; under a master, 3d.; in infant schools, 2d. per week; children under six years of age to be paid for as infants. The consideration of these recommendations was deferred.

School Buildings.—In reference to the suggestion quoted in last week's *Journal* (p. 143), that the Education Department should issue plans suitable for rural schools, it appears that the Department already has plans for buildings of different sizes, adapted for the accommodation of various numbers of children, up to 250. It would be most desirable that these plans should be published, for which, it is believed, the Committee of Council would give permission; and as the demand would probably be considerable, the matter would be well worth the attention of publishers.

CORRESPONDENCE.

THEORIES OF COLOUR.

Sir,—Having no opportunities of attending the discussions at the lectures of the Society, I wish to take this mode of expressing my views on the first of the last series of Cantor lectures on artists' colours and pigments, which is principally on the subject of the three primitive colours. A statement is made therein, to the effect that blue, red, and yellow must no longer be considered the three primary colours, but that green must be substituted for one of them. No arguments or facts of any kind are given in elucidation of the cause of this change. Now, all colours which are made of compounds of other colours are void of any claim to be considered primary colours, and as green is made of blue and yellow, some satisfactory reason will be required for placing it in the category of the primaries. That it is the prevalent colour of the earth gives it no title whatever. The theory of the three primary colours is only so far tenable as they are indivisible. The only changes that can be effected in them are, that by dilution in some colourless medium they can be made paler or stronger at pleasure, but they still remain blue, red, and yellow.

We must approach still nearer the fountain-head of truth, if we wish to ascertain the great first cause of colour, and not be content with a superficial knowledge of its effects. It will be conceded at once, that the source of all colour is light. Proceeding from our great luminous centre, this principle comes into contact with chemical combinations and mediums in different states of density, and certain effects ensue of vast importance in the two great purposes of utility and beauty.

Attention to a few morning and evening glories of sunrise and sunset, will display a system of truths, which are at once the foundation and cause of the only true theory of colour that can be entertained.

The first penetration of the refracted rays of the sun's light into the darkness of nature produces blue. As the light increases and overpowers the darkness, the blue becomes paler, till the sky of mid-day gives us that lovely colour which is nothing more than a mixture of the light and darkness of nature. If the atmosphere were always in the same state of attenuation or transparency, we should never have any other colour in the sky but blue, not even at sunset, except a little variation of paleness; we should always have what artists call white sunsets. But a principle of density is constantly in operation, in varied degrees, which is found, as far as atmospheric effects are concerned, to be a source of every variety of colour, from the most brilliant reds and yellows to the most delicate and mysterious compounds the wonderful powers of nature are capable of. As it is impossible in a letter, and without diagrams, to do justice to this theory, I must call attention to the fact that, as the afternoon sun descends, it shines through that continuously increasing density of atmosphere which always exists in the lower strata of the air near the earth. Now, this increase of the density of the air has a remarkable effect on the colour of the sky. The blue of mid-day begins to give way to paler and warmer tints.

The increasing density of the atmosphere becomes an obstacle to the free passage of the rays of light which thus accumulate, changing the colour of the air from pale to deep yellow, then orange to pure red, till the full effect of light and density of air nature is capable of culminates in a blood-red sun. It has now become evident we have got at the first principles of nature in colour-creation, and that, whether they are the primaries or any combinations of them, they all have their source in the two elements of light and darkness, which is the true theory of colour.

An abstract theory of three primary colours, unsupported by natural facts, must give way to that first effort of nature which gives us everything required. Not only is this the case, but the colours thus produced from these first elements are the most brilliant we see on this planet, all others, as of flowers and gems, being of a secondary nature. Nothing on earth can compare with a brilliant sunrise or sunset sky, for light itself does it. The primary colours can be seen changing into the secondary, as for instance crimson, when a strip of more dense cloud mingles with deep red, and so on into every grade of delicacy and beauty as one tint mixes with another, exactly as the artist does it on his palette. The chemical combinations which, either by attraction or absorption of light, or other unknown influences, produce colour in matters, are well left in the hands of your talented lecturer, who, if he should succeed in adding anything to the permanency or brilliancy of the painter's colours, will have conferred an everlasting boon on the lovers of art.—I am, &c.,

W. G. Herdman.

St. Domingo-vale, Liverpool.

FREEZING OF WATER.

Sir,—I notice frequent observations on the freezing of our ornamental waters, also on the rotten ice. I had occasion, during the Arctic service of two years in the ice, with ample time to think and act, to show experimentally the action of freezing water surrounded by low temperature. It had been supposed by some that ice accumulated from above. Where would it have been in 196 days, at about 10 inches per diem, the rate of a sudden congelation of exposed water in October? I therefore had recourse to the *rationale* of direct proof and reasoning thereon. First, a glass-jar, capable of containing half-a-gallon of water, at 60° Fahr., was placed on a table on deck (under the housing), having behind it a powerful reflecting mail lanthorn. The external air was — 50. In a few minutes the inserted thermometer indicated 32°, the freezing point. But it merely formed a thin skin of ice, excluding the outer air, and was nearer 31° than 32°. Fine crystals of ice were to be seen rising from the bottom, and increasing, as they reached the under side of the crust, its thickness. Why did they rise? Because converted into ice, and occupying greater space, they were specifically lighter (52· to 64·5). This continued rapidly. The sides only exhibited that arborescence we notice on our windows, and with such intense cold surrounding, I instantly saw the danger of any sudden crystallisation of the mass bursting the cylinder, and removed the vessel into my cabin (at 60°). This was frequently repeated, but there were unbelievers still.

Next year, a run of the ice in October having cleared the surrounding sea, and sudden freezing having afforded a glassy, clear surface, I determined to experiment on the grand scale. From a centre, I struck a circle of 30 yards radius, and cut a central hole. Into that hole I inserted a tube open on two sides, formed of two ordinary deals of 9 inches wide, and shouldered at 18 in. by two battens to form the gauge, thus presenting the original surface-line of the sea.

Every ten days (from 6th November to 10th April) on one of the radii, at 30 yards, a cube was raised, and the ice guaged, the mean of those measurements or readings, and also the whole thickness of sea frozen below the surface batten, divided by the term, gave 0·48 inches per diem as the rate of increase.

Moreover, on the said 10th April, as calculated—and Capt. Richards was warned to observe—the loose ice crystals were present, but failed to adhere. That was the moment of our "rotten ice;" freezing below had ceased, although the surface temperature was — 12°.

Now, as regards our ice about London, we must bear in mind that the earth temperature, shielded by a sheet of ice, cannot permit of ice crystals forming at so high a temperature as 32°, or when the land springs are setting in below to raise the former temperature of the water. Consequently, when the ice is even deemed strong, and preserves a good thickness, its cohesion is sadly impaired. The Arctic ice also, in the spring, is found, on being turned up, to be perforated or honey-combed like auger-holes, resulting from the warmer air-bubbles acting on its under sides. Those who have travelled on the ice in June, July, and August, may remember, on sweeping the snow from the ice for camping, or on the nip-edges, to have witnessed these peculiar borings.—I am, &c., E. Belcher.

Connaught-square.

PATENT LAWS.

Sir,—Your correspondent, Mr. Henry W. Reveley, gives some very singular reasons for the abolition of patents; the principal one appears to be, that "as patentees seldom profit by their inventions, patents might as well be abolished." A very odd reason, certainly. Even Boulton and Watt, he says, were no exception in this respect. If Messrs. Boulton and Watt did not profit by the enormous benefit conferred upon their country by Watt's labours and magnificent inventions, it is a standing disgrace to the age in which they lived. One thing is certain, that had there been no patent law, the large sums of money spent by the rich Mr. Boulton on Watt's experiments would never have been forthcoming, and so we might have had no condensing-engine to the present day. It was the hope of reward and fame that brought forth the means to sustain Watt in his persevering and indomitable exertions. Without a chance of either pecuniary reward or celebrity, no one could be found to make so great a sacrifice of both time and money as the carrying out of an important invention requires. It is a fact which, during the experience of half a century, I have frequently seen verified, that however important a discovery a man may make in mechanics, unless he secures it by patent, the large machinists take it up, and he, in a short time, is neither known or acknowledged as the inventor. Under a patent law, an inventor has, at least, a chance of gaining reputation for himself, if nothing more substantial. Our greatest poet tells us that "the soldier seeks the bubble reputation, even at the cannon's mouth." Inventors, at any rate, do the public no harm, as the latter is not bound to adopt a patented article; and I know from experience that people are exceedingly slow in adopting the most successful things, at a price by which they can derive infinitely more profit than the pittance of royalty paid to the patentee.

Mr. Reveley is again in error, when he says that the test of originality can only be obtained by the labour of a body of men going through centuries of documents. It is true that nearly all the mechanical movements known at the present day were known a century ago, so were the letters of our alphabet, and nearly all the words we find in our latest new books.

There is no more difficulty in detecting the novelty or excellence of new and masterly combinations in mechanics, which form improved machinery, than there is in pronouncing a new book to be a novelty, which is merely a fresh combination of words. The first is calculated to benefit society physically, the other to amuse and benefit the public mentally; the latter, on easy terms, obtains a copyright extending to 30 years; the former, at a great expense, can only obtain a protection of 14 years. Now, without the substantial benefits conferred on the world by the inventor in mechanics, the inventions in literature would be of little use. Take away the copyright, and few, if any, more books will be written; take away the patent laws, and England will soon begin to decay. All the nations of the world flock to this country for their machinery, because they know that here they can have the latest improvements in machinery, and also the cheapest manufactures resulting therefrom. As a Swiss gentleman lately said, addressing his countrymen, "England is the country in which all that is good and great has its origin." How much of this is owing to the toils of the inventor, burning his midnight lamp, and working hard, whilst others, less thoughtful men, are asleep, or spending their time in frivolous amusements. Instead of robbing him of the products of his brain, the true policy of the State is to stimulate him by a longer protection on easier terms, to invest the large sum of money now lying idle, which has been wrung from him, and distribute the interest of it annually, in proportion to their works, amongst decayed or unfortunate inventors, or, if deceased, amongst their families.—I am, &c., Evan Leigh.

Town Hall-buildings, 37, Cross-street,
Manchester, December 1st, 1870.

Sir,—Your correspondents upon this subject allow that these laws stand in need of very great alteration and amendment, but they fail to show in what manner they could be carried out. They also fail to disprove any of the arguments brought forward in my letter inserted (p. 27) in your *Journal* for November, 1870, against the ultimate continuance of these laws, and the utter impracticability of their improvement.

Mr. Alexander's fiction of the ideas of an ignorant countryman is too futile to require notice. He confesses, however, that these laws are heavy and lumbering, and require considerable amelioration. In another letter, the same correspondent asserts that the ancient saying, that "necessity is the mother of invention," has no force in this case, and that it is only true with reference to first principles. But the myriads of existing appliances of civilised life are not first principles, and were mostly produced thousands of years before patent right was dreamt of. He instanced railway travelling, electric telegraph, electric light, &c., as the produce of the patent laws, but where would they be without the discoveries of Galvani, the late Professor Faraday, and others, who were wholly uninfluenced by patent right; neither are gunpowder or fire-arms indebted to that law.

Improvements upon crude inventions ever did follow, as a matter of course, and would still, if the vicious excitement of these laws did not exist. Mr. Alexander's poor man finds a perfect but baneful substitute in these laws for the old-fashioned lotteries. Hundreds lose their all, in striving after a stupid vagary, to one who makes anything of it.

I fully agree, however, with him in regard to the term "necessity," so far at least as the existence of these laws oblige every person connected with trade and manufactures, by means of patent right, to overcrow, defeat, and put down all his professional brethren; but where is the advantage to the nation? Suppose for a moment that patenting were to become universal, and that every article manufactured, and every process carried out, were the subject of patent rights, where would be the benefit to any single individual; and who would be so bold as to assert that such a proceeding would be a national benefit in any respect?

It is a sign of the times that a strong party in Congress are resolved to advocate the ultimate total abolition of the laws of patent right in the United States as a national nuisance.—I am, &c., Henry W. Reveley.

Reading.

THE GREAT EXHIBITIONS AND TECHNICAL EDUCATION.

Sir,—One practical mode of assisting geographical teaching in our common schools is to require that each shall be furnished with the Ordnance map for five miles round, or to the market-town usually frequented. This could have been obtained for sixpence, before the government raised the prices. Where there is a parish survey it is to be preserved. On such basis, a child will understand roads, brooks, commons, hamlets, and railway stations. A five-mile horizon is wide enough for most children. The papers of the Geological Survey should also be supplied; the cost for each school will be very small. General geography and maps will be understood after these lessons. A few illustrations at the forthcoming Exhibition will greatly assist the cause of technical education.—I am, &c., Hyde Clarke.

32, St. George's-square, S.W., January 12th, 1870.

GENERAL NOTES.

A New Machine for taking off the hides of dead cattle will shortly be tried at Buenos Ayres. The operation is short, sharp, and decisive, requiring only a minute for each hide. Cold air is forced by a pump between the flesh and the hide, and the thing is done. The process ought to be an improvement on the old hacking and scraping system.—*Brazil and River Plate Mail.*

Hill Settlement in India.—The news from Darjeeling is very satisfactory. The tea crop is large, and of cinchona there are 2,314,000 plants, which will give a good yield of bark. Darjeeling can now hold its own, whether troops are sent there or not, but it is certainly desirable that the Calcutta population and troops should benefit by its climate, and that a railway should give them access. The government has communicated with the Sikhim officials on the old topic of trade with Thibet, so pertinaciously urged by Dr. A. Campbell. Dr. Mouatt, a staunch advocate of Darjeeling, has now returned home. At Raneekhat, which has been so much in favour under the present Viceroy, a church has been founded. Simla itself is now the seat of an established Fine Arts Exhibition. For the Mussoorie church, painted windows have been ordered from Munich. We shall hear more of such places, as the Commander-in-Chief, Lord Napier of Magdala, has sent several of his staff to examine sites suitable for new cantonments.

Proposed New Engineering College.—A deputation from University College, London, consisting of Mr. George Grote, the president, the Hon. George Denman, M.P., Mr. Julian Goldsmid, M.P., and Dr. Storrar, members of the Council; Professor Fuller, C.E., Professor Williamson, F.R.S., and Mr. J. Robson, the secretary, has waited upon the Duke of Argyll, at the India-office, to present a memorial from the Council and the Senate of the College, on the subject of the proposed institution of a new engineering college for the Indian service. The interview with his Grace lasted upwards of an hour. The memorialists consider that the deficiency in the present system has arisen, not from any defect in the existing places of education, but from the injudicious system of examinations hitherto pursued, and from a want of sufficient inducements to well-qualified men to enter on the career proposed to them. The memorialists assume that the latter cause is recognised by the government, for it is understood that it is in contemplation to augment considerably the salary upon which a civil engineer in the service of the Indian government will hereafter commence his work. The memorialists believe the proposed college will be prejudicial to the public service by narrowing the field for the selection of candidates, and by limiting their means of obtaining the requisite instruction. They submit that the working of government colleges has not been such as to recommend the creation of a new government college, having practically the monopoly of appointments, and protected from competition. They suggest that such a step is at variance with the plan for throwing open to all her Majesty's subjects the opportunity of gaining government appointments.

Liverpool Numismatic Society.—A society under this title has lately been formed, for the purpose of furthering the knowledge of coins, medals, &c. The meetings are held every first and third Tuesday evening in the month, at 7 o'clock, in the small lecture room of the Free Library, William Brown-street.

The American Bird Trade.—The bird trade in America seems to be in a flourishing condition. A New York paper says that over 40,000 canaries are brought in every year, and probably 10,000 more are raised in this country for the purpose of sale. The number of bullfinches, goldfinches, thrushes, robins, and larks, annually imported rise as high as 500 or 600 for each variety. There are fully 3,000 Java sparrows brought to the United States by vessels from that region, and fully as many parrots are yearly sold in this city alone. Waxbills and other minute varieties are scarce, and seldom arrive in quantities of more than 100 or 200 each year. Paroquets and lovebirds from Australia follow parrots in their relative importance. In native birds there is no reliable data to go upon. It is roughly estimated that about 10,000 mocking-birds find their way from the wild nest to the cage each succeeding summer."

Fresh Vegetables in Paris.—By balloon post, a communication has been received from Paris, by which it appears that Dr. Leon Soubeiran, the secretary of the Acclimatisation Society there, and a corresponding member of the Society of Arts, has been showing the besieged inhabitants how to obtain fresh vegetables by a simple process, for some time past adopted by the Chinese. It consists in placing in small tubs peas, beans, and tares, such as are usually kept for the food of animals, with a thin layer of water at the bottom, about two inches deep, sufficient to supply the required moisture. The tubs are then kept in a warm temperature, say near the kitchen stove, when the seeds germinate in the course of a few days. The young and tender shoots are gathered, and may be eaten cooked or as salad. It appears by the *Comptes Rendus* of the French Academy, a printed slip from which has been enclosed, that Dr. Soubeiran has been reading a paper on a mode of preserving meat without salt, and that M. Payen has made some observations on experiments for preserving meat by means of desiccation.

Defoe's Proposal for a National Academy of Music.—In a paper on "Music and the English People," read at the recent meetings of the Tonic Sol-fa College, Mr. J. S. Curwen said:—"Let me mention a fact which has interest in relation to the present effort of the Society of Arts to establish a national training school for music. In 1720, Daniel Defoe, author of 'Robinson Crusoe,' but a far-seeing politician and social reformer as well, published a little tract entitled 'Augusta Triumphans, or the way to make London the most flourishing city in the universe,' which is now scarce. Passing over his other proposals, there is one as follows:—'A proposal to prevent the expensive importation of foreign musicians, by forming an academy of our own.' Defoe's proposal was that the governors of Christ's Hospital—then, as it should be now, a school for the children of poor people—should choose thirty boys every year who showed a capacity for music, and that ten of them should be set to study in each of the following departments.—1st, wind instruments; 2nd, stringed instruments; and 3rd, the voice, organ and harpsichord. Those boys were to be kept in training until they became competent performers, and then drafted off into all the bands of the country. Had Defoe's plan been carried out, had his school of instrumentalists and vocalists been engaged for a century and a half in sowing good music broadcast over the land, who can measure the influence they might have exerted on the national character? Music-hall songs and German bands would certainly have disappeared before the exhaustive competition of the English school."

Progress in Canada.—The correspondent at Toronto of the *New York Times* supplied recently to that journal a letter, in which he adverts to the progress of Canada, and especially of the great province of Ontario, in the year 1870. He says:—"Few who knew the Toronto of 30 years ago would recognise it in the metropolitan city of Ontario without wondering at the transformation it has undergone. During the past year it has increased marvellously. It is now a city of over 60,000 inhabitants, boasting some of the finest public buildings, stores, and private residences to be found on the American continent. Less than 50 years ago, the present site of London was a dense wilderness, with not a clearing near it for many miles. A town was gradually hewn out of it, which now has a population of nearly 20,000. This is rather rapid for a town 30 miles inland from the nearest lake port. Hamilton, too, has made great strides, in spite of the drawbacks it has had to contend against. It was laid out in 1813. It has a population of over 25,000, and this year the increase in the number of new buildings has been far greater than ever before. Ottawa, the Dominion capital, has grown into a city of considerable proportions since the seat of government was located there. It is believed to be growing very rapidly just now. The construction of railways gave an astonishing impetus to the growth of towns, and numbers have grown from mere villages of a few years since into large and populous places. But it is manufacturing enterprise that has done so much to accelerate progress and improve the country. Ten years ago, there was hardly a manufacturing establishment of any consequence; now they may be counted by dozens. Ontario was, not many years since, a splendid field for the sale of American surplus manufactures, but it is no longer so, as the market is now fully supplied by the efforts of home industry, and with articles fully up in quality to any imported. In truth, it is held that its woollen manufactured goods are superior to all others, and therefore find ready sale in the United States. Our manufacturers have now no dread of competition, and the rapid multiplication of machinery of all kinds gives employment to swarms of artisans. Skilled labourers are in demand, and frequently it is very difficult to obtain them. Large and increasing foundries are in regular operation, and even the business of manufacturing sewing machines has become one of the most important branches of industry. There are about a dozen large factories of the kind in Ontario, the first having been started in 1860, which had a monopoly for five or six years. Several factories fill large orders for the European markets. . . . . So urgent have the demands of the country become, that the government have deemed it necessary to undertake the improvement of the inland navigation of the country much sooner than was intended, and with that view a Canal Commission has been appointed, composed of commissioners from each of the four provinces, chosen not so much for their party leaning as because they are men most of whom are thoroughly conversant with and interested in the carrying trade of the lakes. It is to be hoped that the enlargement of the St. Lawrence and Welland Canals will be decided on before the construction of new ones is recommended. The enlargement of those canals would be the means of drawing the carrying trade of the West to the St. Lawrence. But no possible objection could be raised to the construction of the proposed Coughnawaugha Canal, to connect the waters of the Hudson and the St. Lawrence, thus forming a continuous route for the largest sized vessels between Chicago and New York. There can be no question that such an enterprise would meet with public approbation, and the government could not well refuse to entertain the scheme if recommended by the Commission. The true interests of the country must be duly considered, and a step has been taken in the right direction, when the government decides to inquire into the feasibility of carrying out the grand project of improving the inland navigation, with the ultimate view of facilitating the transit of sea-going vessels to and from any port on the lakes. The feeling prevails that the country is on the high road to prosperity, and everything points to a cheering future. It is this state of things which prevents the spread of the desire some time since manifested for a change of political destiny, and no one would be rash enough to attempt the slightest encouragement at present of the agitation which certain gentlemen in the province of Quebec endeavoured to commence last spring. The prosperous state of the country, but particularly of Ontario, is the strongest check that has been given to the Independence movement."

New Volcano in Sicily.—The *Precursore* of Palermo announces that the crater of a new volcano has opened on the mountain above Bivona, in the province of Girgenti.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

January 25.—On "New Paper-making Materials, and the Progress of the Paper Manufacture." By P. L. Simmonds, Esq.

February 1.—On "The Preservation of Vegetables." By Geo. Buchanan, Esq.

February 8.—On "Ornamentation considered as a 'High Art.'" By Dr. Christopher Dresser, F.L.S.

February 15.—On "The Commerce of India." By Dadabhai Naoroji, Esq. On this evening Sir Bartle Frere, K.C.B., G.C.S.I., will preside.

February 22.—On "Water Meters." By Frederick C. Bodkin, Esq.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal Geographical Society, 8½. Capt. Sir Leopold McClintock, "On the Recent German Arctic Expedition."
Entomological, 7. Annual Meeting.
British Architects, 8.
Medical, 8.
London Institution, 4.
Social Science Association, 8. Mr. R. Spence Watson, "On the Best Method of Providing Higher Education in Boroughs."
Tues. ...Royal Institution, 3. Dr. Foster, "Nutrition of Animals."
Royal Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion on Mr. Browne's paper "On the Strength of Lock Gates." 2. Mr. W. Bridges Adams, "Train Resistance on Railways."
Ethnological, 8. 1. Rev. Dr. Steere, "On the Languages and Tribes of East Africa." 2. Dr. Eyschmacher, "On African Weapons and Implements." 3. "A Zulu Law Case," communicated by Sir John Lubbock, Bart., M.P.
Wed. ...**SOCIETY OF ARTS, 8.** Mr. P. L. Simmonds, "On New Paper Making Materials and the Progress of the Paper Manufacture."
Geological, 8. 1. Prof. A. C. Ramsay, "On the Physical Relations of the New Red Marl, Rhætic Beds, and Lower Lias." 2. Mr. J. W. Hulke, "Note on a large Reptilian Skull from Brooke, Isle of Wight, probably Dinosaurian, and referable to the genus *Iguanodon*." 3. Sir W. C. Trevelyan, Bart., "On supposed borings of Lithodomous Mollusca."
Archæological Association, 8.
Social Science Association, 8. (Special Meeting.) Professor Leoni Levi, "Is any Scheme of International Arbitration Practicable?"
Thurs...Royal Institution, 3. Dr. Odling, "Davy's Discoveries."
Royal, 8½.
Antiquaries, 8½.
Philosophical Club, 6.
Society for the Encouragement of the Fine Arts, 8. Dr. Zerffi, "Prehistoric Art."
Fri.......**SOCIETY OF ARTS, 8.** India Conference, "On the Utilization of Peat in Indian Locomotives and for other purposes," by Lt.-Col. Romaine Wragge.
Royal Institution, 9. Dr. Odling, "On Recent Improvements in the Production of Chlorine."
Quekett Club, 8.
Architectural Association, Mr. T. Roger Smith, "London as a Field of Study for an Architect."
Sat ......Royal Botanic, 3¾.
Royal Institution, 3. Rev. W. H. Channing, "Laws of Life revealed in History."

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FRIDAY, JANUARY 27, 1871.

PROCEEDINGS OF THE SOCIETY.

EIGHTH ORDINARY MEETING.

Wednesday, 25th January, 1871; Hyde Clarke, Esq., Treasurer to the Society, in the chair.

The following candidates were proposed for election as members of the Society:—

Alexander, Louis Charles, LL.D., 17, New Bridge-street, E.C.
Austen, Francis, 1, Prince's-gate, S.W.
Cox, John A. D., 11, Royal-crescent, Notting-hill, W.
Dillon, Charles Coleman, 30, Lupus-street, S.W.
Foster, Frederick, 316, Essex-road, N.
Moor, Robert Henry, Ph.D., 145, Packington-street, N.
Rowsell, F. W., Admiralty, S.W.
Sharpley, Charles John, 20a, Vincent-square, S.W.
Smith, George, 151, Strand, W.C.

The following candidates were balloted for and duly elected members of the Society:—

Chester, Frederick J., The Elms, Clapham-common, S.W.
Drummond, the Hon. Edmund, 58, St. George's-sq., S.W.
Gordon, John A., 34, Clement's-lane, Lombard-st., E.C.
Robinson, Alfred, F.R.G.S., Mountjoy-house, Huddersfield.

The Paper read was—

NEW PAPER-MAKING MATERIALS, AND THE PROGRESS OF THE PAPER MANUFACTURE.

By P. L. Simmonds, Esq.

The subject which I bring before the Society this evening is one of much importance, in which we are all, more or less, deeply interested. There can be no question of the great value of paper as a means of diffusing knowledge, awakening thought, calling forth invention, and civilising the world. It is the handmaid of all arts, of all sciences, and of all trades. Both in an educational and a commercial point of view, an extensive supply of paper, at moderate prices, is of national interest. The laws of supply and demand will, indeed, regulate the question, but discussion and circulation of opinions may result in extended benefit to the paper-maker as well as to the reading and writing public.

The technical question of what is paper, what are the materials of which it is composed, may well be raised, for it led to a trial, some years ago, between the Excise and a paper-making firm, the Attorney-General v. Barry. In the edition of "Johnson's Dictionary" published about the middle of the eighteenth century (1755), paper is defined as "a substance on which men write and print, made by macerating *linen* rags in water, and then spreading them in thin sheets." "Webster's Dictionary," of our own day, enlarges the list of materials, and describes it as "a substance in the form of thin sheets, or leaves, intended to be written or printed on, to be used in wrapping, &c., and made of a pulp obtained from rags, from straw, from bark, or like materials, pressed and dried."

An historical fact which was brought before this Society twenty years ago, by Dr. Crace Calvert, may be again noticed here. It is that paper, made from the papyrus plant, had lasted from 1,822 years before the Christian era to the eighth century. Egypt was invaded by the Arabians and her trade destroyed. It was then, for the first time, that cotton paper was imported from China by the Arabians, who, two or three centuries afterwards, supplied us through Turkey. The manufacture of their flax paper was so successful that cotton paper was completely laid aside until the commencement of the present century, when once more it expelled from the market the linen paper.

Our word "book" is said to have come from the Gothic word for the birch-tree, some part of which, probably the liber, or inner white rind between the bark and the wood, may have been the most convenient substance which nature has furnished in the northern parts of Europe for portable documents. Other substances than of vegetable origin may be written or printed on, of which we have familiar instances in the present day, in our slates and stone tablets, copper and steel plates, parchment and vellum, gelatine paper, silk play-bills. In olden times, characters, too, were engraven on stone, or impressed in clay, dried and hardened, as the Babylonian bricks, boards of wood covered with wax, plates of ivory and metal, and the leaves of palms were used. The Chinese, Japanese, and Indian papers are made without rags, consisting chiefly of bamboo, the paper mulberry, and other macerated barks and fibres, and their celebrated rice paper, so long a mystery, is now known to be made from the cellular pith of the *Aralia papyrifera.*

Among the influencing causes for the greatly increased demand for paper are the removal of the excise duty on manufactured paper and the stamp from newspapers, the extended number of daily and other journals issued at a cheap price, and the large editions of these called for, owing to the eagerness to obtain intelligence of the progress of the unfortunate war now raging. The increasing commerce of the country must not be lost sight of, and the extensive home and foreign correspondence resulting therefrom, some 700,000,000 letters passing annually through the post. Educational progress also leads to more writing, reading, and book-printing. We have also to remember how many other uses paper subserves, as wrapping material, for cardboard, *papier maché*, *carton pierre*, &c.

Building paper now forms a regular article of commerce in the United States, and more than one public company is doing a large business in it. It is used on the outside of frame buildings, and under shingles and floors, to keep out the cold, and on the inside instead of plastering. It is said to be both warm and cheap. Paper tiles are also used in Saxony for roofing sheds, stables, and barns; and paper collars and other articles of dress have long been in use.

When we consider that 550,000 tons of cotton, 125,000 tons of jute, and 130,000 tons of flax and hemp, were imported and worked up in 1869, besides 53,000 tons of home-grown flax, one would suppose there ought to be a great deal of the waste of these fibres available for the paper-maker. But among the minor tendencies of industries few are more noteworthy than that shown in the increased utilisation of waste materials. As competition becomes sharper, manufacturers have to look more closely to those items which may make the slight difference between profit and loss, and convert useless products into those possessed of commercial value.

Our manufacturers have not been slow to appreciate this truth, as is shown in more than one branch of trade. Thus, the refuse blowings and droppings from the spindles and looms of cotton-mills, which were formerly available for the paper-maker, are now found to possess a high textile value, and form the basis of a distinct branch of trade. Millions of pounds of this waste cotton are now used annually in the fabrication of wadding, common carpets, twine, &c. There are a hundred opportunities among the staple industries of the country to secure an equal economy and profit, by turning to proper uses substances now disregarded and thrown away as waste.

In the manufacture of paper, as well as in all other mechanical industries, there has been great progress made, even in the last half-century. Chemistry and mechanics have each contributed their part. The former has afforded us improved methods for washing, bleaching, and colouring the paper stock, which must yield a different product from what was made by the ancients. The mechanical improvements, too, have been many, both for boiling and running out the pulp. The use of ultramarine, which was at one time almost as valuable as gold-dust, has been so extended and cheapened by the labours of the chemist, that its artificial manufacture must be regarded as one of the triumphs of modern science.

Chemistry has also taught us that the cellulose of all plants is the same as that contained in rags, and that, in fact, the fibre of some plants will give us a paper that cannot be made from rags. Not all plants, however, are adapted to the making of paper. Much depends upon the bark, membrane, and fibre, and there is a difference in the purity of the cellulose in various plants. Chemical tests also show a modification in the fibre of plants. The cellulose of cotton yields a blue colour immediately, with tincture of iodine; that of flax does not turn blue until an acid has been added, and hemp requires both acid and considerable time before the blue colour makes its appearance. These reactions point to the presence and absence of starch and glucose in different species of plants.

The removal of the excise duty on paper, which took effect in the year 1861, renders it difficult to ascertain with any precision the quantity of paper now made in the kingdom, but we may form a fair estimate by looking at the progress under the duty rate, and judge of the advance from the incentives and stimulus to increased production. The following are official figures of the quantity of paper charged with duty:—

	lbs.
1842	96,693,399
1852	154,469,211
1861	229,502,864

From which we may fairly estimate the present production at 300,000,000 lbs.

Our shipments of paper scarcely keep pace with the increased production and home consumption, which may be attributed to foreign competition, and the colonial paper mills now established in Canada and Australia. The exports are officially given as follows of British paper:—

	Quantity. cwt.	Value. £
1860	112,514	450,589
1865	141,075	447,741
1869	214,416	591,436

The exports and consumption compare as follows, in pounds weight:—

	Exports.	Consumption.
1849	5,966,319	126,166,341
1859	20,142,352	197,684,847
1869	24,014,592	276,000,000 (estimated).

In 1869, our export of paper of different kinds, including paper-hangings, was valued at £727,071. The quantity of foreign-made paper received has been annually increasing of late years. In 1869, 412,900 cwts. were imported, valued at £690,547, of which 49,920 cwts. were re-exported. The following are the imports of foreign-made paper of all kinds in the last three years, in cwts.:—

	1867.	1868.	1869.
Printing or writing	174,429	177,220	169,275
Other kinds	151,925	193,387	243,626
Paper-hangings	7,753	5,660	4,435
Total	334,107	376,267	417,306

Besides these foreign figures, we have to consider the quantity used for paper-hangings. The home consumption under this head I can form no estimate of, but give the exports. In 1858, these were stated at 15,000,000 yards, valued at £74,649; in 1869, the official returns gave the quantity of paper-hangings exported at 46,617 cwt., of the value of £132,635.

The paper makers' licences, granted during the time of the duty, afford some idea of the briskness of trade, and the paper-mills at work. I find the number of mills rose from 408, in 1785, to 800, in 1829 (the highest number reached). They then declined annually until 1852, when there were 400, at which, with variations of some 8 or 10, the number has since stood. The licences granted in 1869 were 326 in England, 60 in Scotland, and 22 in Ireland, but all the mills were not at work, and within the last year there have been still further reductions in the number. The *Paper-mills Directory* for 1871 gives the number of paper-mills in working order in England, in 1870, at 274, besides 12 mills not working, making a total of 286, against 290 in 1869. In Scotland there were 63 mills at work last year, against 58 in 1869. The larger number of paper-mills make brown, cartridge, and such like papers; in England, not more than 100 make printing, news, &c.

If we look at a few of the latest figures regarding the publishing and printing trades, we shall see how important is the question of paper to supply the demand. There are at the present time more than 1,400 newspapers in the United Kingdom, of which 110 are daily, of these 61 are published at one penny, and 34 at one halfpenny each. The magazines and reviews number 626. The quantity of paper which these require it is impossible to calculate; but when we find that one London daily paper asserts its average daily circulation to be upwards of 190,000 copies, and if we assume the other London dailies to have each but half this circulation, we can form an idea of the enormous demand for paper, even in the metropolis. Besides the political journals, some of the literary, religious, sporting, and other publications have very large circulations. But we have also to take books into consideration. According to the *Publishers' Circular*, last year there were 4,656 new books and new editions published in Great Britain. In the United States about half this number are issued, and in Germany three times as many. This is independent of the large number of newspapers and books issued in various other parts of the globe. The make and consumption of paper in the United States are nearly as large as our own.

In 1869, we exported 59,291 cwt. of books, and imported 11,463 cwt., and the progress in ten years is shown by the figures of 1859, which were 33,915 cwt. exported, and 6,520 imported.

The price of rags mainly regulates the price of paper, for these are the mainstay of the paper maker, although now supplemented to a small extent by crude vegetable fibres. The comparative scarcity of rags and kindred substances has rendered their supply, as a main article for paper-making, more and more inadequate, while the importation of esparto fibre from the Mediterranean countries has likewise failed to meet the augmented demand.

The import of foreign rags suitable for paper-making has increased in the last ten years about 50 per cent. For twenty years it averaged about 10,000 tons. In 1858, it was 11,379 tons, value £246,133; in 1869, it was 17,000 tons, value about £300,000. The aggregate quantity of rags annually collected in the kingdom, with those imported, may be taken at 70,000 tons weight, worth at least £1,500,000. It takes 100 tons of rags to make 70 tons of paper. Notwithstanding the rags produced by our population of 30,500,000 inhabitants, added to the large quantity of jute, bagging, linen and cotton wrappers, old sails, cordage, &c., it will be seen that we are largely dependent on foreign supplies of waste materials for our paper-mills. Linen rags have declined in price from £22 18s. per ton, in 1866, to £19 12s., in 1869, and cotton rags from £13 19s. to £12 4s.

The average value of the rags and other paper-making materials imported in the last two years, was about £110,000. The quantities are shown in the following return, in tons:—

	1867.	1868.	1869.
Linen and cotton rags	18,407	17,860	16,980
Esparto	54,512	95,828	86,334
Other vegetable fibres	562	52	1,084
Other materials for making paper	794	615	1,702
Tons	74,275	114,355	106,100

Since the discovery of a method of separating ink from printed paper, old newspapers and old books have entered largely into the paper-makers' material. And the lesson of economy should be learnt, to save for market the waste paper, instead of kindling fires with it and casting it to the winds. Let frugal housewives take a hint, and add the present wasted hundredweights of old paper to the great civilising agent of the present day.

A correspondent of mine well observes:—"For many years it has been pointed out, in every possible way, that an endless variety of cheap materials exists in British tropical dependencies, admirably suited for paper-making, but the ever-recurring difficulty is, not where to get it, nor even what to get, but how to induce any one to bring it, or, if brought, how to induce any one to be the first to use it. This want of spirit is the dead weight which presses so heavily on the paper-manufacturer."

Owing to the increased demand, and the enhanced price of rags, it has been found necessary to employ other substances for mixing, such as, for instance, straw, esparto grass, and wood. Generally speaking, and especially as regards the grasses, these auxiliary pulps, however, do not fall very far short in price of the rag-product, and thus, while by such admixtures the immediate demands are met, the cost of paper remains high, and acts as a check on that expansion of the paper-manufacture which is one of the greatest and most urgent requirements of the times.

Wood pulp, chemically produced, although undoubtedly good as to quality, labours under the disadvantage of being too dear, but its production by mechanical agency, which is much less costly, may now be considered as brought to great perfection by means of improved machinery, amongst which Voelter's system claims an undoubted superiority, at any rate, in localities where the raw material is abundant enough to afford supplies for their great converting capacity, and its action is facilitated by a sufficiency of water-power. Under such conditions, each one of M. Voelter's engines of the ordinary size is capable of producing 17 cwt. of pulp daily, at a cost varying in proportion to the nature of the motive power employed, the price of the raw material, the facilities of transport, the rate of wages, and other contingencies.

In all these respects, Sweden, according to a detailed report of Mr. Gustaf Josephson, offers peculiar advantages. The supply of soft pine wood, perhaps the most suitable of all for the manufacture of paper-pulp, and pasteboard, is there practically unlimited, and obtainable at a price of 1½d. to 2d. per cubic foot, whereas in Germany, where a number of such works have been in existence for some time, and have supplied English markets with their produce, which is, however, mostly of inferior quality, the same material is worth about 3d. per cubic foot on an average. Aspen wood is likewise plentiful and cheap in Sweden.

There are now about 160 of these wood-pulp machines at work on the Continent. Some of those in Germany and Belgium, and about 30 of those situated in the Scandinavian countries, where material is abundant, send their pulp to England as a paper material.

The first mode of preparing wood pulp from the pine and other white woods, was to reduce it into thin shavings, which were soaked in water for six or eight days, and then dried and ground into powder by a corn or crushing mill. This powder was mixed with rags, so as to make a pulp, and the ordinary operation of paper-making was then proceeded with. The principal defect of this material was the shortness of fibre.

The preparation of wood pulp has not hitherto been sufficiently successful to make it rival rags, esparto, or straw. Further experiments may, however, go far to remove the present defects.

Esparto, as it is called in Spain, and alfa on the African coast, is a coarse, rushy grass, which has long been used as a fibrous material for rough yarn and cordage, and more than thirty years ago was recommended as a paper-making material, but was only brought into extensive use about sixteen years ago, by the persevering efforts of Mr. Thomas Routledge. No material alteration in the machinery or apparatus is required for working esparto, and much less power is necessary. According to a practical authority,* the successful working of this fibre depends mainly on the careful and proper adjustment and strength of the chemicals employed. The quantity of soda-ash required for neutralising the gummo-resinous matters in the fibre, so as to admit of its being made into pulp, is very large, though not so great as is required for straw; and the fibre, unlike rags, never having before been subjected to bleaching or other chemical treatment, also requires very much more bleaching powder to bring it to colour suitable for printing paper. The quantities required are from five to six times as much as for cleansing and bleaching the coarsest rags.

In a late circular of Messrs. N. W. Chittenden and Co., fibre brokers, they state that, "during the past year, numerous small importations of various descriptions of fibre have occasionally been made, and ready experiments have been afforded to test their capabilities, yet none has been found as a practical substitute; and during the past twelve months upwards of 93,750 tons of esparto have been imported into the United Kingdom, and although there has been but little falling off in the importations of other material previously used, the price of esparto still keeps at about £10 per ton. What effect this may have upon manufacturers who have been at a heavy expense in erecting machinery to work this article, when it was supposed that any quantity could be had at £6 or thereabouts, with but slight fluctuations in value likely to occur, we cannot say, but it seems an astonishing fact, that although the consumption of paper has been greater than ever, and that most raw materials from which it is produced have risen, our makers have not combined to raise the price of their production in proportion."

A correspondent, reading the discussion which took place last year, in the *Standard*, on paper materials, sent me specimens of pulp which he had prepared in Jamaica, under difficulties, from various substances, such as the bamboo, different fibrous plants, simply crushed and macerated, and wood pulp from trees of large growth. The fibrous plants of Jamaica, he observes, are numerous, and deserve a greater amount of attention, but hitherto nothing of a substantial or permanent character has been done practically. The Jamaica papers have since taken up the subject. A recent *Kingston Morning Journal* has the following editorial remarks:—"It seems, from all we can gather, that there is a market for our fibres, and such material as they convert into pulp, if only we would set to work to produce them. There is no lack of material for this purpose. From one end of the island to the other it abounds, of various kinds, and of as various qualities. It is really pitiful to ride about the country, and see the acres of penguin that uprear their heads and spread themselves about as they can find space, preventing all other vegetation from thriving, while it is itself practically of no use whatever, and may be regarded as an encumbrance of the ground. What a mine of wealth we have in these same penguin plants, if only people would take the trouble to set about to extract it. Years ago, the matter was talked over, and it was then set forth that the fibre is abundant, is strong, is of excellent quality for manufacture into certain kinds of cloth and cordage, while the material is as 'common as dirt' in the country. It is a pity that so little—indeed, nothing beyond the trying of a few experiments—has ever been done to turn it into practical and useful account. Besides the penguin for the production of fibre, there are the plantain and the banana plants. There is not a peasant or small settler who does not cultivate them pretty extensively. Travelling through the mountain districts, the very first things to apprise the belated traveller that he is getting within the circle of humanity, is not so much 'the watch-dog's honest bark, baying deep-mouthed welcome,' or unwelcome, as the sight of those graceful plants, waving their leafy wings in the soft night air that plays around them; and, when the village is reached, there is not a cottage but is surrounded by them; there is not a garden in which they do not abound. Then there are the fields, or 'grounds,' that lie beyond the confines of home, on the higher lands, in which plantain and banana plants are to be seen also growing abundantly. These require little or no cultivation. They propagate themselves by means of the suckers that shoot out of their roots, and, except occasionally pulling the grass from around those roots, the trouble they occasion the husbandman is of an infinitesimal character. The plants abound in fibre of a coarse character, that would be valuable in the manufacture of cordage, while the pulp might be converted into paper of a coarse description. All the use that is made of the plant at present is to cultivate it simply for the sake of its fruit. The other portions of it are thrown down, and lie on the ground and rot. There is some singular fatality attending this country, that so much that is useful, so much that is really valuable, is allowed to grow up and then to rot, when it might so easily be converted into money."

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* Mr. W. H. Richardson, on the paper manufactures of Northumberland and Durham.

The paper-yielding stems of the plantain and other indigenous plants have been too long neglected. Useful and tough kinds of paper have been made from them. Simple pressure between rollers and washing would appear to be sufficient for the separation of the fibres of most of them.

A Jamaica correspondent sent me by the last mail a copy of a daily paper, which reports that the governor, "Sir John Peter Grant, is turning his attention to the development of the fibrous wealth lying latent and running to waste in this island. In plainer language, his Excellency thinks there is money to be made by preparing for market the numerous varieties of plants growing without cultivation all over the country, from which fibrous materials may be extracted, for the manufacture of cordage, textile fabrics, and paper; and we learn that he is about to bring to this country a person experienced in the extraction of fibres from the plants containing them, if not for the further conversion of the materials so evolved into manufactured articles. At present, we do not go so far as to insist on the manufacturing part of the project, but we would content ourselves just now with an impetus, such as it is said Sir John contemplates, to the growth and preparation of the raw material for the purposes of the manufacturers of Manchester, Glasgow, and other towns and places in the United Kingdom. We are not so ambitious as to 'despise the day of small things.' Therefore, for the present, at least, we should be quite satisfied to witness the shipment of a few tons of raw material spoken of, by way of a beginning to a new industry which, we are convinced, if followed up with spirit, is calculated to provide a handsome living, if it do not lead to affluence, to such persons as may engage therein, provided that they set about the work understandingly, and carry it on skilfully, and at the lowest possible cost. Nor does it appear to us that any very elaborate process, involving complicated and costly machinery, is absolutely necessary for the purpose of separating from fibre-producing plants, such as we have in such luxuriant abundance in the island, the ligaments, which form their strength and real substance, from the feculences which keep them together in a state of cohesion. Now, the Jerusalem dagger, as well as the common dagger (this I believe to be *Yucca gloriosa* and *Aloefolia*), grow luxuriantly all over the island. In regard to the latter, it is too common to render necessary one word about it. The other variety is not so well known. The leaf is more soft and pliable, and seems to us to be more adapted to the manufacture of cordage, and perhaps for textile fabrics, than the better-known kind. We can assure our readers, and we now address ourselves more particularly to those abroad, who are in any respect interested in spinning and weaving—that the fibre of the two plants we have already named require no bleaching—at least it seems so to us; for immediately as it is cleaned, washed and dried, it is as white as the best bleached linen thread, and much whiter than the printing paper on which this article has been written. Nor this alone. It is as fine as the finest silk as it comes from the worm, tough, and elastic. Unlike the plantain fibre, which breaks if made into a knot, it is tenacious, and can bear any complication of knots without snapping. This is one of the greatest desiderata in all fibres, whether for cordage or textile purposes. Then, if we mistake not, whatever substance is suitable for cordage and woven fabrics is equally suitable for manufacture into paper, with this advantage, that, for the latter purpose, the waste and refuse, embracing short, broken fibres, may be used with equal benefit to the long, sound fibre employed for the other purposes named. And as there has for many years existed an outcry about the scarcity of rags, which the wars now raging will serve to enhance, from the demand for lint and bandages for the wounded, it seems to us that we have hit upon a plan—which, by the way, we did as long ago as the time of the Crimean war—whereby the wounded may be benefited, without in the least inconveniencing the paper-manufacturer. We may add to this, that this latter will be able to turn out a superior article, because he will have for stock a raw material much stronger than the old rags he has been in the habit of employing in his manufactory. We have already alluded to the marked whiteness of the fibre of the dagger. In this, as well as in its greater flexibility and tenacity, it is far superior to the fibre of the plantain or banana of any description, which would require considerable bleaching for either paper or any of the textile fabrics."

The bamboo is not a new paper material, although it has only recently been introduced into this country for that purpose. Much of the common Chinese paper is made from it, as may be seen described in Herring's work on Paper, page 31. The American paper-makers have for some time drawn supplies from British Guiana, Jamaica, and other parts of the West Indies. In the paper which I read before the Society two years ago,* I called attention to what the Americans were doing with bamboo as a paper material, and this seems to have drawn attention here to this gigantic grass.

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* *Journal*, vol. xvii., 1869, p. 175.

During last year, some supplies of a very excellent new material were imported from the Portuguese settlements on the west coast of Africa, where considerable quantities may, it is said, be obtained. It is the fibrous bark of a Sterculiaceous tree, the baobab (*Adansonia digitata*), and, from its tough fibrous net-work, it would in quantity be very valuable to the paper-makers. It is not a tall tree, but attains gigantic dimensions in growth, being described by travellers as a "vegetable monster," and "behemoth of the forest," being frequently 80 or 90 feet in circumference. Livingstone asserts that nothing short of boiling the tree in sea-water could possibly destroy its power of vitality. Constantly barked by the natives, the tree nevertheless retains its full vigour, and a removal of the very core or centre of the stem would not, according to that traveller, affect the existence of the tree; and "the reason is," to quote his own words, "that each of the laminæ possesses its own independant vitality; in fact, the baobab is rather a gigantic bulb run up to seed than a tree." This tree or an allied species (*Adansonia Gregorii*) is found in the West Indies and North-Western Australia. The bark fetches readily here £14 to £15 per ton. This bark furnishes indestructible cordage, and a close thread used for cloth and ropes. Ropes made from it are said to be so strong that there is, in Bengal, a saying, "as secure as an elephant bound with baobab rope."

At a late meeting of the Scottish Paper-makers' Association, the chairman urged that the attention of makers should be turned to the introduction of other materials to cheapen the cost of production, or to increase the per-centage of paper yielded by the materials now in use. Wood-pulp might soon be more generally used, as, from recent information, there were means lately discovered, and soon to be patented, whereby the fitness of this material would be greatly improved, and its price be exceedingly moderate. An inquiry into the practicability of growing a vegetable fibre at home as a substitute for esparto was held by several Scotch paper-makers with the Chamber of Agriculture, but no definite conclusion was arrived at. The general opinion, however, was, that straw was the cheapest and best material that could be had, but great difficulty exists in obtaining large supplies, owing to the lease stipulations requiring it to be consumed on the farm. The market price of straw here being also £6 per ton above what it is in Sweden and Belgium, it can be imported from those countries cheaper than it can be bought here.

The vacoua sugar bags, which are made from the tough longitudinal fibres of the leaves of the *Pandanus utilis* and other species of the screw pine, are a useful paper material. Three millions of these bags are made annually in Bourbon, and a large number also in Mauritius. The leaves are cut every second year, and each plant yields enough for two large sacks or bags. The leaves yield paper of good quality, light and strong.

In Australia, attention is being directed to the utilisation of local materials for their paper-mills. At the recent Intercolonial Exhibition at Sydney, in September last, a bronze medal was awarded to the Paper Company for its brown, printing, and news-printing, made at their Liverpool mill. The brown-paper was chiefly made from refuse New Zealand flax; the printing is used by the local journals. The hand-made papers, shown by Dr. Mueller, of Melbourne, proved from what a great variety of vegetable fibres paper can be made, but the difficulty to be conquered is commercial—not mechanical—the cost of reducing much of the fibre into paper being prohibitory.

A Select Committee of the House of Assembly of South Australia reported, in August last, that thousands of tons of material, equal to any demand, and suitable to the manufacture of fibre, is growing extensively in various parts of the colony, and a large proportion on the Crown lands, while the cutting of it does not destroy the plant, but tends to improve it. The Committee report their opinion that a new and valuable industry might be opened up, not only to supply the colony with material useful for various manufactures, such as hemp, rope, and paper, but there would also arise a very large European trade. The Committee, therefore, recommend that a bonus of £2,000 be offered by the Government for the first 500 tons produced in the colony.

Dr. Mueller, in an elaborate article on the barks, foliage, grasses, rushes, &c., of Australia suited for paper-making,* remarks that forest regions and coast lines, swamps and flats subject to inundations, should prominently yield the material for the factory; for, on open pastures or otherwise occupied tracts of country, even paper material cannot be harvested for an unlimited period, at the expense of the soil, with impunity. In factories situated in the vicinity of forests, the soda expended in paper manufactures might be profitably regained by evaporation of the ley, and crystallizing it with coal or sawdust. In viewing (he adds) the immense supply of various kinds of paper material here cheaply available, there is no reason why they should not form, closely pressed, an article of export probably less inflammable than rags; and, still more, it may safely be anticipated that, together with the consumption of rags in local factories, the new articles indicated will largely enter into the fabrication of paper, the product of Victorian industry.

I have not thought it necessary to take up the time of the meeting by an enumeration of all the Australian materials on which Dr. Mueller has experimentalised, with more or less success. Many of these have been repeatedly brought under notice, others are new; but I have specimens of various papers made from them here, for the inspection of those interested. These papers have not been subjected to chlorine, or drawn through size.

In the reports of the jurors at the New Zealand Exhibition of 1865, it is stated that New Zealand produces a number of fibrous plants and grasses suitable for the manufacture of paper, a branch of industry which must, at some future time, become an important one. The bountiful supply of pure water with which almost every portion of the colony is blessed, and the facilities which exist for the erection of mills to be driven by water power, combined with the abundance of paper-making material, which grows in profusion throughout the colony, constitute New Zealand as *par excellence* a favourable country for the production of paper for the supply of this and the other Australian colonies. With regard to paper-making material, the *Phormium tenax* must again occupy the first place.

Not only is the fibre admirably suited to that purpose, but it is the more valuable, inasmuch as the refuse particles of fibre, after its preparation for spinning, are available for the manufacture of paper. In the event of the cultivation of the *Phormium tenax*, there will always be a large quantity of damaged, and what would otherwise be waste leaves, which would be valuable to the paper-maker. Forty years ago, paper was made of it to print an edition of a work by Mr. John Murray, of Edinburgh, on the plant and its uses. The peculiarity of this paper is its tenacity, which property should make it valuable for documents and printings to stand a great deal of wear and tear. No better paper could be used for bank-notes, or for the printing of valuable standard works.

Many of the native grasses of New Zealand are sufficiently fibrous for the manufacture of paper, and the profusion in which they grow on almost every variety of soil, and under every condition of the climate, is an additional reason why efforts should be made to utilise them. One variety of grass in particular claims attention, from its resemblance in many important features to esparto; this is the "snow grass," one of the tussocky

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grasses of the colonists (*Schoenus pauciflorus*, Hooker), which grows rank and luxuriant at high elevations and on barren soil, in the interior of the Middle Island. Experiments have been made at Dunedin as to the paper-making qualities of this grass, and the trial was sufficiently satisfactory to establish its value for the purpose. But while I direct attention to these paper-making materials, I fear Australia is too far distant to be thought of for any extensive supply of raw material, and we must look to nearer quarters, such as the shores of Northern and Western Africa, Brazil, Central America, and the West India Islands.

Seven or eight years ago, in a work which I published on the utilisation of Waste Substances, I suggested that the woolly fibre adhering to the hulls of the cotton seed might be economised in the manufacture of paper, and I am glad to find that this, like very many other hints thrown out, has since been carried into practice.

At the last meeting of the British Association a paper was read by Mr. Thomas Rose, of the firm of Rose and Gibson, of Sankey Mills, Earlstown, on the further utilisation of cotton seed, and especially by converting the short cotton fibres adhering to the husk of the herbaceous cotton, and the husk itself, into paper. The seed yields, in round numbers, 50 per cent. of kernel and 50 per cent. of fibrous husk. The kernel yields about one-third crude oil and two-thirds cake. The fibrous husk gives an average of 30 per cent. pure fibre. The process of operating is this, the cotton seed is fed between a pair of rollers, running at differential speed, and not quite in contact. This cracks the husk or shell, and allows the solid kernel to fall out and be easily separated. A system of riddling further separates a great deal of the dry, broken husk. After this it is boiled in caustic soda, in a revolving boiler, by which means much of the remaining husk is got rid of, and final washings so completely liberate the cotton that it is ready for bleaching. After this process, it is reduced to pulp, and converted into paper. Supposing this to prove a success commercially, of which Mr. Rose (who is now in America on the subject), appears to be sanguine, it will further utilise a waste product on which I have often spoken in former years in this room, and add something to the wants of the paper-maker as regards raw material.

In a late number of the *New Orleans Picayune* (Nov. 10, 1870), I find an article giving elaborate statistical calculations about the value of the cotton seed and its subsidiary products; but I am a little sceptical as to American estimates and figures, particularly when the money value of the oil, oil-cake, and ashes of the hulls, as a fertiliser, are set down at the large sum of £11,000,000 sterling, or equal to one-fourth of the value of the incoming crop of cotton. The quantity of cotton seed from an American crop of three million bales is represented to be 2,250,000 tons. Now, sharp as our American cousins are in turning matters into money, they do not appear yet to have thought of utilising the fibre. If this is all woolly-seeded cotton, the weight of seed spoken of ought to yield about 300,000 tons of pure fibre, worth, to paper-makers, not less than £7,500,000. And this is quite irrespective of the bark of the stem of the cotton-plant, which I have not yet heard is economically used.

Looking at the utilisation of this small cotton seed fibre, I see no reason why another material should not be available, in the fibrous husk or covering of the betel nut of India (*Areca catechu*), which is in such general use throughout the east. The fibre has a soft and cotton-like feel, and is capable of being spun into twine. Immense quantities of these husks are now thrown away, and, as a paper material, they ought to be collected in large quantities and at little cost. From Ceylon, about 70,000 cwt. of these nuts are shipped annually, and large quantities from Pinang, Sumatra, and Travancore, and from other quarters there are also large exports.

One material has been again brought into notice, the New Zealand flax lily (*Phormium tenax*). Twenty-five years ago, it was shipped from the colony as a paper material in solid lumps, to lessen freight. The paper obtained from it is the strongest of all. The subject, from that time to the present day, has been one of almost constant discussion. The readiness with which the large richly-fibrous leaves can be turned into pulp for a very substantial paper, entitles the plant not alone to consideration, but also the fact that it may be permanently established with the greatest ease in any swampy ground.

The leaves of many palms, but chiefly of the dwarf palm, *Chamærops humilis*, *Phœnix spinosa*, and other species, have lately been imported for paper-making, and are found useful if well separated from the leaf-stalk, which is hard, stiff, and brittle.

A patent has lately been taken out for applying the creeping stem of the antidote cocoon (*Feuillæa cordifolia*) as a paper material. This is a cucurbitaceous perennial scandent plant, climbing on the highest trees, very common in Jamaica.

It has been well remarked that it is from a careful observation of the laws of vegetable growth and decay that man has been enabled to take advantage of many of the beautiful vegetable products that lie scattered about in luxuriant profusion, and in proportion to the pains he takes to observe the laws of nature, and the judgment he displays in applying this knowledge to scientific or useful purposes, so are the results beneficial to the community at large. One man looks perhaps at the chemistry of vegetables, another merely at the physiology, while a third considers it useless to waste time with such abstruse studies, and inquires merely what is the mercantile value of fibrous substances, and how cheaply they can be brought into the market. Now, all these inquiries have their relative importance.

In this superficial inquiry on paper-making materials, I have merely touched upon a few of the more prominent, without going into practical details, which can best be supplemented by those present who are specially engaged in the manufacture. The subject will not have been introduced in vain if any of the facts or suggestions I have brought forward shall result in benefit to those who are more specially interested in paper-making.

The paper was illustrated by an esparto plant growing, raised from seed, alfa, diss, palm leaves, and other fibres, from Mr. E. Lloyd, Bow Paper-mills; *Adansonia* bark, bamboo and paper made from it, Algerian flax, and the straw from which it is obtained, palm leaves, New Zealand flax leaves as grown wild, antidote cacoon, wood pulp, &c., from Mr. N. W. Chittenden; sorghum stalks from Italy, the panicles of which are made into brushes, and the waste used for paper making, from Mr. John Draper, 3, Winchester-buildings; various fibres and specimens of paper made therefrom by Mr. James Collins, of the Pharmaceutical Society; flax waste, and paper made therefrom by Mr. Potter, of Darwen; paper collars, cuffs, and wrist-bands, for ladies and gentlemen, from Mr. Edward Tann, 308, High Holborn; cotton seed, and paper made therefrom, from Messrs. Rose and Gibson, Earlestown; waste cotton, and the manufactures made from it, from Mr. Robert Thatcher, Oldham; besides numerous specimens from Mr. Simmonds's own collection.

DISCUSSION.

Mr. N. W. Chittenden said that many fresh fibres had been shown, and much had been said about them, but he had not yet seen anything which would take the place of esparto; and from all he knew, he thought the only thing at present at all likely to compete with it was the dwarf palm. The result of experiments by the paper makers had led them to the belief that a greater percentage of fibre was produced by this substance than from any other material they had tried. The next consideration was, whether it could be obtained in large quantities and at a reasonable price. There were plenty of fibres, many of which would be very useful, and he was sometimes shown specimens of what he called a pot sample of paper produced from them by importers; but when they were asked if they could forward any in large quantities, they were not prepared with an answer. The real object should be, to produce something which would pay the importer, and which could be supplied to the paper maker at a reasonable price. What was wanted was a fibre which could compete with esparto, and which could be sold at a price of about £7 10s. a ton, Spanish esparto being now about £10. He believed the dwarf palm did not take more chemicals, and was more easily bleached than esparto. Next to that, the New Zealand flax would, he thought, be most likely to prove useful. He should like to know if cotton-seed had been used to any extent commercially.

Mr. Simmonds did not think it had been made use of, except experimentally.

Mr. G. Noble said that at present esparto was the only practical material which could be made use of by paper-makers, and as he knew all about this substance, the introduction of which had, unfortunately, cost him about £35,000, he would make a few remarks upon it. In 1851, he imported the first small cargo, and tried it all round the trade, but it met with a very cool reception, and it was not till 1860 that he was able to import it in any quantity for the first time. Mr. Routledge's name had been mentioned in connexion with its manufacture, but he (Mr. Noble) had really supplied him with the means of bringing it forward. In 1860, about 3,000 tons were imported, and the height of his ambition then was to see imported 30,000 tons per annum. However, upon the breaking out of the American war, and consequent increase in the price of cotton, paper-makers began to see there was something in the material, and, in 1868, no less than 96,000 tons were imported. Last year, it was rather less, but in the present year the import would be something like 92,000 or 93,000 tons. The price that would have paid all charges, and left a good profit to the importer, was about £5 10s. a ton, but now it was £10, £10 10s., and even £10 15s. for the best qualities, such as the sample on the table, the difference having all gone into the pockets of the Spaniards; in fact, the importers got a great deal more out of it at £5 10s. than they did now. Great improvements had been made in the method of manufacture since it came into general use. At first, it was chopped up into little bits, while some bruised it, but now when free from the hard roots, it could be put into the machine a ton at a time, and he had seen it go in in a raw state and come out in six hours in the form of paper ready for printing. When the demand became great, the paper-makers thought the importers were getting large profits, and sent agents abroad, the immediate consequence of which was that the price went up, for the moment an Englishman landed it was telegraphed up the country, and the price rose immediately. He had ridden over thousands and thousands of acres of tracts where this grass was growing, a considerable distance in the interior but as it could be brought to market on mules, and in mule carts, at £5 10s., there was no reason why it should cost more than £6 10s. in England. The quantity on the ground diminished every year, because the growth of the plant was very slow, taking eight or ten years to come to perfection in a favourable soil, and on any of the lower grounds which were fit for cultivation, directly the plant was exhausted, the land was ploughed up and planted with cereals, so that they were constantly driven forward into the interior, which, of course, increased the cost. They had now to go from 60 to 160 miles to get a supply, but the introduction of railways towards the mountains would have the effect of saving the cost of carriage. Still, the supply must fall off year by year; but there were, no doubt, immense districts, further in the interior, still available, and if it ultimately became exhausted, there were no doubt numbers of other fibres which would come in and take its place, if people would only pay attention to the subject, and, instead of trying to manufacture paper themselves, send the raw material to Great Britain. As a rule, directly a man found a fibre which he thought suitable, he wanted to make paper himself, and so realise the profit on the manufacture, but they forgot the immense labour, outlay, and interest on capital for plant which was required, and, after all, they only sent an imperfect article into the market, which could not find purchasers. If they would but send the raw material to a British paper-maker, he would turn it into paper. Paper-making was like extracting gold from the ore. The amount of paper produced was the test of the value of the raw material. With regard to the dwarf palm, he was told that he could get millions of tons of it; and, in 1867, he imported a small cargo, and had tried, time after time, to introduce it. Having, however, ridden himself over the country where it grew, he believed that the millions of tons would very soon diminish to hundreds, when one came to consider the immense breadth of land from which one had to gather sufficient leaves to make a ton. No doubt, however, it would be useful to supplement esparto. There was another fibre called diss-grass, grown in Africa, where there was an immense quantity of it, which was not so valuable as esparto, but when the price of the latter was at £10, diss could be bought for £7 or £7 5s., and would really be very useful as an auxiliary. He had had several cargoes of it, and where he had sold it as common esparto, people would use it. The *Adansonia*, again, was certainly a very valuable article, but, unfortunately, it was at an enormous price, he having first paid £14 10s. a ton for a small cargo. Without exaggeration, he believed this could be obtained almost by the million tons, and without going so far as the West Coast of Africa for it; in fact, if there were any paper-maker present who wished to make a large fortune, he could sell him the freehold of as many acres as he pleased at 1s. 6d. or 2s., the land being thickly covered with the tree which produced this valuable fibre. Anything which was brought to England with a good fibre, and which could be supplied at a moderate price, would in a short time be taken up by paper-makers, although there was always a difficulty at first; but when one found it useful, another would soon take it up. In conclusion, he would strongly recommend all persons engaged in this business to confine themselves to bringing the crude material into the market at as small an expense as possible, rather than attempt to manufacture it.

Mr. James Collins said he had put on the table one or two specimens of paper made from some *Adansonia* recently imported, and he understood it could be obtained in any quantity, but there was also this to be said that the *Adansonia digitata* was a tree of very slow growth, so that when once a tree had been stripped another would not grow again in the lifetime of the stripper. There was no doubt, however, that it was a most valuable fibre, both for rope and paper making. He had shown the paper made from it to several bank managers, who had said it was a capital paper for bank-notes, being extremely strong. There was this difficulty about getting it that, at present, the natives, where it grew, had so few wants, that vices had to be created in order to produce the virtue of industry. There was another plant which had been known for many years, which, though it did not look like it, was in reality a large rush, growing to the height of eight or ten feet, of which any quantity could be got. He referred to the palmete. It had been tried once or twice, but at present had not met with a favourable reception. It grew so luxuriantly that many rivers in South Africa were choked up with it so as to impede the navigation. In the northern part of Australia, another species of *Adansonia* (*A. Gregorii*) was found, but he did not know whether it would be so useful for the purpose under discussion.

Mr. Pickstone remarked, with regard to cotton-seed that in America, on almost all cotton plantations, all the spare cotton-seed was required for manure, so that if it were disposed of for the purposes of paper-making it would only be at a price which would purchase some other fertilising agent. Indeed, on most cotton plantations, at present, guano was used to a considerable extent, in addition to the spare cotton-seed. Moreover, if it were found commercially valuable, no doubt Yankee speculators would go south and buy it up, and prices would soon rise.

Mr. J. C. Wilson inquired if the fibrous portion of the seed was used for manure?

Mr. Pickstone said the seed was used after the cotton had been taken off. It was but recently that the seed had been even pressed for the purpose of extracting the oil.

Mr. Wilson said he supposed the seed would still be useful for manure after the cotton fibre had been taken from it.

Mr. Pickstone said this was no doubt true, but in that case the operation must be done on the plantation; and, if there were any demand for it, he gave the Yankees credit for being quite as sharp as the Spaniards, and probably the price would soon go up. He did not doubt there was the quantity of seed mentioned in the paper available, which, after all, was not very large, considering that it was produced from between seven and eight millions of acres.

Mr. Lloyd said no doubt an immense variety of fibres could be obtained from almost any tropical country, but after all, to paper-makers, it was a matter of £ s. d. The dwarf palm could be obtained in almost any quantity in Algeria, but the cost of collection was rather more than that of esparto, every leaf having to be picked separately. It also required more chemicals in the manufacture, and did not give the same yield. Another difficulty was, that the fibre in the fan part of the leaf and in the stalk were different; what would cook one would not cook the other, and what would sufficiently cook the stem would destroy the leaf entirely. The leaf must be cut with a pair of scissors. Moreover, another difficulty was this, that in one part of the leaf there was a little yellow wax, which was extremely difficult to kill. It was not noticed until it got on to the hot rollers, and then it showed itself as a yellow spot on the paper. The diss grass took a considerable quantity of chemicals in the manufacture, and the yield of paper was very inferior to esparto; but still it was being used to some extent in consequence of the high price of the latter article. With regard to esparto, it was now being picked so extensively that in process of time it must die out, and, as Mr. Noble had said, it took from eight to ten years to replace it. Indeed, he believed the seed very seldom came to maturity. He had been in a district where many thousand tons were gathered every year, but had never seen a seedling plant, and where apparently healthy seed had been planted in English conservatories it had not made its appearance in two years. With regard to cotton seed, he would observe that as the Americans were now sending to Europe for esparto, it would seem to follow that if cotton seed were available it would be used there, and would not come to England. There were many fibrous plants in the north of Africa which would no doubt be valuable, but the expense of collecting, drying, and shipping them would be so great that they could not be brought into the English market. About £5 or £6 per ton was the limit which paper-makers ought to give for a fibre in the raw state.

After some remarks from **Mr. Fordred**,

The Secretary said there was hardly a week in which he did not receive one or more letters containing a small quantity of some extraordinary fibre, and a small piece of paper, probably made with a pestle and mortar, and inquiring whether the enclosure would not be very valuable for paper-making purposes. As there were so many gentlemen present who were acquainted with the subject, he should be glad to know if the answer which he had been in the habit of sending was the correct one, or if any better could be suggested. His answer generally took the form of a threefold question, viz:—What was the quantity of the fibre which could be supplied; at what price per ton could it be delivered; and could a continuous supply be depended upon. He was bound to add that he very seldom got any reply to these queries.

The Chairman said it had always been one of the objects of the Society to increase the supply of materials for various manufactures, both from foreign countries and our own colonies, at the same time that they endeavoured to improve the manufactures themselves. To this end, meetings like the present had been held, the proceedings had been reported in the *Journal*, and, while no one who had any suggestion to offer was turned away, those were particularly welcome who, in distant regions, remote from the ordinary means of information, were disposed to exert themselves with a view to benefiting English manufacturers. To many of these persons it would be highly interesting to peruse the valuable information which had been supplied by Mr. Simmonds, supplemented as it had been by the remarks of other gentlemen present, and he only wished that subjects of so much importance were more widely cultivated. On the present occasion they had had an example of one of those champions of commerce to whom the country was indebted for a great deal of its prosperity and wealth. One gentleman had told them that he had been the means of introducing a trade which was now carried on to the extent of about a million per annum, and this had been effected at a personal loss of about £35,000. He would not ask—it was idle to do so—if that gentleman had received from the government any appreciation of his services. It was so idle to expect such a thing, that he only alluded to it in order to remind his audience of the neglect with which such exertions were unfortunately treated in this country. He feared it would be equally futile to ask that gentleman and his fellow labourers how far the government had participated with them in their exertions, for it was because of the want of any systematic organisation in such matters we were dependent on the exertions of individuals, who, unfortunately, might sometimes be checked either by want of means or by one of those accidents to which human life is subject. If, however, there were a properly constituted minister of commerce, the nation would not be entirely dependent on the exertions of individuals, and at the same time those who were disposed to exert themselves for the benefit of the community would feel sure of a proper degree of recognition and support. The subject itself was very important and extensive, as had been practically proved by the amazing growth of the one particular branch, to which allusion had been made; and he had no doubt that there were other materials of like importance which would equally add to the trade of the country, if they were properly brought forward. With regard to the cotton seed, there was a great deal in what Mr. Pickstone had said, but the subsequent explanation must not be forgotten, which he could confirm, that there were countries where the cotton seed was not consumed on the plantation, the ginning establishments not being connected with them; and, in some places, the seed was even burnt, as an entirely waste product. If, therefore, it could be converted into paper, in conjunction with the production of oil, a considerable source of supply might be open to our paper-makers. With regard to esparto grass, which was now generally obtained from Spain, he would venture to suggest that it might perhaps be procured from other southern peninsulas of similar climate, such as Italy, Greece, or Asia Minor, or it might perhaps be cultivated to advantage in some of these localities. With regard, however, to all subjects of that kind, the only means by which foreign competition could be successfully met, would be by a thorough organisation of the trade itself. Mr. Simmonds had referred to the Scottish Papermakers' Association, but something beyond that was wanted—something which, with regard to paper, was an equivalent to the Cotton Supply Association of Manchester, or the recently formed Silk Supply Association. A papermaker's club, such as existed in London, was not sufficient; some public organisation of the whole trade was required, which would be able to do its work very efficiently, much better, probably, than it could be done by that Society, by the Board of Trade, or by the Colonial-office. What was wanted was not so much subscriptions as co-operation for the purposes of experiment, and that practical information should be communicated to correspondents abroad. The expenditure of a very small amount of money in this way would induce the colonies and foreign countries to lay out large sums in experimenting upon different fibres, and they would thus take a great deal of labour off the hands of individuals, only they required first of all to be put in the way of expending their money properly. With regard to one fibre, which was not, however, immediately available for the purpose of paper making, the Indian government was going to a large expenditure, and the New Zealand government had been constantly engaged in promoting the growth and utilisation of the *Phormium tenax*. A great deal of good would be effected if information were supplied to these governments how they could best spend their money profitably, for they all felt deeply interested in obtaining the best price for the productions of their respective countries. In this respect the colonial government differed essentially from the imperial, inasmuch as they endeavoured to benefit, as far as possible, every individual in the community, whereas at home it was left to individuals to look after the public good. The fancy paper and paper-hangings trades had not much benefited by the extension of schools of art and various organisations for promoting technical education; and therefore he thought it desirable that if such an association as he had referred to were formed, it should include all these branches; and not be confined simply to the supply of materials for printing and writing papers. English writing papers were superior to almost any, and were largely used even on the Continent; but he had been lately informed that in some other descriptions the Americans were competing favourably with English makers, simply because the latter did not produce an article suitable to local requirements. In conclusion, he moved a cordial vote of thanks to Mr. Simmonds for the able manner in which he had brought this important subject under their notice.

The vote of thanks was carried unanimously.

CANTOR LECTURES.

ON ARTISTS' COLOURS AND PIGMENTS.

By Frederick S. Barff, Esq., M.A., F.C.S.,

Assistant Professor of Chemistry, University College, London.

Lecture V.—Delivered on Monday, Dec. 19th, 1870.

Fresco and Silicious Painting (continued).

This evening, ladies and gentlemen, our subject will be silicious painting; but before we enter upon its consideration, it is absolutely necessary that I should give you some notion of what silica is, its peculiar properties, how it behaves under different circumstances, and what can be done with it. It is a very useful, and, at the same time, a very intractable material. Chemists find it very much in their way in performing analyses, and unless you are acquainted with its behaviour, you will not know what results may be produced from its application. Silica exists in nature in the form of flint and sand. There are various other forms of silica, chalcedony and onyx. Quartz is crystallized silica, chalcedony is amorphous silica, and the beautiful striated onyx is nothing else but chalcedony with silica, coloured by various metallic oxides, which act as colouring agents. Then, again, we have beautiful agates, and they also are silica. Now, in whatever form this substance occurs, it is insoluble in water, absolutely insoluble, but, at the same time, it may be held in solution in water. Silica is a compound body, being a combination of the two elements called silicon and oxygen. I have here, through the kindness of Messrs. Hopkin and Williams, of New Cavendish-street, a very beautiful specimen of crystallised silicon. I think, even at a distance, you can see that it glitters; it is a black, crystalline, excessively hard substance, and absolutely insoluble in water, and in all acids but one. It is soluble in the acid contained in this bottle, which is known by the name of hydro-fluoric acid, or, as chemists call it, hydric-fluoride. This silicon is obtained from silica by a very interesting process, so interesting that I must take up a minute or two of your time to explain it. In this bottle is an intensely white powder—beautifully white; it would make a beautiful pigment if it had body, but unfortunately it has no body at all. It is called fluo-silicate of potash; it is a compound of potassium, fluorine, and silicon. I do not think I need go into a description of its preparation, as it would be rather beyond the scope of our lecture, but if this substance be mixed with some of the metal sodium and heated, the sodium and potassium unite with the fluorine, and there is left behind simply the element silicon. Now, if this mixture be put into a crucible along with metallic zinc, and if the whole be heated together to such a temperature that the zinc does not volatilise, and if it be allowed to stand for some time, the silicon will be set free from its combination, and will crystallise in this menstruum, and afterwards the crystals may be obtained by dissolving the zinc, which easily dissolves in hydrochloric acid, whereas the crystals of silicon are left untouched by the acid.

If silica is insoluble in water, how can it be rendered soluble in that substance? Here is a piece of glass. This piece of glass is a silicate; it is formed by the union of sand, soda, and lime. Other materials are used for the purpose of counteracting the bad colour of the sand, but I need not consider these now. This glass will not dissolve in water. But possibly you may have noticed in some of the old church windows pieces of glass in which you may see a number of small holes, irregular in shape, on the surface which has been exposed to the weather. I do not mean on the side painted upon, but on the one exposed to the weather. This is owing to the fact that, in former times, they were not as careful as we are now in preparing their glass, and in seeing that the fusion was perfect and complete, nor was the admixture of the materials as even as it is in modern-made glass. There were then in those glasses silicates of two kinds—a silicate which would dissolve, and a silicate which would not dissolve. Now, the silicate which will dissolve is an alkaline silicate, in which the alkali is in excess, and so this silicate dissolves out, leaving the holes mentioned. If we take some sand and some caustic soda, and fuse them together, the sand will be dissolved, and I think I shall be able to show you this in the course of the lecture. In this silver crucible—we cannot use a platinum crucible, because it is affected by caustic soda, or caustic potash—we have some melted caustic soda, and here is some common silver sand. If I put some of this silver-sand into the caustic soda, the sand will melt, and we shall have evidence that the sand has melted by a reaction, which I will explain to you later. I will leave this mixture to fuse for some little time, and then submit it to further treatment, and test it for silica. A longer process, but one equally sure for dissolving silicate, is simply to boil the sand in a solution of caustic soda, or caustic potash. Some years ago, a gentleman, whose name is well known in connection with silicates, adopted a process (whether his own or not I do not know, but he followed it very largely) of making soluble silicates. Mr. Ransome, who then had a factory for artificial stone manufacture at Ipswich, made his soluble silicates in this way. He took lumps of flint, which he calcined, and when they were hot they were thrown into water; that rendered them friable. They were then suspended in metal baskets, in a digestor, in which was put some caustic soda in solution, and they were boiled in this liquid for a long time under pressure. The pressure employed was not very great, I think somewhere about 40 or 50 lbs. to the square inch, but I am not quite sure, and so perfect was the solution that all the silica was dissolved up in the course of time. This way of making soluble silicates is open to objection for the purposes to which I shall speak of their application this evening, because they were too alkaline. Then, again, the caustic soda is generally mixed with some soda salt, such as sulphate, and sulphate of soda is most deleterious in its effects on silicious painting. The best way to make silicates of soda and potash for silicious painting is by the process of fusion, not in crucibles or glass pots, as they make ordinary glass, but in a reverberatory furnace—a furnace in which there is a bridge, and on one side of the bridge is the fire, and on the other is the hearth of the furnace, and fire is continually playing over the top of the bridge, and, therefore, over the materials put upon the hearth. Caustic soda and sand are mixed together and put into this reverberatory furnace and heated, and when heated to a sufficiently high temperature they unite, forming silicate of soda. The charge is then drawn out, and a fresh one put in, and in this way large quantities may be made in the course of a day. Here are some specimens sent to me by Alderman Rumney, of Manchester. This is a specimen of silicate of soda made by him. The lower part of the bottle contains some of the finer specimens, and above are some of the more impure. Here is a specimen of silicate of potash, made in the same way. You notice, I dare say, that the silicate of potash is less coloured than the silicate of soda. These silicates, when they are taken from the reverberatory furnace and allowed to get cold, are put into vessels with water, and heated by spare heat from any available source, and gradually a liquid is formed, a thick, oily-looking liquid, of which I have a sample in this bottle. This is silicate of soda, which was sent by Mr. Rumney, and here is silicate of potash. You see the silicate of soda seems to be much better in colour than the silicate of potash, although in the dry state the silicate of potash is less coloured than the silicate of soda. The colouring matter of these silicates, I fancy, is organic matter, generally speaking. It is evidently not in the original fused silicate; it is some colour which gets into it. The silicate of potash almost always has this colour, and it is quite certain that a substance of this kind, coloured in this way, would not be attractive to the eye of an artist, and he would hardly like to venture on it as a medium for painting with. Here, however, is a specimen which I think is not open to the objection as to colour. This is a specimen of purified silicate of potash, which has been prepared for painting with. It was originally made by the same gentleman, Mr. Rumney, of Manchester, and was at first as dark-coloured as this, but if this silicate be allowed to stand in large vats, such as will hold two or three cwt. of the fluid silicate in solution, the colouring matter gradually subsides, and after two or three months you are able to draw off with a syphon a nearly clear liquid from the upper part, but even in this condition the silicate is not in a sufficiently prepared state for a painting vehicle. It is too alkaline, for there is too much potash present in it. In order to charge it sufficiently with silica it is necessary to precipitate some of the silica from its solution in potash, by a method which I will show you directly, and then to dissolve up that precipitated silica in the alkaline silicate, for it dissolves very easily if you keep it at a moderate temperature. Here is the silicate which has been poured away from the silver crucible. Mr. Taylor will take some of it, break it into small pieces, put it into water and boil it, and we will test the liquid afterwards for silica. When an alkaline silicate is treated with acid, if the silicate be strong, the silica at once gelatinises. Here is some silicate of potash in the crude form, which will answer perfectly well for our purpose. I will add to this some hydrochloric acid, and you will see that immediately this liquid mass will become solid. If, however, the solution of silicate be dilute, then this does not take place. Here is some diluted silicate, and if I add hydrochloric acid to this, I do not think we shall have a precipitate; if we do, it will show that I have not sufficiently diluted it. The substance precipitated in the first experiment, which is a hydrate of silicic acid, can exist in solution in water and in hydrochloric acid; whereas, if it be dried at a tolerably high temperature, the water of hydration is drawn off, and then we get a silica which is not soluble in water; in fact, we get silica in the state chemically in which it originally existed before it was dissolved. Now, if to this solution, in which I have put hydrochloric acid without getting a precipitate, I add some ammonia, we shall immediately precipitate the silica, and you will see it will fall down as a white flocculent precipitate. The liquid has now become turbid, and there are a number of white flocculæ floating about in it. This precipitate is exactly the same as that obtained in the first experiment; it is precipitated silicic hydrate. This hydrate is the substance which is added to the alkaline silicate of potash, and before silicate of potash can be used with success for silicious painting, it is necessary to charge it as much as you possibly can with silica. Here is some of the mass that has been fused in the silver crucible. I will put this into a foot-glass, and add some water to it, and will then treat it in the same way that I did the last solution. It is not very clear, but I think we shall presently see a perceptible difference. The liquid has got more turbid, and a small quantity of silica is separating out. In the course of a short time more will separate, and we shall get a distinct precipitate after a little while.

Silica can be obtained in the form of a clear white powder, such as you see it in this bottle, and the best way of getting it in this state is from gaseous fluoride of silicon. When the acid commonly called hydric-fluoric acts upon glass, it destroys the silica of the glass, decomposes it, and it is made use of in the arts for etching upon glass. Here are a number of pieces of glass that have been etched with this substance; these lines that you see are eaten out of the glass by means of it. When this hydric-fluoric acid acts upon silica, it forms gaseous fluoride of silicon and water. The gaseous fluoride of silicon, when it passes into water, decomposes, one-third of the silicon being deposited as silica, and it was in that way that this white powder was obtained. The remaining silicon is combined with fluorine and hydrogen in this hydric salt, and it may be precipitated by the addition of ammonia. If, to this same hydro-fluo-silicic acid—the substance which remained in the liquid when the fluoride of silicon was passed into water—we add some ammonia, we shall get a white precipitate similar to this which we have already got. There is a white precipitate forming in the solution of the silicate which we made just now, which will increase, and settle down to the bottom of the glass. This soluble silicate is an exceedingly viscid, sticky substance. If you take it in your fingers and rub them together, it feels like gum, it sticks the fingers together, and, in fact, it has been suggested that it should be used as a gum. It is used in the manufacture of soap to a very great extent, and a gentleman, who is very famous as a soap manufacturer and practical chemist (Mr. Gossage, of Bristol), has discovered a way, which is very interesting to chemists, and I believe profitable to manufacturers, of obtaining alkaline silicates. He takes chloride of sodium, and heats it to a high temperature in the presence of steam. It requires an extremely high temperature, and then a double decomposition takes place; the chlorine of the chloride of sodium leaves it, and goes to the hydrogen of the water, forming hydrochloric acid; the oxygen unites with the sodium, forming sodic hydrate, and this acts upon a quantity of sand, which is in the chamber made up into the form of balls, in porous masses, and acting upon it dissolves it, and forms soluble silicate of soda. The use of silicate of soda in soap is not objectionable, as some persons might think; it should not be called an adulteration, because the alkaline silicates are good detergents. If your hands are very dirty, and you take some of this silicate, you can readily wash them quite clean; I think, perhaps, you would get them cleaner, if very dirty, with silicate than with soap.

Other applications of this soluble silicate deserve a moment's notice in passing. It has been suggested that ladies' dresses may be saturated with the silicate of soda and dried, in order to render them uninflammable, but there are certain objections to this. In the first place, I do not conceive that any lady would wear a dress after it had been so saturated, because it would destroy the beautiful appearance of it altogether. Here is a piece of paper which was once opaque, and it has now become somewhat transparent from having been soaked in silicate of soda. If I hold this over the lamp (it is quite dry) it does not catch fire like ordinary paper does, but it chars. Now, although I would not recommend ladies to use this substance for their muslin dresses, yet I think silicate of soda might be very beneficially employed in saturating the wood of which houses are constructed. I believe that if the principal timbers of a house were saturated with silicate of soda or potash, which might easily be done in the same way in which timber is saturated with creosote, we should have far fewer fires than we have at present. Wood soaked in silicate of soda or potash will not burn with a flame, and if it do not, then there is no fear of a fire spreading if it should happen to break out in any part of a house. There is another use to which soluble silicates have been applied, I think, with great benefit; and this is not taking us out of our way, for it is an illustration of how they act in binding colours to a wall. Here I have a mass extremely hard and difficult to break, which has not been made long, only a day or two; it has been dried rapidly; if it had been dried slowly, it would have been more difficult to break. It is a mass consisting of powdered pumice-stone, carbonate of lead (white-lead), and silicate of soda. When these substances are mixed together, they remain in the fluid state for a short time, but in a few minutes they set like plaster of Paris, and gradually the compound gets harder and harder; and, if any pressure is used, then you get a tile so hard that you cannot mark it with your foot by walking on it. Artificial stone is made with soluble silicates, and for many purposes no doubt it is useful. But why I brought this experiment before you this evening was to show you the bonding power of silicates in binding silicious materials together; and not only silicious materials, but other materials which will unite chemically with silica. If you take simple pumice-stone, which is a silicate, and mix it with silicate of potash or soda, and allow it to dry, it will dry into a hard mass, but then a portion of the silica will remain for some time soluble, so that if you put it into water, it will soften in the course of time. But the substance which I have here will not soften at all, because there is a material in it (white-lead) with which the silicate unites chemically, and with which it forms an insoluble compound. I think, perhaps, it would be interesting to show you this action. I will put a little powdered pumice-stone on a glass plate, and you will see how rapidly the setting action will take place. I have mixed the silicate with some of the pumice-stone, and I will add a little white-lead to it, and in a very short time you will see that it will set into a hard mass. Of course I cannot incorporate them as well here as I did in the laboratory, but I have done it roughly, and I will now put the mass into this piece of paper, and in a short time we will examine its condition briefly. Now, having given you a history of silica and its behaviour with particular re-agents, I will enter upon our subject, that of silicious painting, and give you a description of the method as originally discovered by Dr. Fuchs, of Munich, and which I believe has been practised of late in this country. It was found that when soluble silicates were mixed with sand and with carbonate of lime they formed a hard mass, and this gave the idea that such a mass might, when formed, be tinted with colour. The method in which Dr. Fuchs describes his process is exceedingly interesting. He begins by giving a description of the various kinds of silicates which he prefers to use in carrying it out. First of all, he uses silicate of potash made as I have described, charged with as much silica as it can hold. Then he also recommends the use of silicate of soda, which does not seem to be so active and energetic in forming combinations as silicate of potash. And then he uses a mixed silicate, which he calls a double silicate, a silicate of soda and potash. This double silicate he makes in two ways; first, by mixing together the materials of which it is composed, and fusing them together. He takes 100 parts of quartz sand, 28 parts of potash, and 22 of neutral carbonate of soda; to these he adds a little charcoal, and then they are fused together; in this way he prepares what he terms the double silicate. Or, he says, that if he mixes together three measures of potash water-glass in the concentrated form, and two measures of soda water-glass, that is silicate of soda, a liquid will be produced which will answer all the purposes of that made by the first-named method. He uses also another preparation, which he calls his fixing solution, which is more alkaline than the others, and composed of one part of the sodic silicate, and four of the silicate of potash, the potash having been saturated with silica, and to this he adds, as he requires it, some caustic potash or soda, generally potash. The reason of using these four different materials is this. He found that, in his method of painting, silicate of potash was likely to get opaque, and to injure the colours. He found that, when alkali was added to it, it was not liable to this objection, but it became more transparent. He used silicate of soda because this does not act so rapidly, and therefore penetrates more deeply below the surface upon which the painting is to be executed, and it is a matter of considerable importance in silicious painting that you should have the silicate to penetrate as far as you can, to bind together all the ingredients of which the painting ground is composed, and silicate of soda has this property of penetration.

The point of first importance in executing a silicious painting is to have a well-prepared ground, and this, if you remember, I said was a most important thing in fresco-painting. In fresco-painting you have to use a considerable amount of lime with your sand in order to make your ground firm, hard, and enduring, because you have to depend upon the slow action of the lime dissolving up some of the sand, and thereby forming silicate of lime, for the hardening process and durability of the wall; the action of the carbonic acid of the atmosphere has a great deal to do with this, as I mentioned last Monday evening. But in silicious painting you use a binding material which will hold the paints and the coating of the wall together with a firm, enduring bond. I have already given you an instance of the bonding power of silicates. This substance which I poured just now in the liquid state into this paper is set into a firm hard mass, though, of course, it must be allowed time to dry before it will become as hard as this which I broke before you just now. In preparing a wall for silicious painting, the first thing is to take care that the wall is dry on the outside. Suppose, however, it is desired to paint on a wall through which moisture has come, how are you to prevent the moisture penetrating through the wall. I shall presently describe to you another mode of silicious painting, in which silicate of alumina and potash are used. If you mix silicate of alumina and potash together with some carbonate of lime, and you coat a wall with it, and then, after it is dry, if you keep on coating it until it is saturated, and the surface of it shows what is called an egg-shell gloss, you will then have a wall which will resist from without the entrance of damp. So, if it should be necessary to paint a silicious painting in an exposed situation, you have, I believe, the means of preventing damp penetrating through the wall. But I will speak further of this method of protecting walls when we come to treat of the other method of painting which I mean to lay before you this evening.

The painting ground should be prepared with good mortar, made of old lime and sand, so that no cracks appear upon it, and no blisters, such as are sure to happen if the lime has been, what builders technically call, freshly run. It must be allowed to remain and be acted upon by the carbonic acid of the air for months before it is fit to use for this purpose. I ought to have mentioned last Monday what was told me by Mr. Newton, who, I believe, heard it from Sir Charles Eastlake, that there is somewhere in the Houses of Parliament a very large store of lime that has been run for some years. It may have been overlooked, but it would be an invaluable material for artists who are going to paint either in fresco or in silicious vehicles.

When the wall has been prepared in this way, the next thing to do is to put on a skimming coat, but in order that it may be porous, a large quantity of sand should be employed. And it must be sand that is angular, and not sand the edges of which have been rounded. In lieu of sand, crushed dolomite, the stone of which the Houses of Parliament are built, magnesian limestone, answers very well indeed. And, from my own experience, I have no doubt that if you mix a small quantity of powdered glass or silica in a fine form with the lime, you assist the bonding power of the compost, and at the same time render it more permeable to the soluble silicate which is to be afterwards employed. When the wall has been prepared thus, and allowed to dry, it should be saturated once or twice with a solution of silicate of potash, or, what is better, with the double silicate of soda and potash, having a specific gravity of about 1·2. Then may be (and it often does happen) that a sort of glossy skin will form over the surface of the wall. This glossy skin will prevent the further penetration of the silicates, and it is necessary to be very careful to get rid of it. Various processes were recommended to Dr. Fuchs, by his friend and fellow-labourer the great artist, Professor Kaulbach, of Munich, for getting rid of this skin; he suggested scraping it over with an iron straight-edge, but Dr. Fuchs thought it better not to do this, because, by so doing, particles of the sand would be removed from the wall, and therefore leave holes in the ground. You can remove this glossy skin from the wall by treating it with a solution of phosphoric acid. A phosphate of lime is thus formed, and this phosphate of lime forms a very hard and enduring compound with silicates. After the wall is got into such a state that all its particles are well bonded together, and that it has perfect suction, then comes the most delicate process of all, which is the fixing of the painting ground. This ground should not be more than one-eighth of an inch thick; Dr. Fuchs recommends one-tenth of an inch, but it should certainly not be more than one-eighth. It is composed of sand and lime in different proportions; there must be much less lime than there was in the preparatory ground. All you want is sufficient lime just to hold the sand together while it is being put upon the wall. When this ground is finished, it is to be saturated with the silicate, so that the whole mass, the under ground and the painting ground, are well bonded together. If you get too much of the silicate on the surface, so as to stop the suction, it is recommended to apply heat, and the method of applying it is to coat the wall all over with alcohol and set it on fire; the heat is thus distributed evenly, and you cause the particles to contract, and allow space for the silicate, which is to be applied, to penetrate. When the wall is in this state it is ready for painting. As to the method of transferring your cartoon, of course you cannot adopt that which is used in fresco-painting, as the ground is not in a soft state. You may adopt any plan that you think efficacious for the purpose, but that which I always adopted, and have found it to answer very well, was to rub the back of the cartoon with powdered charcoal, and then trace it upon the wall. Pouncing, however, does very well.

You prepare your colours for silicious painting just in the same way as for fresco-painting; they are ground excessively fine, and the vehicle with which you paint, in the process which I am now describing, is simply water. Before painting, you must moisten the wall, so that there should not be too great suction. Then you go on painting your subject with colour which is simply held by water; it is obvious that when this water evaporates, the colour will lie in a finely powdered state upon the surface of the painting ground, and will be easily removed. And herein is one of the greatest difficulties in this method of painting. One requires a something, however slight its bonding powers may be, to hold the colours on, so that you may paint them as often as you like without disturbing the under coats. One way in which the colours are fixed is by means of a fine spray of the silicate thrown upon the wall from a syringe. There was, I believe, great difficulty in performing this operation in the earlier stages of silicious painting, but a syringe was invented by a gentleman in Munich which, I believe, acts by means of cross jets, and in that way throws an exceedingly fine spray of the silicate upon the picture. This spray should be thrown on until the wall is fairly damp, and it should be repeated after drying until the colours cannot be removed, and Dr. Fuchs recommends that it should be continued until a white handkerchief is not marked when passed over the picture. Of course, the application of this handkerchief must be very delicate in the first instance, and even later, because some of the small particles of sand might be broken off from the wall, and remove with them some of the colour. If portions of the colour, therefore, come off on the white handkerchief, it is not necessarily a proof that the colours are not firmly bonded to the wall, but only that particles of sand have come away, because they are not as yet firmly attached to their neighbours, or to the lime in which they are embedded. After some time, the paintings should be examined, to see whether the silicate has gone in, and left some of the colours imperfectly fixed. If that is found to be the case, there is no difficulty in repeating the application of the silicate by the same process. From what Dr. Fuchs says, and from experiments which had been made in this mode of painting in Berlin and elsewhere by Professor Kaulbach, there is no doubt whatever that when this process is adopted with care, paintings executed by it do stand exceedingly well.

But it always appears to me that there is a difficulty here. You are putting in an alkaline silicate, and there must be some alkali to come out in some form or other, and if it meets, as most likely it will, with sulphates in the wall, it will form a soluble sulphate, or by the action of the atmosphere it will become converted into carbonate, or if it meets with chlorides it will form a chlorine salt, and these will either crystallise out, or effloresce out, or deliquesce out, and this must, as it appears to me, tend to injure the body of the painting, if not to disintegrate its surface. Experience only, of course, will prove whether I am right or wrong in this surmise, but it appears very likely to happen, and I know that in the experiments which I have made myself it has happened, and that in the course of time some of the colours have been covered with a mildewy appearance owing to some of these salts having passed out through the surface of the picture. If the salts are sulphates, sulphate of soda or potash, one can hardly understand why they do not break up the surface of the wall, for they crystallise in crystals which are perfectly able to throw off the small superincumbent mass that is imposed upon them, and so in that way I should fear the paintings executed in this manner would suffer from the injurious effects of these crystallisable salts. I have no wish to underrate this method of painting, for I have the most unlimited respect for the gentleman who, through so many difficulties, and in opposition to so many prejudices, carried this system of painting to the perfection which he did. I allude to the discoverer of it, Professor Fuchs, and also to his great colleague, Herr Von Kaulbach. My object is not to decry anything or anybody's process; but here we have met together for the purpose of ascertaining what is the best way of doing certain things. I have freely on one or two occasions given my opinion, which I believe I have backed with evidence, as to the use of certain pigments, as to their durability, and to the propriety of continuing the use of them. I threw out those hints not that I wished to go counter to prejudice, but I wished, if possible, by argument and by experimental illustration, to overcome prejudices.

I do not wish, in what I am going to say about another method of silicious painting, in any way to detract from the merits of Dr. Fuchs' process, nor do I say that, in the end, the process which I shall recommend to you this evening is really a better one. All I can say is, that my experiments lead me to believe it a better one, and I think it will be found to be so practically. But what I want to do, and what I ask you to do, is to give both a fair trial, and see which stands the best. If that which I suggest does not stand as well as the other, no harm is done; the trial will only serve to increase your knowledge, and it will serve to show you the direction in which we ought to look for perfecting what I believe is now on all hands said to be one of the best methods of painting which can be adopted in order to ensure the durability of mural pictures, ornament, and decoration.

When sulphate of alumina is fused with potash, it forms a compound, just as silica does when it is fused with potash; you get an aluminate of potash formed in the former case, and in the other a silicate of potash. In this bottle there is a solution of aluminate of potash which was made by Mr. Rumney, of Manchester, and sent up to me a few days ago for exhibition this evening. This aluminate of potash behaves very strangely. Here it is a colourless liquid; it is very strong, and as long as it is kept in this concentrated state, it will remain a clear, colourless liquid; but if we dilute it, it will, after a short time, get turbid, and some of the alumina will be deposited—by no means all, but only a small portion. The product, as it comes from the reverberatory furnace, is seen in lumps, not having a vitreous fracture, like the silicate of potash, but in dry lumps, which are impregnated with iron, rendering them reddish. If you dissolve these in a little water, you get a clear solution, of course with a precipitate of iron oxide, from which it is to be filtered. If you dissolve them in a quantity of water, you do not get out all the alumina, but only a portion of it. Here I have some of this aluminate of potash, which I have diluted with water. You see it is now perfectly clear and colourless, although I distinctly observe at the bottom small flocculæ of alumina floating about. On Saturday, I diluted some of this, and left it until to-day, and when I went to the laboratory this morning I found that a tolerably active precipitation of alumina had taken place. I then filtered off the alumina, and got this clear liquid. I will now show you the action which takes place when silicate of potash is mixed with silicate of alumina. I will take them first in their concentrated forms. You see they gelatinise at once. If they are mixed in a dilute state they will not gelatinise at once. In these glasses are some specimens of this gelatinous product that has been dried. They were made many years ago, and were exhibited in the Exhibition of 1862; they were placed in vessels filled with dilute sulphuric acid, so that for the whole space during which that Exhibition lasted they were subjected to the action of dilute sulphuric acid, and you see, therefore, that they must be proof against the action of that acid. I shall presently have to call your attention to this fact. After the lecture, anyone can take out these specimens and examine them; they will be found very hard, indeed some of them will scratch glass. If this silicate of alumina and silicate of potash be mixed in diluted solutions, the mass does not solidify rapidly. This morning at eleven o'clock I mixed some of the two solutions together, and Mr. Taylor tells me that at five o'clock they begun to gelatinise. They were mixed when of a tolerably heavy specific gravity, and if you take the liquids of a lower specific gravity you will find you can get them not to gelatinise in less than from twelve to twenty-four hours. If you mix together silicate of alumina, at 1·12 specific gravity, and silicate of potash at 1·2, the mixture will remain for some ten or twelve hours in a liquid state, clear as water. Mr. Taylor has diluted some of these two silicates, and put them together, so as to show you that they do not immediately gelatinise. Here, then, we have a vehicle for painting, which may be used with the colours; in fact you may mix your colours with it just as you would with any other vehicle, oil, water, or what not. When the colour is placed upon the prepared ground, it adheres to it, and you can paint over it again and again as often as you like.

The advantage of this process, and it was this which led me to turn my attention to the discovery of it, is this, that you have no appreciable alkali free. You form here an artificial felspar. You have alumina, silica, and potash united together. This compound here on the table contains these three substances, in a hard, insoluble form. Here, then, there is no fear of an excess of alkali efflorescing or deliquescing out, or coming out in any other way. I have never known, when these materials have been used, the coloured surface to become mildewed, or apparently mildewed, in the slightest degree. I have here, roughly painted on a piece of tile, some colours to show you the effect. This is a ground of common plaster, lime, and sand, put on by a common workman, and the lime used was not old, run lime. Three of these slabs were prepared, but two of them were so badly blistered and cracked that I could not bring them, and even this one is blistered to some extent. I purposely took such a slab, which presented most unfavourable conditions, in order to put the experiment to the most complete test. The colours are all, I think, perfectly fixed upon the slab, although they were only put on last Saturday. They were mixed with some of this silicate of alumina and potash, laid on with a brush, and after that the silicate of alumina and potash, in a dilute state, was brushed over them two or three times. I believe that if this were put out in the open air, under a water-spout, so that the wet might drop upon it, you would not find that any change would take place in the surface. Of course, if damp were allowed to get into it from behind, the mortar would become rotten and break away.

I wish here again to refer to the aureolin yellow, because when one commits an error, one cannot make too complete a reparation. What I said about this colour on the first occasion was calculated to bring it into disrepute, but on Monday last I made the *amende honourable*, and I wish to do so still more perfectly this evening.

These two yellows are both aureolin yellow, and they have stood the test of the caustic potash, and the alkaline silicate, and here is the little flask which was accidentally left behind last week at University College; it contains a specimen of aureolin yellow in a strong solution of caustic potash; and, as you see, it has kept its colour perfectly, notwithstanding it has been in the caustic potash since Thursday week.

As to the ground necessary for painting upon with this silicate of alumina and potash, I need say very little about it. The directions which I have given you for silicious painting grounds will serve perfectly well, only if instead of using silicate of potash and silicate of soda you will use this aluminate of potash in a dilute solution with silicate of potash, I believe you will get a firmer, harder and more enduring ground than by using silicates alone.

It is a matter of regret that time goes so rapidly, for many things which I had intended to say in the course of my lectures I had been obliged to omit, and probably if I were now to enter more fully into this subject I should only weary that patience with which you have been so kind as to listen to me on every occasion. I had hoped to have mentioned that colours to be used in silicious painting should be, as I conceive, impregnated with silicates. This is easily done, and I do not think anyone accustomed to the preparation and manufacture of colours will say that there is any difficulty in it whatever. Although these masses of colour appear to you to be opaque, many of them are transparent; and when the material is used in small quantity it is practically transparent. In fact, the difficulty which you will find is to make your colour cover down well with this vehicle. Ultramarine, for instance, if used in this manner, requires two or three coats before it becomes as solid as in this specimen, and even this is not as solid as it should be. Other colours also will work with wonderful transparency with this vehicle, so that I do not think want of transparency will be brought forward as an objection to it. If you want to prepare colours for silicious painting, either by this process or the other (for I believe it would be an advantage in either case), with silicates; you should saturate them in the one case, or possibly in both, with silicate of alumina and potash. All the particles of the colours will become impregnated with this material, and after drying the colours will not be found to be injured in tint at all. They may be ground up very fine, and it will be found that the colour is intimately mixed with silica and alumina, which combines readily with the soluble silicate of the alumina and potash used. Silica has a wonderful affinity for all substances of its own kind, as is shown in a remarkable manner by the test-tubes in laboratories which have been used for silicates, for they resist all efforts to clean them. Here is one, showing the marks of a silicate, which it is almost impossible to remove, scratch it how you will. In this tube some silicate of lime was used, and the tube is covered all over with particles of silica, which cannot be removed by any ordinary process.

If silicious painting should find favour in your eyes, and in the eyes of other artists in this country, I have no doubt that there are those who will be willing to prepare colours suitable for its execution, and who would make it their study to prepare them in the best way. That silicious painting, which is wonderfully enduring, ought to be introduced into this country, for the decoration of our public buildings, there can be no doubt, and it was with the view of encouraging its introduction that I was mainly led to undertake to deliver this course of lectures. I do conceive that the beautiful works of art, which we see painted on canvas, contribute very much to selfish gratification. They hang in the rooms of the wealthy, and surely the wealthy have a right to be gratified with what they purchase, and now, through the energy and enterprise of the gentlemen at South Kensington, those wonderful works of art that were formerly kept from public view, have been brought before us, and we are able to see many of them; yet we do not, or the poorer classes amongst us do not, see them as often as they ought to do; they have not such frequent access to them as I conceive they ought to have—or rather not to them, but to such works of art as would refine their tastes. If our artists, who are great in oil painting, would try their hand upon this method of silicious painting, for it is more in their style than fresco-painting, it would be a great boon, for they would be able to ornament and decorate our public buildings, and those places which are frequented by the working classes, with instructive and beautiful paintings; for I know of no art which is more humanising than the art of painting. Persons who are not instructed in it in any way, and who have little or nothing of what is called taste, generally show that nature has given them true taste, for we usually find them gathered before the most beautiful paintings, which receive the approbation of the cultivated and refined. If, I say, we could have our public buildings, whether places of recreation or of instruction, decorated with beautiful paintings on the walls, they would appeal to the feelings of the persons present, and I think it would be a very great public gain, for they would delight and instruct the unlearned, and that is why I feel so anxious to recommend this method of painting, which will enable our artists to accomplish this boon for their fellow-countrymen.

And now that I have trespassed so long upon your time, nothing more remains for me but to thank you very cordially for the kindness and attention with which you have heard me throughout this course of lectures. I believe many of you came here to be instructed, and I have no doubt you have been disappointed. Many of you no doubt hoped to have heard more about the materials ordinarily used than my time allowed me to say. But I am sure you will forgive me, knowing the motive I had in view. I have endeavoured as much as possible to select things which are typical, rather than to enter into details which are not so; and I have also endeavoured, as much as possible, to keep in the background the science which is now the pursuit of my life, and only to use it as a means of illustrating that which was the principal object of my lectures. I hope, however, that I have succeeded in implanting in you a desire, if you had it not before, of knowing more about chemical and physical science in connection with art. If I have done this, I have done a great deal. If I have taught you nothing but what you knew before as regards the manipulation of your painting, the permanence of your vehicles, or the stability of your colours, still, if I have been able to show you that, by following out a course of science, our young artists especially will be made better painters; if I have been able to show you that by going through a laboratory course they will gain a use of their hands and a readiness in manipulation which nothing else that I know of can give them, my efforts have not been in vain.

The Secretary then proposed a vote of thanks to Mr. Barff for the interesting and instructive course of lectures which he had just delivered, and announced that, in the course of next year, he would give a second course on "Ceramic Painting."

The vote of thanks was carried unanimously.

APPENDIX.

The following is a short list of the composition of those mineral colours which are commonly employed by artists. Colours which are not in general use are omitted; and as vegetable colours have not been noticed by me in my course of Cantor Lectures, I thought it better to leave them to future consideration, as it is my intention to republish the part of those lectures which refers to the chemistry and composition of colours in an enlarged form. I have been led to this determination by the request which has been made to me by some who were present at the delivery of my lectures, as well as by artists who were not there. I shall in this work treat of all pigments, mineral, vegetable, and animal, as well as of vehicles, media, and painting grounds, in such a way that it will, I hope, serve as a useful manual for artists.

Composition of certain Mineral Colours.

LEAD PIGMENTS.

White-lead is a basic carbonate, turned brown and black by the rapid or slow action of sulphuretted hydrogen. It, after a time, loses its body, to a great extent, by chemical action with the oil with which it is mixed. It cannot be used with sulphides of metals less energetic than lead, as it reduces them, forming brown sulphide of lead. It is a pigment which should never be used in pictures, except for the first preparation of canvass or wall-painting grounds.

Sulphate of Baryta, called barytes and constant white, is very permanent, of a bluish tint; has no body in oil, but is a good white in fresco, silicious, and water-colour painting. Chemically, it has no action on other colours, and is not itself affected by any ordinary destructive agent. It is a natural product, called heavy spar.

Cremnitz White, a beautiful white, with less body than ordinary white-lead; it is, doubtless, made by precipitation; it, like ordinary white-lead, decomposes sulphides, and is decomposed by sulphuretted hydrogen.

Flake White is a form of carbonate of lead, therefore liable to the same objections as other lead whites. It has good body.

Oxychloride of Lead is a basic chloride of lead, and is altogether useless as an artist's pigment, it has but little body, and is decomposed by sulphuretted hydrogen. It is sometimes called Pattison's white-lead.

Chromes—Light, Middle, and Orange.—All these pigments are chromates of lead, and therefore liable to be blackened by sulphuretted hydrogen. Light chrome contains lead sulphate with lead chromate; the middle tint is a neutral chromate, and orange chrome is a basic chromate of lead. When used with oil, they may, with care, retain their colour for a long time, the oxidised oil protecting them from the action of sulphuretted hydrogen. They cannot be used in silicious, fresco, or any other method of water painting. They are destroyed by alkalies; they should never be used with Prussian blue or kindred colours. On the whole, it would be as well for artists to reject them, as better and safer pigments can be employed for the same purpose as they are.

Red-lead is a mixture of two oxides of lead. The tint is good, if well made. It cannot be used with white-lead, and it is blackened by sulphuretted hydrogen. It should not be employed as a pigment.

ZINC PIGMENTS.

Zinc-white (oxide of zinc) is a permanent pigment, is not affected by sulphuretted hydrogen; does not form soap with oils and fats, therefore it retains its opacity, does not decompose other pigments, and, if used with proper vehicles, retains its whiteness. It is the best and safest white that can be used. It is most durable in silicious painting, as it forms chemical compounds with potash and silica.

Chinese White is a zinc white.

Zinc Orange is a most unstable pigment.

Naples Yellow is made from zinc and antimony; and that which is now prepared by the best colour-makers is a good pigment, and may be safely used in oil. The old Naples yellow contained lead, and was therefore objectionable.

BISMUTH PIGMENTS.

Pearl White is a salt of bismuth. It blackens by the action of sulphuretted hydrogen, and should never be used as a pigment.

Bismuth Purple is the higher oxide of bismuth; it is blackened by sulphuretted hydrogen, and therefore valueless.

COPPER PIGMENTS.

Blue Verditer is hydrated oxide of copper; it is acted upon by sulphuretted hydrogen; it should not be used in oil, and though more stable in water, it is hardly a pigment for high art work. Certain blues are made from the natural blue basic carbonate of copper, and from malachite, but they have no interest for the artist.

Emerald Green is made by precipitating a solution of arsenious acid (common arsenic) with acetate of copper. It is on the whole a permanent colour. It should not be used with cadmium yellow, as that is a sulphide, and with it forms sulphide of copper, which is brown. It is a good oil pigment when properly used; it has but little body. It answers well in water-colour painting; it cannot, however, be used in fresco or silicious painting. If it is desired to mix it with a yellow, Mr. Salter recommends aureolin. It should be remembered that emerald green is a deadly poison. The other copper greens are Scheele's green, Schweinfurt green, malachite, verdigris, and chrome greens (these are not the true chrome greens). Scheele's green and Schweinfurt green contain arsenic. None of these pigments are of value to the artist, and therefore they do not require special notice here.

COBALT PIGMENTS.

Smalt is a fused silicate of cobalt, used in water-colour painting. It is permanent, but has little body. If ground too fine it loses its beautiful tint. It can be employed in fresco and silicious painting. It is not affected by sulphuretted hydrogen.

Cobalt Blue.—Thénard's blue is made by precipitates, a solution of alum with a soluble cobalt salt, and heating the precipitate. When well made, it is a good permanent colour, useful in oil and water. It can also be employed in fresco and silicious painting. It is, however, somewhat affected by light, losing its brilliancy slightly. It is said to be changed by the sulphuretted hydrogen in the air. This I very much doubt.

Cobalt Green.—Rimnan's green is prepared by acting on a solution of sulphate of zinc with a cobalt salt, and by heating the precipitate. It is a permanent colour.

Aureolin Yellow.—An excellent pigment in every respect. It is a double nitrite of potassium and cobalt. It is not acted upon by lime or by potash; it is, therefore, a good pigment for fresco and silicious painting. It may be used with safety in oil and in water. Sulphuretted hydrogen does not affect it, and it is permanent when submitted to the severest tests. It is not affected by admixture with other colours.

IRON PIGMENTS.

The Ochres are earths coloured by oxide of iron. The natural colour of these earths is yellow, but by burning they get darker, and some become red. Indian red, red ochre, light red, &c., are all earths with more or less of the oxide of iron in them. All the ochres are permanent and stable if they have been well prepared. They may be used safely in every style of painting.

Venetian Red, as now prepared, is an iron-red; but, whether from adulteration or not, it contains lime; and, as it is made from the sulphate of iron, sulphate of lime gets formed, and this prevents its employment in silicious painting, for with silicate of potash a silicate of lime is immediately formed, and it becomes hard and lumpy. It may be used in oil, water, and fresco.

Colcothar is also an oxide of iron; it is very permanent, and, I believe, generally useful as a pigment. It can be obtained of different tints. It is, however, especially useful in fresco and silicious painting.

Prussian Blue and *Antwerp Blue* are prepared by precipitating a solution of ferrocyanide of potassium with sesqui-chloride of iron. There are, however, other methods of preparing them commercially, but their composition is the same. These colours are not acted upon by acids, but are destroyed by alkalies; they cannot, therefore, be used in fresco or silicious painting. Prussian blues are really stable colours, with care in their use, and, when well protected, they last a long time, but they are liable to be decomposed by light and by alkalies.

MERCURY PIGMENTS.

Vermillion is a sulphide of mercury; it may be used in oil, water, fresco, and silicious painting. In all cases, however, it gets slightly darker in time; this is not a chemical but a physical change. The description of the preparation of vermillion has already been given in this course of Cantor Lectures. With the exception mentioned, this pigment is very permanent.

Iodide of Mercury.—A compound of iodine and mercury; is a beautiful colour, but it is easily decomposed by other pigments, nor is it in itself permanent. It should not, I think, ever be used as a pigment.

CADMIUM PIGMENTS.

Cadmium Yellow, Red, &c.—These are sulphides of cadmium, and, when well prepared, are very stable; they can be used in fresco and silicious painting. It has already been mentioned that cadmium sulphide decomposes emerald green. It is not safe to use it with lead pigments, unless it has been most carefully prepared; and here, inasmuch as decomposition may take place, and lead sulphide, which is black, be formed, it is better to avoid the mixture; no such mixture can occur in fresco or silicious painting, and it would be well if there was no chance of its occuring in any other style of painting, by the banishment of white-lead from the list of artists' pigments. No other salts of cadmium are important as pigments.

CHROMIUM PIGMENTS.

Green Oxide of Chromium.—This oxide is perfectly stable, and, as so many tints of it can be obtained, including the beautiful viridian, I hope it will be more largely employed than it has been. It can be used in all vehicles, and is perfectly permanent in fresco and silicious painting. Other chromium compounds are used in painting; the chromates of lead have already been treated of. Chromate of barytes is a good, safe pigment; it is used under the name of lemon yellow. It is permanent in fresco and silicious painting. The chromates generally are unstable colours, and, as there are so many other good yellows, they should not be used as pigments.

I have now noticed the composition and behaviour of some of the most common pigments, and, for the reasons already given, I think it needless at present to prolong the list.

MUSIC AND DRILL IN STATE-AIDED SCHOOLS.

On Friday last, at noon, two deputations from the Society of Arts, representing the Drill Committee and the Musical Education Committee, waited upon the Right Hon. W. E. Forster, M.P., Vice-President of the Committee of Council on Education, at the Privy Council-office, to urge the importance of these subjects being made compulsory in all State-aided schools. The deputation consisted of Lord Henry G. Lennox, M.P., Chairman of the Council, the Right Hon. Sir John Pakington, Bart., M.P., Vice-President of the Society, Mr. Edwin Chadwick, C.B., Mr. Hyde Clarke, the Rev. Canon Cromwell, Captain E. F. Du Cane, the Hon. Seymour Egerton, Lord Gerald Fitzgerald, Mr. W. S. Fitzwilliam, Sir John Harington, Captain Phipps, R.N., Mr. J. F. Puttick, Mr. E. C. Tufnell, Captain Tyler, attended by the Secretary, Mr. P. Le Neve Foster, and Major-General Lindsay, deputed to attend by the War-office, was present.

Lord Henry G. Lennox said he had been asked by the Society of Arts, as he held the office of Chairman of the Council, to introduce the subject of drill—one of two subjects upon which the deputation had waited upon Mr. Forster to-day. The Society of Arts had for a long time taken a deep interest in the question of drill, and they had done all they could to impress on the public mind how very advantageous it would be, in any general system of primary education, if gymnastics and physical training could be introduced. The Council, at a late meeting, had resolved unanimously to request the Drill Committee "to wait upon the Vice-President of the Committee of Council on Education, to urge upon him the importance of making drill and gymnastics part of the training in elementary schools throughout the country." There were two special grounds he had to submit. They were, first of all, the benefit which accrued to the child while at school, inasmuch as it induced habits of discipline and order, and, secondly, it had the effect of greatly benefiting and improving the health and condition of the children, and furnishing an increased aptitude for physical labour. Some large employers of labour went so far as to say that the work performed by two drilled assistants were equal to that performed by three undrilled workmen. Sir Joseph Whitworth, Sir William Fairbairn, and Mr. Rawlinson, C.B., spoke in the highest terms of the value of drilled workmen: and Mr. George Sykes, manager to Messrs. Sharpe, Stewart, and Co., of Manchester, held the same opinion. Then they had the authority of many military men for saying that drill in boyhood prepared men for being better soldiers. Major-General Napier's opinion on the point was well known; and Field-Marshal Sir J. Burgoyne, who was prevented from being present, had approved of the objects which the deputation had in view.

Mr. E. Carleton Tufnell said the system of drill was adopted in all the large schools under his inspection. At present, almost all the pauper children were collected in very large schools about the metropolis, to the number of 8,000, and in every one there was a drill-master, and the government had sanctioned the system to such an extent that they paid the whole salary of the drill-masters. The advantage had been so very obvious, that there was not one manager of any of the schools who would not think it a very great evil if the drill-master were dismissed. In one school, near the Crystal Palace, where there were 700 children, the managers at one time dismissed the drill-master, and the result was that the school got into such a state of disorder in the course of a month, that they were only too happy to recall the drill-master; and in that month about £100 worth of damage was done to the building by the children.

Mr. Forster—Could not order be kept without the assistance of the drill-master. The schoolmaster ought to have kept order.

Mr. Tufnell said the schoolmaster's time was, and ought to be, entirely taken up in teaching.

Mr. Edwin Chadwick, C.B., observed that there were principles of physiology which hitherto had not been brought within the schoolmaster's cognizance, involving the necessity of exercise of the body, which, if not provided for, outbursts of nervous irritability and irrepressible disorder, and conflicts ensued. The masters who had served in schools where there was no drill, and also in schools where there was, would attest the great difference it made in producing order and quickening all the mental work. Without the drill they might with conflict get some order in the day, but in the boarding-houses the nervous irritability broke out in the dormitories in bolstering and disturbances at night.

Mr. Forster observed that when he was at school they had some drill, and yet they had bolstering at night.

Mr. Chadwick said that was a proof that the principle was imperfectly applied, and that there was insufficient bodily exercise during the day, for if there had been enough of it, there would most assuredly be quiet rest at night. This result of the military drill upon the sedentary classes had been marked in the volunteer movement, for it had been observed, on days of drill and field exercise, young men went home to bed, and dancing saloons and night houses were emptied of them. In respect to the schools, however, when the military drill was first introduced into the district half-time schools, it was necessary to engage non-commissioned officers as teachers; but now, from highly successful instances, where the schoolmasters were themselves taught and made drill-masters, it enabled them to get prompt obedience and precision in changing classes, and in all the operations of the school, and made the drill so enter into the very fibre of every day's work that it was now deemed commendable that, for efficiency as well as economy, the schoolmaster himself should be drilled and taught to drill his scholars. His independent conclusion was corroborated by a proposal lately made by the War Department of Switzerland, that the exemption of the schoolmasters of the national schools from military service should be withdrawn, and that they should be specially trained and receive military instruction, that they might drill, and give military instruction, up to the secondary and the superior schools, so as to prepare youths for service as officers. If, however, we were to have no wars, if we were a nation of Quakers, it was well worth having these systematised exercises ininvolved in the military drill on sanitary and economic grounds, as means for promoting the bodily aptitudes to manual labour, and augmenting the duration of working ability and production. Indeed, when visiting Yorkshire some time ago, he found that the Quakers, at their school or college at Ackworth, had adopted these views. The children were drilled by a sergeant, who had become a Friend, and who now and then went to Woolwich to keep himself up with the age, and collect new exercises. Being curious how the military terminology was avoided, he (Mr. Chadwick) found it was done by numbering the movements. But how did they get rid of the word "march?" Thou shalt hear. "Forward, friends," was the command. "Halt" was the only military word they had not got rid of.

Mr. Forster inquired whether the military drill in the national schools in Switzerland was compulsory?

Mr. Chadwick said one statistical authority had represented that it was so; but this, if it were intended as a general system, was a mistake. It differed in the different cantons, and was generally voluntary, and began at eight years of age.

Mr. Forster asked how it was in Holland?

Mr. Chadwick stated that it had been there introduced into the secondary schools, and was found to answer so well that it was now proposed to introduce it into the primary schools. The very extracts from the evidence now submitted to him (Mr. Forster) had already been copied in the United States, and had already been acted upon there, and also in some of the provinces in Canada, and state grants had been voted for the purpose.

Mr. Forster—The case for drill has been very fully stated.

Captain Phipps and Mr. W. S. Fitzwilliam referred to the good effect which had been produced on board the training ships by drill.

The Rev. Canon Cromwell said drill was a very important element in the discipline of training colleges as well as in schools. During the 15 years he had to do with such colleges, the drill-teacher had been found of great service. He had often noticed that it was the only physical exercise which many of the young men took. They had annually to submit a balance-sheet of all their expenditure, and hitherto the drill-master's salary had not been included, but he hoped Mr. Forster would kindly consider the propriety of allowing the cost of a drill-instructor in future.

Mr. Hyde Clarke observed, with respect to drill, that it was a system which had resulted from the study of full a century, amongst all European nations.

Sir John Pakington, Bart., M.P., said, before Mr. Forster replied, and before he brought forward the subject of music, with which he was officially charged, he had something to say on the question of drill. With regard to the question of drill, they had had the expression of opinion from several gentlemen who viewed the subject from different points. Mr. Tufnell had referred to the effect of drill in the great pauper schools of London and its immediate neighbourhood, where vast bodies of children were collected together. Canon Cromwell had spoken of training colleges of a higher class, and gallant officers had referred most favourably to those institutions in which drill was already introduced. But what he wished to press upon Mr. Forster was, to consider whether or not these advantages might not be extended far beyond this narrow area, so that all schools might enjoy the same advantages. He was convinced that the effect of teaching drill would be of the greatest physical advantage to the children themselves, and of the greatest national advantage, especially if they considered the subject upon which public attention was, at the present time, particularly directly fixed—that of national defence. He could speak as a witness of the system adopted in Switzerland. He had never been there without seeing the schools, and he had often met the school children taking their walks in the neighbourhood of Basle and Zurich. The little ones marched with as military an air as the Guards in Hyde-park. These boys were not only taught their drill, but all the elementary portion of the duties of a soldier; and he hoped the government would come round to the opinion that they could not do better than to teach children drill, if it were only to make them far more apt than they were now to receive military instruction later in life. He, however, did not rely on the military aspect of the question alone. Having said so much upon drill, he had, in the next place, to speak on the second branch of his subject, namely, the musical education of the children. Now, as regards music and singing, which they were desirous of having introduced into all schools, there were several present who could speak of the excellent military music which could be heard in the schools of London. But apart from any military advantages conferred in teaching music, it would, on many other grounds, be desirable to teach music so as to improve the British character; and amongst the humbler classes it would have the effect of refining the feelings and improving the taste. The art of singing was one of the most enjoyable a child could possess, not only from a religious point of view, but from many other points. It was desirable that singing should be taught. And now that they had what they might call a national system of education, he did hope that the government would feel that by the adoption of the suggestions made, a great additional advantage would be conferred upon the children of this country by making it, at least, compulsory in all the elementary schools.

Mr. Tufnell said, in the schools under his charge, music, both instrumental and vocal, had been adopted. The children in all these schools not only sang, but carried out the musical part of the services in the church. There appeared to be a strong tendency to cultivate instrumental music; and the schools under his inspection were now supplying the bands of all the regiments with music boys. They had a difficulty before in finding places for boys; but now they had been set to play, the result was that that they could not supply boys fast enough for the demand. He was aware of the advantages which would result from the adoption of music teaching in the schools some time before he could get the Poor-law Board to allow it; but the President of the Board, when he saw the actual result of the system, not only allowed the expenses of the drill-master, but also the band-master as well. They always insisted that one of the masters should be a good vocalist, so as to be able to teach singing and to play the organ. The result was that every pupil-teacher was able to play the organ before he left the school.

Mr. Edwin Chadwick said that the idea of teaching music in schools was by no means a modern innovation. A document had been discovered in the handwriting of Thomas Cromwell, giving a system of education approved by Henry the Eighth, and which contained directions for the teaching of music.

The Rev. Canon Cromwell said there was such a demand for masters who could teach music at the present time, that one of lower attainments in other respects was preferred to a man who had no musical knowledge.

Mr. J. F. Puttick spoke of the progress made in those schools where music was taught, as compared to those where it was omitted, and suggested the importance of the government putting forth a system in which music should be taught.

Mr. Forster said he was very glad indeed to have met the deputation upon both the subjects which had been the topic of conversation. Any subject which the Society of Arts brought before Lord De Grey or himself with regard to education would receive, as it would deserve, the greatest possible attention. He was very well aware of the great help to the cause of education given by that Society, and the extent to which it had gone in promoting the national measure which had recently been passed. He was conscious of the obligation due to Sir J. Pakington and others in the House of Commons, who might be said to have had as much to do with the measure almost as he himself, and to whom it would be both foolish and ungrateful not to pay the greatest possible deference to what they said. There was no doubt whatever of the advantage of teaching both drill and music in the schools. No one would deny that, and the advantages which would result therefrom, especially from drill. There was one way in which drill was used which had not been alluded to by any speaker, and that was the drill of infants in infant schools. They must have all seen that it would be impossible for the mistress to get on at all with instruction without drill; and there was no doubt that drill in schools where older scholars received instruction was equally valuable. He himself had been a pupil at a Quaker school where drill was taught, and the master came in the wicked uniform, and gave the word of command in military form. Still, however, it did not altogether do away with their boyish energy, but left plenty of room for indulging in mischief. The question, however, was hardly whether the teaching of these things was good, but what they should do in enforcing their being learnt; for they must draw a line between enforcing them and giving facilities for their being taught. There was, to begin with, a great difference between the manner in which the questions would be received. Drill was scarcely a matter upon which there would be a difference of opinion; but it was not so with music. They were, moreover, in a similar position to the Chancellor of the Exchequer when he had no surplus, and a great many people wanted taxes taken off. In the primary schools there was scarcely any surplus of time, after devoting an adequate portion to reading, writing, and ciphering. He did not mean to say these subjects were not better learnt if combined with others, but the making them compulsory was difficult; the giving of facility for them was quite different. In those schools to which Mr. Tufnell had referred, the full time of the poor children was at the service of the schoolmasters. That was some compensation for their being paupers. The suggestion made by Canon Cromwell with regard to training schools was most practical, and he should take care that it was fully considered. He had no objection to state that they were condsidering how far it would be possible to give facilities, or to enable drill to be practised in the schools. He did not think that in this they could run much in advance of public opinion, and he did not think it would be very wise to rely much on the purely military aspect of the question. The advantages which would accrue in other respects ought not to be lost sight of or treated lightly. He had never been taught music—and he much regretted it—or possibly he would have more harmony in his soul. There, again, the same difficulty as to time arose. A very influential deputation had waited upon them to urge the teaching of science in schools, and possibly others would want drawing taught, but then they had no surplus of time at present with which to deal with these subjects. He would be glad to have any practical suggestion on the question of music; there was no dispute on the mode of drill, but there was with regard to music, so that, as soon as any programme on any system was drawn up, it would be sure to meet with opposition from those who adopted some other system. However they would be glad to have any practical suggestion made to them, and he thanked the deputation for waiting upon him.

The interview then terminated.

SCHOOL DRILL AND MILITARY INSTRUCTION IN SWITZERLAND.

In a recent article on this subject, the *Echo*, after referring to the reception of the deputation, says:—

"The War Department of Switzerland is meditating an advance upon what these educational reformers have proposed for England. Here, the general instruction in drill is suggested for all rate-aided and State-aided primary schools; there, it is now proposed that military instruction shall be extended to the secondary and the superior schools. And this, it is considered, may be done without injurious interference with the studies and training preparatory for civil service. They are to go hand-in-hand together, each helping the other. Here, in all the schools, the military training is very much confined to drills within the school-yard. There, it is proposed that the bigger boys in the secondary and superior schools should be taken out into the country, and in the open instructed in outpost and skirmishing duties. Would not our lads like this—those especially who are 'dunces at syntax, but dabs at taw?' Would it not be physically good for them to have fine weather excursions with an object, in the free air of such commons as those of Surrey? The Swiss military authorities propose that their youth shall be instructed in geography in the open, and practised in taking field sketches. This is good exercise in drawing for the hand and eye—good, too, as a pleasure, and valuable as a qualification for many civil purposes—for civil engineering or for land surveying. The Swiss War authorities say they would not add to the time occupied in schools, nor detract from civil studies. Might they not have added that they would greatly improve upon the ordinary routine, which does nothing for the physical man? They refer to the need of keeping bodily and mental training going on together, as a fundamental principle recognised completely in Switzerland. Here, we are only beginning to look at it. In the land of Pestalozzi, one of the foremost educationalists of this century, where his precepts are followed out in the infant schools, and in the primary schools a lad has his primary instruction completed before his eleventh year, and is passed well through his secondary instruction by his thirteenth year; he will, by his sixteenth or seventeenth year, have completed those preparatory studies qualifying for the service of a commissioned officer of the scientific corps—and all must now have science to wield the new weapons which science gives—by the time they are usually begun in this country.

"If the primary instruction, with the military drill given in some half-time schools in the metropolis, were followed up by such good secondary instruction as is now given in the City of London Middle-class School, or the Birkbeck School, the same results would be obtained in England, at an immensely reduced cost in time as well as in money. To keep the youth of the country well up in their exercises, the Swiss army authorities propose that they shall, after leaving school, be obliged to have fifteen half-days' exercise in each year, before final enrolment as qualified soldiers. Would not our lads of the desk, or the counter, the workbench, the loom, or the plough, like their employers to be obliged to let them go on these half-holidays to meet their comrades of the school for a field-day with them? Would not such a regulation be hailed here as "jolly?" Here, in the district half-time schools, where military drill and training have been systematically introduced, even before it was adopted in the schools of Switzerland and Holland, it was at the time a necessity to have these exercises conducted by drill corporals and sergeants. But now, in Switzerland, the military authorities are proposing that the exemption of the schoolmaster from military service shall be withdrawn, that he shall be drilled himself, and receive special military instruction, in order that he may impart it to his scholars. An independent conclusion to the same effect had been arrived at by educational reformers here, from seeing how well some of the boys, drilled by school teachers, went through their exercises at the school drill review held at the Crystal Palace. And there are good reasons for the change. When the drill is given by the schoolmaster, it enters into all the work of the school, in taking places, changing classes, entering and leaving in order; it quickens and improves all the work; and it does much to remove the notion that the drill is exclusively useful from a military point of view, and that the defence of the country is external to the duties of citizenship. Besides this, the schoolmaster is, *ex officio*, a more intelligent man, and has greater influence over the boys. 'Turn out *them* toes, you there!' were the words of command at a recent school drill. 'That is bad English, sergeant!' exclaimed a little urchin from the ranks, on whom the soldier looked lashes for the mutinous impertinence, and for the titter it excited. Of course, with the schoolmaster, no such disaster to discipline and solemn decorum could occur. It is to be added that such a measure as that proposed by the Swiss army authorities would, in itself, bring, in the school teachers, a valuable contingent of between twenty and thirty thousand men to a national defensive force.

"Let us, however, look seriously at the wise and broad general policy of the Swiss War Department, and commend it to our own in concentrating military instruction as much as possible on the non-productive school stages of life. On their system they aver they have accomplished in weeks what nations with standing armies occupy years in doing. The training of a school-teacher in Switzerland occupies usually three years. 'Let six or eight weeks be added for military instruction, and the sacrifice of time demanded,' says a great Swiss military authority, 'is by no means heavy.' About four weeks are now occupied with military exercises by the adults. The Swiss War Department is now likely to require two weeks more. Six weeks is what they demand as sufficing, on the basis of early school training, to get what Sir John Burgoyne cries out for in England—'a manœuvring field force.'"

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

As already announced, the Council in aid of this object will give six concerts in the Albert Hall, and a guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed, announced in last week's *Journal*, was £2,352 10s.

The following gentlemen have since guaranteed the amount set opposite their names respectively:—

	£	s.		£	s.
James Ellis, M.D.	10	0	A. M. Silber......	10	10
W. S. Fitzwilliam	10	0	C. T. Wilson	10	0
W. Harrison (Highbury)..........	25	0			

The number of tickets taken, as announced in last *Journal*, 272.

S. James Ainsley......	2	T. V. Lister..........	1
W. H. Biss	2	George Tyler	3
Thomas Fisher	2	W. T. S. Oakes	2
W. S. Fitzwilliam	2	Major Pratt	4
W. Gwynn	2	C. Richardson	3
W. Harrison (Highbury)	2	Rear-Admiral Ryder ..	1
G. M. Kiell	2	Griffiths Smith	2
R. Lewis	3	C. T. Wilson	3

The first concert will be given on April 12th, and it will be the first public performance in the hall after the opening ceremonial by Her Majesty the Queen. The dates of the other Concerts are April 19th, July 5th, 12th, 19th, and 26th.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

A subscription of one guinea entitles a member of the Society of Arts to a transferable numbered and reserved seat at each of the six concerts.

CANTOR LECTURES.

The second course of Cantor Lectures for the session will be delivered by Dr. CRACE CALVERT, F.R.S., and will treat of "Dyes and Dye-stuffs other than Aniline." The course will consist of five lectures, and will commence on TUESDAY evening, the 7th of February, and be continued the subsequent Tuesday evenings till completed. These lectures are open to members, each of whom has the privilege of admitting two friends to each lecture.

INSTITUTION.

The following Institution has been received into Union since the last announcement:—

Leicester, Working Men's College.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

Official Catalogues.—Her Majesty's Commissioners have entered into arrangements with Messrs. J. M. Johnson and Sons, of Castle-street, Holborn, for the printing and publishing of the official catalogues.

Pottery.—The Committee of Selection will consist of the following:—Lord Lichfield, Mr. C. M. Campbell, Mr. C. Drury Fortnum, Mr. M. D. Hollins, Mr. Alfred Morrison.

Music.—Although her Majesty's Commissioners have not included in their official programme music as one of the fine arts capable of exhibition, or musical instruments as a class, it is yet contemplated to make use of, to the fullest extent, the exceptional facilities that will be afforded in the coming Exhibition for the display of musical execution. The Commissioners, with the view of making this display thoroughly international, have taken steps to secure, if possible, the attendance of the best organists and military bands of the Continent, and have issued a circular to the effect that each foreign country taking part in the Exhibition should be invited to send its most celebrated military band to perform at the International Exhibition, and that a sum of money, at the rate of £5 for each member of the band, not exceeding forty in number, shall be allowed to the band selected by each foreign country. The Commissioners will, also, further provide the members of the bands with free lodgings in barracks, and with soldiers' rations for ten days. Each band so selected will give two performances every day for a week, at times appointed, during the hours the Exhibition will be open to the public. Each foreign country is also invited to send its most celebrated organist to perform on the organ now in course of construction for the Royal Albert Hall, to whom an honorarium of £50 will be allowed. Each organist so selected will give two performances every day for a week, at times appointed, during the hours the Exhibition is open to the public. By this means, the public visiting the Exhibition will have an opportunity of hearing some of the most celebrated Continental organ and other instrumental performances, it may be added, without extra charge, and the capabilities of the grand organ of the Albert Hall will be developed as far as the most talented performers can do so. This instrument, which the builder, Mr. Henry Willis, claims to be the largest in the world, consists of five claviers, the compass of the four manual claviers extending from CC to C in altissimo (in five complete octaves, or 61 notes), and that of the pedale from CCC to G (two octaves and a fifth, or 32 notes). The pedal organ consists of 21 stops—1, double open diapason (wood), 32 ft.; 2, double open diapason (metal), 32 ft.; 3, contra violone (metal), 32 ft.; 4, open diapason (wood), 16 ft.; 5, open diapason (metal), 16 ft.; 6, bourdon (wood), 16 ft.; 7, violone (metal), 16 ft.; 8, great quint (metal), 12 ft.; 9, violoncello (metal), 8 ft.; 10, octave (wood), 8 ft.; 11, quint (metal), 6 ft.; 12, super octave (metal), 4 ft.; 13, furniture, 5 ranks; 14, mixture, 3 ranks; 15, contra posaune (wood), 32 ft.; 16, contra fagotto (wood), 16 ft.; 17, bombarde (metal), 16 ft.; 18, ophicleide (wood), 16, trombone (metal), 16 ft.; 20, fagotto (wood), 8 ft.; 21, clarion (metal), 8 ft. The first, or choir organ, comprises 20 stops—1, violone, 16 ft.; 2, viola da gamba, 8 ft.; 3, dulciana, 8 ft.; 4, lieblich gedact, 8 ft.; 5, open diapason, 8 ft.; 6, vox anglica, 8 ft.; 7, principal (harmonic), 4 ft.: 8, gemshorn, 4 ft.; 9, lieblich flöte, 4 ft.; 10, celestiana, 4 ft.; 11, flageolet, 4 ft.; 12, piccolo (harmonic), 2 ft.; 13, super octave, 2 ft.; 14, mixture, 3 ranks; 15, corni di bassetto, 16 ft.; 16, clarionet, 8 ft.; 17, cor anglais, 8 ft.; 18, oboe, 8 ft.; 19, trompette harmonique, 16 and 8 ft; 20, clarion, 4 ft. All the pipes in this organ are of metal. The effect of wood is imparted by the harmonic construction, and the disadvantage of using wood for small pipes is therefore avoided. The stops numbered 1, 3, 6, 8, 9, 11, 14, and 17 are intended to represent what is called the "echo organ" in some large organs, and in them placed on a fifth clavier. The second great organ contains 25 stops—1, flûte conique, partly harmonic, 16 ft.; 2, contra gamba, 16 ft.; 3, violone, 16 ft.; 4, bourdon, 16 ft.; 5, open diapason, 8 ft.; 6, open diapason, 8 ft.; 7, viola da gamba, 8 ft.; 8, claribel, 8 ft.; 9, flûte harmonique, 8 ft.; 10, flûte à pavilion, 8 ft.; 11, quint, 6 ft.; 12, flûte octaviante harmonique, 4 ft.; 13, viola, 4 ft.; 14, octave, 4 ft.; 15, quinte octaviante, 3 ft.; 16, piccolo harmonique, 2 ft.; 17, super octave, 2 ft.; 18, furniture, 5 ranks; 19, mixture, 5 ranks; 20, contra posaune, 16 ft.; 21, posaune, 8 ft.; 22, trompette harmonique, 16 and 8 ft.; 23, tromba, 8 ft.; 24, clarion harmonique, 8 and 4 ft.; 25, clarion, 4 ft. Of the above stops, only the basses of the bourdon and claribel are of wood. The third, or swell organ, contains 25 stops—1, double diapason, 16 ft.; 2, bourdon, 16 ft.; 3, salcional, 8 ft.; 4, open diapason, 8 ft.; 5, viola da gamba, 8 ft.; 6, flûtes á cheminées, 8 ft.; 7, claribel flute, 8 ft.; 8, quint, 6 ft.; 9, flûte harmonique, 4 ft.; 10, viola, 4 ft.; 11, principal, 4 ft.; 12, quinte octaviente, 3 ft.; 13, super octave, 2 ft.; 14, piccolo harmonique, 2 ft; 15, sesquialter, 5 ranks; 16, mixture, 5 ranks; 17, contra posaune, 16 ft.; 18, contra oboe, 16 ft.; 19, baryton, 16 ft.; 20, voix humaine, 8 ft.; 21, oboe, 8 ft.; 22, cornopean, 8 ft.; 23, tuba major, 8 ft.; 24, tuba, 4 ft.; 25, clarion, 4. Of these stops, only the basses of the bourdon and claribel flute are of wood. The fourth, or solo organ, contains 20 stops—1, contra basso, 16 ft.; 2, flûte á pavilion, 8 ft.; 3, viola d'amore, 8 ft.; 4, flûte harmonique, 8 ft.; 5, claribel flute, 8 ft.; 6, voix celeste, 8 ft.; 7, flûte travesiére, 4 ft.; 8, concert flute, 4 ft.; 9, piccolo harmonique, 2 ft.; 10, cymbale; 11, corno di bassetto, 16 ft; 12, clarionet, 8 ft.; 13, bassoon, 8 ft.; 14, French horn, 8 ft.; 15, ophicléide, 8 ft.; 16, trombone, 8 ft.; 17, oboe, 8 ft.; 18, bombardon, 16 ft.; 19, tuba mirabilis, 8 ft.; 20, tuba clarion, 4 ft. Nos. 11, 12, 13, 14, and 17 are enclosed in a swell box. Couplers:—1, solo sub octave (on itself); 2, solo super octave (on itself); 3, swell sub octave (on itself); 4, swell super octave (on itself); 5, unison solo to great organ; 6, unison swell to great organ; 7, unison choir to great organ; 8, swell to choir; 9, solo to choir; 10, solo to pedals; 11, swell to pedals; 12, great to pedals: 13, choir to pedals; 14, sforzando. A double-acting vertical movement, struck by the heel of either foot, instantly detaches and connects the movement of the pedal organ from all but the bourdon, violone, open diapason (metal), and octave, and also draws and withdraws the pedal coupler to great organ. Eight patent pneumatic combination pistons govern the whole of the stops of each manual organ. These 32 pistons appear immediately below and in front of each clavier, concentrated so as to be at all times within reach of the hands of the performer. Six pedals govern the stops of the pedal organ by means of ventils. Two pedals apply and detach a movement that causes the aforesaid six pedals governing the pedal organ to act also upon the combination movement of the great organ. Six pedals govern and combine in various ways all the other accessories, and thus, by one instantaneous operation of the performer, vary the effect of the whole instrument at once. Two tremulants, governed by pedals (one to the swell, the other to the solo organ), are applied. These tremulants act only upon suitable stops. The sforzando is brought into action by means of a pedal. Two pedals govern the great to pedal coupler. The patent atmospheric contrivance of 1862 for actuating the swell independently of the swell pedals is also applied. The internal metal pipes consist of 5-9ths lamb-stamp commercial tin, and 4-9ths soft lead, and the scales of these, as well as those of the front, are suitable to the proportions of the building. All the front pipes are made of tin 90 and lead 10 in 100 parts, and are burnished and polished in the same manner as those in the best continental organs. The main reservoirs in which the compressed air is forced are placed in a chamber prepared in a clean and dry locality. The feeders supplying the air by steam power are of the most ample size, and constructed to receive their wind from the room above, and not from the locality in which they are placed. To carry out this arrangement (of the highest importance) passages are provided for the wind-shafts to and from the organ to the chamber in which the main reservoirs are placed. The main reservoirs deliver their wind to numerous reservoirs in immediate connection with the pipes.

All objects for exhibition must be delivered at the Exhibition Building, at the entrances specified, on the days named below:—

		Entrances.
Feb. 1 ” 2	Machinery for pottery..	Exhibition-road.
” 3 ” 4	Machinery for woollen and worsted fabrics	Prince Albert's-road.
” 6 ” 7	Scientific inventions	Prince Albert's-road.
” 8 ” 9	Educational works and appliances (except Section E, Results of Teaching, which must be delivered at the house of the Society of Arts)	Royal Albert Hall.
” 10 ” 11	Pottery and raw materials	Exhibition-road.
” 13 ” 14	Woollen and worsted fabrics and raw materials	Royal Albert Hall.
” 15 ” 16	Sculpture not applied to works of utility	Prince Albert's-road.
” 17	Painting applied to works of utility	Prince Albert's-road.
” 18 ” 20	Sculpture applied to works of utility	Prince Albert's-road.
” 21	Engraving, lithography, photography, &c.	Royal Albert Hall.
” 22	Architectural designs, drawings, and models	Royal Albert Hall.
” 23	Tapestries, carpets, embroideries, &c.	Prince Albert's-road.
” 24	Designs for all kinds of decorative manufactures	Royal Albert Hall.
” 25	Copies of pictures, mosaics, enamels, &c.	Prince Albert's-road.
” 27 ” 28	Painting not applied to works of utility	Prince Albert's-road.

EDUCATIONAL NOTES.

The London School Board.—At the meeting of the Board on Wednesday, the arrangements for collecting returns from the elementary schools of the district were settled. All elementary schools, private as well as public, will be included in which the ordinary fee does not exceed 9d. per week. In schools where some scholars pay more and some less than 9d., all those paying 9d. and under are to be returned. Of course, all free, ragged, and industrial schools are to be included in the inquiry. After considerable discussion, a committee was appointed to consider the propriety of putting into operation such of the clauses of the Elementary Act as relate to industrial schools, and also how far Mr. Evelyn Denison's Act and the Workshops' Act were at present in operation within the metropolis, and whether they could not be more generally enforced by the action of the Board or otherwise.

The Endowed Schools Commission and School Exhibitions.—A paper has been drawn up by a member of the above commission, respecting the probable bearing of the Endowed Schools Act upon national schools, and has been submitted for consideration to the Standing Committee of the National Union of Elementary Teachers. The writer assumes that it is very desirable, in the interests of the public, that children of more than ordinary ability should be enabled to obtain higher education than that of the primary schools, whenever their parents are prepared to forego the wages which might otherwise be earned in the time. At any rate (he says) the policy of the Endowed Schools Commissioners is founded on this assumption. They believe that endowments could not be more wisely used than in facilitating access to the highest education which children in any class have the leisure to acquire and the ability to use. Accordingly, they propose to abolish the system of indiscriminate free education, and to substitute for it a plan of graduated exhibitions, by means of which scholars who evince sufficient merit may obtain gratuitous instruction in schools of the third, the second, and the first grade, and so be enabled, if they desire it, to proceed to the Universities. The writer allows that this system may, to some extent, work unfavourably as regards elementary schools, by drawing away their most promising scholars at a comparatively early age, and by diminishing in some degree the number of suitable candidates for pupil teachership. "It is to be hoped, however," he proceeds, "that these considerations will be outweighed by others of not less significance. The fact that there are four or five pupils in a school competing in an examination in which the prize is not money, but simply the boon of a more advanced education, cannot be without its influence on the public opinion of the school, and especially on the estimate formed by both parents and children of the worth of knowledge; and the fact that in a given school the pupils were often successful would add greatly to the repute of its teacher, and would probably attract into it a greater number of hopeful scholars than would be withdrawn by reason of the exhibitions. Moreover, a candidate for pupil-teachership, when approved by the managers, has before him a better career than the ordinary holder of an exhibition; for he is not only to receive special instruction and professional preparation during five years, but is also entitled to an increasing stipend throughout the whole of that time." After pointing out that the number of exhibitions obtainable, especially in endowed day schools of a higher kind, will not be uniform throughout the country, but will depend largely on the value and distribution of the local endowments, the writer asks (on the hypothesis that such exhibitions may in some places be very numerous) what estimate the above-named committee may form of the probable per-centage of scholars in an average primary school who are likely to be found intellectually qualified for such exhibitions, and who would be permitted by their parents to make use of them so as to pursue their instruction to or beyond the age of 15 in a superior school. The means by which the selection can be best made are then referred to at considerable length, involving many questions of detail; and, in conclusion, the writer, in inviting the opinions of the committee, points out that for the working of the great experiment which the Commissioners are now about to make, it is highly important that there should be complete and friendly interaction among the primary schools and those of higher grades.

Large v. Small Schools.—Mr. Edwin Pears, the secretary of the Social Science Association, in a paper "On the Metropolitan School Board and its Work," draws attention to the advantages of large schools as compared with small ones. He points out that "such schools are likely to give much more efficient teaching. The teacher in the small school will be but a superintendent of inefficient pupil-teachers or monitors; the large school may be supplied by an efficient master with a well-paid staff of assistants; and thus each child may be, during every portion of the school hours, under the direct instruction of a competent teacher. The large school system will be cheaper for the State, as well as for the parents and managers. It will, moreover, improve the social condition of the teacher. As is the schoolmaster, so is the school. Secure the efficiency of the first, and that of the second will come of itself. Hitherto the greatest drawback to the profession of schoolmaster, that which has made its best men leave it whenever they had a chance, has been that a man had no possible opportunity of promotion in it. Large schools will necessitate gradations of rank, with progressive salaries. They will do much to lift the profession of teaching from the dead, dreary level which it at present occupies, and will give the country the services of a body of teachers made doubly efficient by the prospect of promotion. It has been objected that the denominational system unnecessarily multiplies the number of schools, and the objection has a certain weight. But I believe that when the increased efficiency and the diminished cost of teaching children in large schools become generally known, the clergy will be prepared to adopt the expedient suggested. Five or six clergymen, of as many parishes, may determine that the whole of their children shall be massed together and re-arranged into classes. Each of the existing school-houses would, under such a system of amalgamation, become the room for one class only of a large union. Supposing five national schools thus united together, then instead of having five masters, each superintending four or five classes conducted by incompetent assistants, we should have five classes, over each of which there might be a teacher with an assistant to help him. The arrangement suggested, of having one schoolroom for one class, and another altogether removed for another class of the same school, is one which is in existence in Germany and Scandinavia, where it is found to work well. Obviously, with the largest and most closely packed population in the world, there is no place where school amalgamation of this kind can be tried under such favourable circumstances as in London."

CORRESPONDENCE.

THEORIES OF COLOUR.

Sir,—Your correspondent, "W. G. Herdman," is, I venture to think, not much posted in the teachings of modern science under this head, or he would hardly have made it a matter of complaint against Mr. Barff that he gave no arguments or facts "in support of his statement in reference to what are now considered the three primary colours." Mr. Barff very properly took this for granted as generally admitted by men of science. Mr. Herdman would seem to be unaware of the writings of Herschel, Stokes, Clerk Maxwell, and the teachings of Tyndall, which all go to confirm Mr. Barff's statement. Indeed, this view is now taught by all our leading physicists. The experiments of Clerk Maxwell, as detailed in his paper before the Royal Society, are of a very convincing character, and well worthy of consideration by Mr. Herdman.—I am, &c.,

Nemo.

Sir,—The public in general, and artists in particular, are, unfortunately, so little acquainted with the sciences of light and colour, that one is not surprised to find again and again brought forward, in different forms, the loose speculations of the ancient philosophers, who endeavoured to account for the variety of colours by incomprehensible mixtures of light and darkness—light seen through darkness, or darkness seen through light. Few dare, like the courageous "Parallax," to defy our astronomers and geographers; but any one feels himself at liberty to promulgate a theory of colour, though, in fact, the truth of nature has been perfectly demonstrated on this subject, as well as about the form and motion of the earth.

If your correspondent, in the *Journal* of the 20th January, would make himself master of what modern science has ascertained, he would no longer think that the blue of the mid-day sky is "nothing more than a mixture of the light and darkness of nature," or that "all colours have their source in the two elements of light and darkness," which he too rashly asserts is "the only true theory of colour," and the only one "that can be entertained." Let him ask Sir John Herschel (in his "Familiar Lectures"), or any one who understands the matter, and he will soon perceive how defective and indefensible such notions are. They were, in fact, refuted more than two centuries ago, when Newton showed that the white light of the sun is a mixture of innumerable kinds of light, all differently refrangible, and distinguished by the peculiar sensations of colour which they excite in the eye, as exhibited in the prismatic spectrum; and that the colours of all objects, sky and earth included, are simply due to the kinds of light which those objects send to the eye.

But if Newton's great discovery about colours is not so generally understood as it should be, much less is it known that only recently, both in England and on the continent, the series of prismatic colours, the constituents of all the colours in nature, have been accurately examined; and that it has been distinctly shown that all of them can be imitated by mixtures of the best prismatic red, green, and blue, near the beginning, middle, and end of the spectrum, and by them alone. This being so, it is evident that all colours in nature can be so produced, and that in the prismatic red, green, and blue, we have the nearest approach that can be made to three simple, elementary, or primary colour-sensations.

Nor need your correspondent doubt that facts and arguments have been abundantly given in corroboration of this doctrine, strange as it may seem to him. It is easy, for instance, to show by many direct experiments, that green is not produced by the real mixture of yellow and blue, and to explain why, nevertheless, that colour is given by the mixture of yellow and blue pigments over white, or the superposition of yellow and greenish blue glasses. It is easy, again, to show that the best yellow includes the sensations of red and green as strongly as white does, and only wants the sensation of blue to make white.*

These, and many such, are beautiful and interesting truths, calculated to be of great use to all who have to do with colour in art, for harmony depends on the real relations of colours; but those who have hitherto thoughtlessly accepted the nonsensical and useless theories that still too much prevail among artists, should take care to study the matter with unprejudiced minds.—I am, &c.,

W. Benson.

NOTICES OF PUBLICATIONS.

The Schools for the People, by G. C. T. Bartley, Examiner, Science and Art Department, published by *Bell and Daldy*. The readers of the *Journal* will, doubtless, remember the publication last year of several articles on industrial and other schools. The publishing capacities of the *Journal* were, however, not sufficiently great to enable the author of them to complete the series, as he had wished and intended, and he has accordingly brought it out in one book under the above title. The origin of these articles, and the motive of their preparation, may be gathered from the preface. Mr. Bartley says that "the issue of this volume on the subject of education, at a time when the topic has been discussed by so many great authorities, requires perhaps an explanation as to how it originated, and the motives which led to its preparation. Having been engaged under the Science and Art Department for eleven years, the subject of schools, their history and development, had constantly come before his notice in the course of his official duties. In not a few instances has it happened that he had experienced difficulty in arriving at facts bearing on the general relation of schools of different descriptions with the educational system of the country. As a matter of private study, and quite apart from his official work, he had become much interested in the subject of pauper children, and the modes which exist for their improvement. He was thus led to consider the working of workhouse, district, industrial, ragged, reformatory, and such like schools. One branch led on to another, and the complete history of education in England during the last three hundred years seemed so interesting and instructive that he commenced a series of articles on the rise and progress of the chief descriptions of schools." Some of these articles appeared as stated and they are now reprinted with others, and afford a complete account of the history, development, and working of each description of English school for the industrial and poorer classes: Elementary schools in connection with the Committee of Council on Education, such as national, British, and denominational schools; schools in connection with the Science and Art Department of the Committee of of Council on Education; schools under the direction of the Lords Commissioners of the Admiralty, such as training ships for the royal navy and schools on board Her Majesty's ships; schools under the direction of the Secretary of State for War; certified industrial schools; certified reformatory schools; workhouse schools; district schools; schools for idiots and imbeciles; and schools not aided by public grants, such as cathedral schools, parochial charity schools, Sunday schools, ragged schools, dame schools, private adventure schools, &c. The value of the information contained in this volume to the school boards and educational organisations throughout the country, may be gathered by a reference to the articles we have referred to as being already published; and its usefulness is much increased by a copious index of every subject touched upon. The work is largely illustrated with wood engravings.

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* In the last paragraph of the report of Mr. Barff's first lecture which Mr. Herdman refers to, I observe that yellow is omitted to be mentioned along with sea-green and pink as the third secondary colour, complementary to the primary blue.

GENERAL NOTES.

Society for the Encouragement of the Fine Arts.—This society held the first conversazione of the season, at the Gallery of British Artists, on January 19th. Vocal and instrumental performances took place, and Dr. Heineman made a statement as to the programme for the session.

The Suez Canal and Shipping.—Mr. Charles Turner, M.P., the Chairman of the British Shipowners' Company, in the course of his remarks, alluded to the effect the success of the Suez Canal was having upon shipping. He said that undoubtedly much of the trade to the East was passing into the hands of steam-owners, who, through the short passage by the canal, were enabled to offer superior advantages to shippers, though coal, iron, and beer would still be exported by long sea.

Cheese Factories for Wigtonshire.—A meeting was held in the Town Hall, Stranraer, on Friday, the 5th January, to discuss the advisability of establishing cheese factories in the county on the American system, and a committee was appointed to inquire into the details regarding the management of the Derbyshire cheese factories, and to report at a future meeting.

Inspection of Mines.—Among other news, the Melbourne papers inform us that a Bill has been introduced by the colonial government for the regulation and inspection of mines. It is proposed to provide that the mere occurrence of an accident in a mine shall be held to be *primâ facie* evidence of neglect on the part of the proprietors, and that the onus of disproving neglect shall rest upon them. To this the *Pall Mall Gazette* adds:—"We should probably have fewer mining and railway accidents in this country if a similar principle were adopted in our domestic legislation. It is certainly worth considering whether some modification of the old principle of deodands could not be introduced to meet such cases."

Coral in Italy.—On the coast of Palmi, in Calabria, a coral reef has been discovered. The Calabrian sailors have fished up a large quantity. But now three boats from Torre del Greco have arrived, which were equipped expressly to send there, and are doing extremely well. This coral is of a rose colour, and of good quality, and pieces of extraordinary size are extracted. The place where the fishing takes place is rather inconvenient, as when the wind blows, and the sea is agitated, the current of the channel renders the efforts of the fishers almost impossible. On the contrary, however, in fair weather the fishing is most easy. If this first discovery should be followed by others on this coast, everyone will see the great advantage which the Calabrian sailors and the bold fishers of Torre del Greco will derive from it.

Indian Tea Cultivation.—Dr. Archibald Campbell writes as follows:—"I have the pleasure to send you a memorandum on the tea statistics of Lower Bengal, for last year. It shows a total export of more than 11,000,000 lbs., being nearly 3,000,000 lbs. increase over the previous year. For the present year, even at the same rate of increase, we may reckon on 15,000,000 lbs. as the amount of export. To this, for all India, has to be added the produce of Kumaon, Dhera, Dhoon, Kangra, and the Neilgherries. For Darjeeling, the memorandum gives the produce for 1869 only. For this year it may, I believe, be reckoned at more than double. In 1862, when the Indian teas were first exhibited in London, the total produce was reckoned at 2,000,000 lbs. only, so that the steady increase may be considered satisfactory. There is no doubt, I believe, of the great future that is in store for Indian teas, not only in England, as their excellent quality and perfect purity become better known, but in all the extensive tea-consuming countries north of the Himalayas, when the Indian government takes real pains to procure safe and easier transit in that direction. In Assam, there are 290 plantations, containing 29,350 acres under tea, which produced last year 435,772 lbs. of tea. In Darjeeling, there are 44 gardens, having a cultivated area of 10,067 acres, which yielded 851,549 lbs. of tea in 1869. In Sylhet, there are 22 gardens, having 2,240 acres cultivated, which produced 239,909 lbs. In Cachar, there are 118 plantations, and 24.374 acres under plant; the produce last year was 4,009,832 lbs. of tea. The other districts, such as Dacca, Chittagong, Hazareebagh, and Lohardugah, contain only a few gardens, and have not furnished proper statistics. There are but few imported coolies in Sylhet and Darjeeling, but in Assam there were 21,667, but the returns are not satisfactory. Cachar had 14,776 labourers under contract, and 15,000 time-expired men. About 200,000 rs. was remitted to Cachar during the year. The quantity of tea exported from Calcutta was 18,434,000 lbs., against 8,789,344 lbs. the previous year, showing an increase of 2,644,651 lbs."

Victoria Meat Preserving Company.—It has been pointed out that the concluding remarks of Sir Antonio Brady, the chairman of the ordinary meeting of Jan. 18th, when Mr. Jones read his paper, "How Meat is Preserved," were omitted from the report. They were to the effect that he had never seen or tasted finer samples than those exhibited on the table in the shape of Australian corned beef.

Hospitals as Schools for Women.—Dr. Acland, on the recent opening of a new fever ward in connection with the Radcliffe Infirmary, Oxford, delivered an interesting popular lecture to a large audience, which comprised the artizans employed in the construction of the building and their families. Good air, food, and water, in sufficient amount, were insisted upon as the primary essentials of life. The clothing, fires, and dwellings in use amongst all civilised communities were shown to be comparatively secondary requirements. He insisted on the great value of hospitals as means of instructing women, not only in nursing, but also in cooking for the healthy as well as for the sick—a department of female industry which, despite the cry for woman's work, has hitherto been sadly neglected in this country. Were cooking intelligently and practically taught to the girls and women of the lower and middle classes, the food of the people would be materially economised; it would be rendered greatly more valuable and digestible; comfort and health would hence be increased, whilst a great legitimate field would be secured to women for the prevention, if not for the cure of disease.

Cultivation of Silk in Portugal.—Mr. Consul Crawford, in his report on Land Tenures and Agriculture in Northern Portugal, says the cultivation of silk has, within the last quarter of a century, attained a considerable development in Portugal, and the singular exemption of the silkworm, in the province of Tras-os-Montes, from the disease which has been disastrous to this industry in most parts of the world, and in every other part of Europe, has of late years very greatly stimulated this development. The rearers of silk in France were first to discover that, when the disease was at its height in 1864, the seed procured from Japan and from this province of Portugal were the only two kinds that were free from the taint of disease. Much seed and many cocoons were accordingly exported; and although the exportation of the seed is probably not increasing, for the produce of the native seed is not found to spin so fine a cocoon abroad as in Portugal, that of the cocoons themselves is already very considerable. It has been stated by a French gentleman engaged in the trade to average 7,500 cwt. a year. The silkworm industry here differs in no respect from the same industry pursued elsewhere in Europe, but it is more generally in the hands of small producers. The rearing of silkworms and the production of silk have long been the dream of sanguine political writers in Portugal. The profits seem, at first sight, enormous. A woman can manage the produce of an ounce of seed (costing 1s. 8d. to 2s.), with some little help in the collecting of leaves; the silkworms so produced will consume the leaves of six, eight, or ten trees, according to their size, and give a hundredweight or more of cocoons, yielding nine or ten pounds of raw silk, priced at 16s. per lb.; so that the work of a woman and a child, during little more than a month, should produce over £8 sterling. Though silkworm rearing, from the rapid growth of the mulberry tree in this country, and the suitability of the climate to the silk moth, is likely to be quite as profitable as in the most favoured regions, experience has already shown that the extravagant prospects of gain held out are not to be arrived at. The leaves used in feeding the caterpillar are those of the black mulberry, which attain to almost the dimensions of a forest tree in this climate; no other appears to be used for this purpose than the black species; but within the last ten years many trees of the best French and Italian varieties of the white mulberry have been planted.

Inodorous Paint.—A composition for mixing with white-lead and other colours, to form a paint in lieu of linseed oil, turpentine, and the usual driers, has lately been brought out. The advantages claimed for this vehicle are, it dries very quickly. In less than half an hour after application it is sufficiently dry and hard to receive another coat. It is perfectly inodorous. A room can be used the same day it is painted. It is peculiarly adapted for painting offices, counting-houses, stairs, ships' cabins, and all work where time is an object. It cleans readily, and is not affected by soap or alkalies. It is economical in use, though the composition is in itself necessarily, from the materials employed, dearer than linseed oil. In consequence of the body contained in the composition, three coats of paint mixed with it are equal to four of ordinary paint; and the great saving in the time always lost by workmen in going from one job to another, or waiting until such paint is dry, is more than sufficient compensation for the greater original cost. For example, a street-door, which requires the attendance of a workman on five several days to complete the painting and varnishing, can, by the use of this composition, be painted with four coats and varnished in one day. The material consists of methylated spirit, shellac, and castor-oil, and the composition is patented.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

February 1.—On "The Preservation of Vegetables." By Geo. Buchanan, Esq.

February 8.—On "Ornamentation considered as a 'High Art.'" By Dr. Christopher Dresser, F.L.S.

February 15.—On "The Commerce of India." By Dadabhai Naoroji, Esq. On this evening Sir Bartle Frere, K.C.B., G.C.S.I., will preside.

February 22.—On "Water Meters." By Frederick E. Bodkin, Esq. On this evening John Hick, Esq., M.P., will preside.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal United Service Institute, 8. I. Commander W. Dawson, R.N., "On Offensive Torpedo Warfare." 2. Rear-Admiral A. J. Ryder, "On a Naval Hammock: its Buoyancy, and the use that may be made of it for Saving Life in cases of Collision, &c., at Sea."
Social Science Association, 8. Mr. Rupert Kettle, "On Boards of Conciliation and Arbitration between Employers and Employed, and what is required to give them further success."
Victoria Institute, 8. Rev. J. H. Titcomb, "On Archæology, with some of its Parallels and Contrasts."
London Institution, 4. Prof. Huxley, "On the First Principles of Biology." (Educational Course.)
Medical, 8.
Institute of Actuaries, 7. Mr. Samuel Brown, "On the Mortality of Europeans as compared with that of the Natives of India."

Tues. ...Civil Engineers, 8. Discussion on Mr. Bridges Adams' paper, "Train Resistance on Railways."
Anthropological, 8.
Royal Institution, 3. Dr. Foster, "On Nutrition."

Wed. ...**SOCIETY OF ARTS, 8.** Mr. G. Buchanan, "On the Preservation of Vegetables."
Pharmaceutical, 8.
Royal Society of Literature, 4¼.
Obstetrical, 8.

Thurs...Royal, 8½
Antiquaries, 8½.
Royal Institution, 3. Dr. Odling, "Davy's Discoveries."
Linnæan, 8. Capt. Chimmo, "Natural History of Deep Sea Soundings between Galle and Java."
London Institution, 7½. Mr. F. S. Barff, "On the Action, Nature, and Detection of Poisons."
Chemical, 8
Royal Society Club, 6.

Fri.......Royal United Service Institute, 3. Capt. T. B. Strange, R.A., "On Practical Artillery Instruction."
Royal Institution, 9. Mr. W. Spottiswoode, "Some Experiments on Successive Polarization of Light made by Sir C. Wheatstone."
Geologists' Association, 7½. Annual meeting.
Philological, 8¼.
Archæological Institute, 4.

Sat......Royal Institution, 3. Rev. W. H. Channing, "Laws of Life revealed in History."
Associated Arts Institute, 8¼. Mr. Soden Smith, "Traditional Ornament in Goldsmiths' Work."

Journal of the Society of Arts.

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FRIDAY, FEBRUARY 3, 1871.

PROCEEDINGS OF THE SOCIETY.

NINTH ORDINARY MEETING.

Wednesday, 1st February, 1871; F. A. Abel, Esq., F.R.S., Member of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Armitage, Thomas R., M.D., 33, Cambridge-square, W.
Besant, Walter J., 9, Pall-mall East, S.W.
Brinton, Thomas H., 5, Newcastle-place, Clerkenwell, E.C.

The following candidates were balloted for and duly elected members of the Society:—

Birch, John, 9, John-street, Adelphi, W.C.
Blyth, James Nisbet, 4, Chiswell-street, E.C.
Bowron, John, 14, Churton-street, Pimlico, S.W., and Brooke-house, Trowbridge.
Cooke, Philip, Uxbridge-road, W.
Drinkwater, J. Handforde, Red-hill, Surrey, and Messrs. Carr and Co., 42, Bread-street, E.C.
Fulton, Robert, Saracen-foundery, 84, Upper Thames-street, E.C.
Gibson, John, 13, Great Queen-street, Westminster, S.W.
Hall, C. Hall, 72, Oxford-terrace, W.
Harsant, Frederick May, Linden-villa, Lewisham-park, S.E.
Hesse, Imanuel, Messrs. Loewenthal and Hesse, 11, London-wall, E.C.
Price, Kynaston, 36, Great Ormond-street, W.C.
Rotton, R., 3, Boltons, West Brompton, S.W.
Routh, Chas. H. F., M.D., 52, Montagu-square, W.
Safe, James W., 2, Inverness-road, W.
Soper, Francis L., 146, Adelaide-road, N.W.
Tredcroft, Edward, 3, Morpeth-terrace, Pimlico, S.W.
Vaughan, Rev. D. J., St. Martin's-vicarage, Leicester.
Waugh, John, Derby.

The Paper read was—

ON THE PRESERVATION OF VEGETABLES.

By George Buchanan, Esq.

The subject that I have ventured to take up and introduce to your notice this evening is the preservation of vegetable alimentary substances by a dry cold blast process, or using a current of dry air at the natural temperature.

I find encouragement to submit the matter to your consideration, in the acknowledged interest and solicitude which the Society takes in all things that tend to aid and promote improvement in arts and manufactures; and on this I confess that I found a hope of obtaining, by the stamp of the Society's approval, currency for a new process, that might otherwise share the usual fate of novelties, generally, as Bacon says, "more admired than favoured."

The efficiency of the process, and its economic possibilities, are questions of sufficient importance, I trust, to be accepted in excuse for my trespassing on your time and attention.

The first lessons in the art of preserving vegetable substances for future use were, no doubt, learned from nature's teaching, exemplified by the action of the sun and wind in drying the grass of the field. Early observation probably pointed out that, whilst the sun effected the object by its separate power, the wind failed of the purpose by its sole motion, and hence it would be inferred that heat was the prime operating cause. This conclusion we see shadowed forth by the ancients, in the fable which ascribed the persuasive force to the one but denied it to the other, it being forgotten or unknown that the wind is the child of the sun by the air, and owes its rough and chilling demeanour, as it does its existence, to the great source of heat and drought.

The natural method is observed at work to this day. In haymaking, tobacco gathering, &c., the plants when cut down are left in the field, exposed to the sun, for a day or more, and are then removed to barns and sheds, where there is a free circulation of air. And when the summer fruits are gathered, figs, raisins, and bananas, they are spread out in the sun and air, on osier or bamboo frames, which are taken indoors or covered up from the dew at night.

Attention was next attracted to the great drying efficacy of radiant and reflected heat, and the evident advantage to be derived from applying it soon led to its employment, as is shown by the old habit of housewives at home, drying their sweet herbs on flag-stones, and the practice abroad, of planters using paved floors, and hardened terraces of sand and lime, for curing coffee.

But natural heat not being at all times suitable, or conveniently attainable, recourse was then had to artificial heat for supplementing its shortcomings, and the great capabilities of the latter for general service obviously suggested experiments of a varied kind in the operations of drying and garnering the products of the earth.

How or when artificial heat first came to be employed as a curative agent, the Chinese, possibly, could best inform us, as tea is perhaps the oldest in date of all preserved vegetables, unless we turn to the Hindoos, and suppose their custom of scalding rice, to insure its better keeping, to be of an earlier origin. Rice, however, may be excepted, as ripening of itself into a solid, flinty grain, needing no more than the other cereal grasses artificial means to be employed for ordinary preservation; and the scalding process involves the use of a pot or vessel, which implies some progress in the arts; whilst, on the other hand, the primitive mode of drying tea seems to have been by squeezing it into cakes, and applying the direct heat of bamboo or charcoal fires; a method still followed, with but little variation, by the hop-growers of our own country.

From the open fire to the pot or pan, and thence to the oven or kiln was no wide step, when the need or desire of storing substances of a perishable nature came to be felt; and since nearly all kinds of fruits and vegetables may be preserved by one or other of these means, the spirit of imitation led man to follow in the wake of his father's experience, without much inquiry or change of proceeding.

Preserving processes thus partook of the direction of some of the three ways of cooking, namely, baking, boiling, and roasting. And these modes, either simple or mixed, form the basis of the numerous attempts that have been made to discover a perfect system of curing and preserving.

Amongst the processes may be noticed dipping into boiling water, or into a saline or mucilaginous solution, and hanging up in the sunshine or in a kiln to dry; enclosing in bottles and jars, corked or luted down, immersed in cold water, and then exposed to a boiling temperature; or placing in air-tight vessels, heated in a steam bath; drying on hot plates, or in currents of heated air, and compressing into flat cakes; parboiling, and pouring into the vessels boiling water, melted fat, or jelly; heating the canisters to the boiling-point, and soldering up whilst the air in them is rarified, or hermetically sealing when the steam is blowing off; stoving by heated steam, and raising the temperature in ovens after exhaustion of the air; lastly, using antiseptics, as heated salt, sugar, and vinegar, or other chemicals.

But these attempts have not been successful, for they affect prejudicially the flavour of the preparations, and in articles used for food the flavour constitutes the quality. Heat, we see, is the common characteristic of all the processes, and the quality of all kinds of food is more or less altered by its action. A slight rise of temperature alters the character of the albumen, and doubtless renders it less easy of digestion. Many useful matters, as starch and sugar, are removed by boiling water, and the flavouring essences are taken up by it. A deprivation of the true savour is occasioned, and the preparation acquires a warmed-up flavour, vapid, like dishes that have been re-cooked. Those vegetables in which the saccharine principle predominates, as carrots and parsnips, are found to preserve the best by cooking, but the salts, which are known to constitute a valuable assimilative element in their use, are diffused by exosmose in the liquid that is commonly thrown away when the vessels are opened. Where no water is used, the liquid that is found in the tins is simply a more concentrated solution of the juices and salts, and consequently a like deterioration of the article ensues. Preserves of the soft and bulky vegetables, as cabbage, spinach, and water-cress, have hitherto been failures, and are practically unavailable, valuable as they would be as anti-scorbutics, and for the comfort they would confer at sea. It would, indeed, be difficult to overrate the importance of a sure and economic means of preserving vegetables fresh for use, and convenient for transport to supply the needful wants of man.

Whatever the merits of the treatment adopted under the new process, in principle it is opposed to the use of a high temperature. The time and labour expended in the inquiry have been great, but the experiments have been attended by a favourable result, and much encouragement is given for the opinion that the process can be employed very advantageously in the preparation of fresh vegetables to be stored for food.

When along with Mr. Rodgers, Professor of Toxicology in the London Hospital, I began these investigations, we had been experimenting upon an idea of his for preserving meat for future use without cooking it, and by experience of the effects obtained under certain conditions, the thought was suggested that the method proposed might be even more applicable to the drying of tea and coffee leaves. But no plants from which to get these leaves were within reach, and for experiment sake, it was necessary to take what was nearest at hand, and appeared suitable for the purpose. The savoury herbs presented themselves, recommended by their agreeable odour, and basil, mint, sage, and parsley were chosen for diversity of texture and flavour. Two of these had the further eligibility of being used like tea for infusion.

The problem was, how to keep the fulness of natural flavour and nutritive value, without the aid or addition of any chemicals or foreign matters whatever.

From the repeated failure of heat to accomplish the required end, and the inferiority of the preserved articles to the fresh substances, it was desirable to take a new direction in pursuit of the wished-for discovery. Nature's lessons had evidently been misconstrued, or there was more to be deduced from the action of the sun and wind than was dreamt of in ancient philosophy.

That the hot sun preserved the substance by drying was visible enough, but it was not so perceptible that it injured by evaporating the essence, or changed by exciting fermentation. Nor, on the other hand, was it clear that the cold wind, though it did not dry, preserved by condensing, and did not diminish the flavour.

For instance, in hay-making, we see how a scorching sun dries up the sap, making the grass hard and tasteless as straw, and deficient both in weight and quality; or a close, still day sets up an excessive fermentation of the pent-up juices that often results in sourness; and how warm, breezy weather dries the hay of a good colour without more spontaneous heating than serves to produce the sweet smell, so pleasant in the meadows at the hay-making season. Thus, hay-making must be acknowledged to be a more refined process than it mostly gets credit for, and does not consist in merely expelling the moisture in the shortest possible time from the mown grass. But if this could be practically managed, and the green herbage converted into fodder under cover, or without exposure to the sun, a considerable saving of nutritive matter would be effected; and, as grass is known to be more nourishing than hay (in the opinion of some doubly so), it would, by retaining its properties when dried, be much more valuable for winter food. Again, we are told by persons who have resided in the New England States and Canada, how well vegetables keep in the long, cold winters, covered up in dry sand in cellars and outhouses, and that the meat and poultry, bought frozen as hard as stones, are packed or laid on stone shelves, or the floor over the ice-cellar, until wanted for use, when they are thawed by immersion in a vessel of the coldest water placed in a far corner of the kitchen, and are considered better eating than if they had been freshly killed.

In this interchangeable and mutual action of the sun and wind, therefore, lay the secret of success, and it pointed to some combination of hot and cold, to temper the curative process in any artificial means that might be resorted to. Moreover, it comes home to us personally, as we feel whichever of the two—burning sunshine or cooling breeze—we may prefer, our well-being and comfort are relatively dependent on them both.

The necessity being thus recognised of a low temperature to retain the essence unimpaired, and of a high temperature to keep the substance undecayed, the conflicting principles of the two had to be reconciled, and made to work in unison.

This, as might be expected, is practically arranged in nature's operations. The limits of temperature, from 32° F. on the side of cold, to 60° F. or thereabouts on that of heat, were found to give a range within which vegetable substances retain their flavour whilst giving up their moisture, and fermentation is restrained from interposing.

But the atmospheric changes hinder the uniformity and rapidity of such drying processes as are requisite for fixing the colour and avoiding decay of the texture. The help of art must be called in to the aid of nature, so as by controlling to direct the phenomena of evaporation, and carry on the drying to the best advantage. Evaporation is known to be influenced by the increased dryness of the air, and by its greater velocity, by the larger extent of surface exposed, and by the decreased pressure on the surface. Air naturally contains more or less moisture, and drying power may be conferred upon it either by heating it or abstracting its humidity; the effect of increased dryness in either case, as regards removal of water, is alike, but very different in its result on the vegetable. Recourse was, therefore, had to artificial means, by which to free the air of its moisture, and to mechanical appliances, by which to drive it rapidly along the surface of the matter operated upon, which, in order to expose a large surface, was sliced and disposed in thin layers on stages.

By the process, as described in the letters patent, the substances are deprived of moisture whilst subjected to a carefully regulated low temperature. Air is compressed in a chamber containing material suitable for absorbing moisture, and, so dried, is let into a chamber wherein the substances to be preserved are put. In this chamber the current of cold dry air ascends through and over the substances under treatment, which are spread out and kept moving until they cease to lose weight.

To revert to the herbs. After being prepared by subjection to this treatment, they were tried by a standard of comparison obtained by drying some more of the same kind at a temperature of 100° Fahr. Separate infusions were then made with boiling water, when the superiority of those dried by the cold-blast process was at once apparent, both in the colour and the flavour.

Samples are presented of mint, sage, parsley, marjoram, and other herbs. Seeing in what perfection they can be preserved, it deserves consideration whether we should not, by making a greater use of the savoury herbs than is usual in the kitchen, conduce very much to our health and enjoyment. To their more general and fuller employment in French cookery may be ascribed a good deal of its excelling quality, and the universal relish for seasoning, aptly named, with our food is symptomatic of some want of the digestive function that is supplied by it. Nature has provided the pungent and aromatic condiments for a more useful purpose than a display of profusion, and seems to suit their production to the climate and to the aliment of the people. In tropical countries, we find pepper, ginger, and spices in plenty, to aid the prevailing vegetable diet, and in temperate regions we have the stimulating herbs and seeds to correct the grosser animal food. That the sweet herbs are so little prized is, perhaps, owing to the short time in summer they are to be had in good condition, and the loss of flavour attendant on the imperfect way of drying them in the sun or by fire—objections that are removed by the new mode of preservation.

The issue of the trial with the savoury herbs was the beginning of a series of experiments with the garden or table vegetables, continued until the whole list of them had been gone through, from the portly cabbage to the humble watercress. The result was so successful as to dispel any doubt that an improved way had been found to preserve and economise this perishable and indispensable part of our food supplies. But to justify the adoption of the process as an invention of practical value, the preserved articles had also to be submitted to the test of keeping and cooking.

The first point was determined by putting up a portion of the vegetables in glass jars, and keeping them for a period now of two years. Although there may have been no occasion for this check, as perfect dryness in theory does not allow of decay, it was advisable, in case of doubt being expressed, to make appeal to the assurance of fact. And by perfect dryness is here not meant chemical dryness, but a crisp dryness, such as naturally retains still so much moisture as comports with perfect preservation for an indefinite period, if the air be excluded.

The second point was decided by the old rule *de gustibus non est disputandum.* Everyone who was invited to give an opinion pronounced the soups, stews, &c., made of the preserved vegetables to be excellent, and quite as good as if fresh vegetables had been used. The preserved vegetables were even eaten more than once under the supposition that they were fresh. Samples have also undergone an official trial at the Royal Victoria Victualling-yard, Deptford; and a letter from the Secretary of the Admiralty informs me "that the samples of potato, spinach, cabbage, and onion have been tried, and are so far approved that orders will be given for the trial on board the ships of the Channel squadron." A few were also sent to a relative in Sydney, New South Wales, who wrote in reply, "one and all turned out excellent; no fresh vegetables could be better. I wish we could purchase a good lot to have at hand, they would be invaluable in the bush."

These vegetables are found to cook more easily and in shorter time than the fresh; it might be anticipated they do not altogether resume their original size when cooked, and practice has shown that they are easy of digestion, consequently that a larger amount of vegetable food is taken in a given bulk than when fresh is taken—a fact that may ultimately prove of great advantage.

Here, then, is the solution of the question, how to preserve vegetables with all their strength and freshness of flavour, and without taking from their appearance—a matter of no little moment when to please the eye is one of the first steps to favour. The samples now presented, comprising eighteen different sorts, attest the efficiency of the process, by showing what has been done in a tentative way. As this measure of success has been attained in the preparatory trials, it may be fairly assumed that the matured manufacture will be productive of even better results.

Upon the merits of the process, in an economic sense, it is needless to enlarge, either in respect of the public advantage to be derived from the possession of additional reserves of food, or as regards the private benefit to be obtained from the development of a simple and inexpensive manufacture. It will be enough to remark that the convenience to families of a store of vegetables, providing for the table, at any season of the year, any kind required at a moment's notice, the saving of labour and waste in the kitchens of hotels and eating-houses, the capability of provisioning fleets and garrisons with a variety of palatable and wholesome food; above all, the facility of preventing attacks of scurvy on board the ships of the navy and mercantile marine, are advantages sufficient to form a broad foundation for a new and active industry.

The researches gave an opportunity of noting the amount of moisture in the various herbs and vegetables, and a comprehensive table was formed of the results. This table presents a most interesting exposition of the very large proportion which the liquid bears to the solid constituents of these vegetable substances.

Quantity of Moisture lost by Vegetables and Herbs prepared by the Dry Cold Blast Process.

Name.	Order.	Proportion.		Water.		
		Dry	Fresh			
		ozs.	ozs.	ozs.	gills.	per cent.
Onion	Lilyworts	1	6·78	5·78	1·15	85·25
Leek	,,	1	10·39	9·39	1·87	90·37
Vegetable marrow	Cucurbits	1	12·57	11·57	2·31	92·04
Watercress	Crucifers	1	13·41	12·41	2·48	92·54
Cabbage	,,	1	9·24	8·24	1·64	89·17
Savoy	,,	1	9·88	8·88	1·77	89·86
Cauliflower	,,	1	11·45	10·45	2·08	91·26
Brussels sprouts	,,	1	6·66	5·66	1·13	84·98
Broccoli sprouts	,,	1	6·23	5·23	1·04	83·94
Turnip tops, stripped	,,	1	7·00	6·00	1·2	85·71
,, bulb	,,	1	9·96	8·96	1·79	89·95
Seakale	,,	1	13·14	12·14	2·42	92·39
Rhubarb	Buckwheats	1	22·31	21·31	4·26	95·51
Sorrel	,,	1	18·77	17·77	3·55	94·67
Beet, garden	Chenopods	1	5·47	4·47	·89	81·78
Mangel	,,	1	8·5	7·5	1·5	88·23
Spinach	,,	1	7·93	6·93	1·38	87·38
Green pea	Leguminous	1	3·94	2·94	·58	74·08
Broad beans	,,	1	4·66	3·66	·72	78·54
Kidney bean	,,	1	10·42	9·42	1·88	90·41
Apple	Appleworts	1	6·1	5·1	1·01	83·6
Potato	Nightshades	1	3·28	2·28	·45	69·51
Tomato	,,	1	9·66	8·66	1·73	89·65
Basil	Lubiates	1	8·4	7·4	1·48	88·09
Mint	,,	1	4·75	3·75	·75	78·94
Sage	,,	1	3·25	2·25	·45	69·23
Tarragon	Composites	1	2·67	1·67	·33	62·54
Jerusalem artichoke	,,	1	4·89	3·89	·77	79·55
Lettuce, cos	,,	1	17·5	16·5	3·3	94·28
Celery	Umbellifers	1	11·13	10·13	2·02	91·01
Parsnip	,,	1	3·58	2·58	·51	72·06
Carrot	,,	1	6·1	5·1	1·02	83·6
Parsley	,,	1	5·48	4·48	·87	81·75
Chervil	,,	1	6·66	5·66	1·13	84·98
Mushroom	Fungal	1	12·28	11·28	2·25	91·85

Many people have a vague idea that the food they eat is made up, in a large measure, of water naturally contained in it, but the actual quantity is amongst the things not generally known. To learn of a certainty that in a bunch of hard carrots and turnips, weighing together 10 lbs., when scraped and pared for cooking, there are seven pints of water to 1¼ lbs. of aliment, may well call forth an exclamation of surprise like that of Prince Hal's, "O, monstrous! but one half-pennyworth of bread to this intolerable deal of sack." The coloured sketch illustrates the proportion of liquid and solid matter in a carrot, turnip, and cabbage, the sea of blue surrounding each little island, as it were, represents the watery element in their composition.

To the farmer and market-gardener the table forms a valuable index, showing how little he has to return to the earth, in the shape of fertilisers, to make it reproductive, and how much is supplied to form his crop by the gifts of rain that waters and the dew that moistens his fields. Here we read another of nature's lessons, teaching the intimate connection and dependence upon each other of works of drainage and irrigation, the necessity of collecting and distributing the fruitful showers as well as of drawing off the superfluous moisture, and of arranging these processes so as to go hand-in-hand, if large and heavy crops are to be successfully grown.

It might be supposed that, under the circumstances of the treatment by the dry, cold blast, some of the nutritive elements of the vegetables would be carried off with the moisture; but a careful analysis, made by Mr. Rodgers, has proved that no loss is sustained of the salts described by Liebig and other eminent chemists as being so essential to the health and sustenance of man. The nitrogen values here tabulated fully correspond with estimations of some of the vegetables made independently by Playfair, Boussinghault, and others, and thus there are good grounds for a confident opinion as to the general accuracy of the table. Although the results may, in some instances, appear high, they have been carefully verified. The nitrogen value of the meat being about one-seventh per cent., the nutritive per-centage of any of the vegetables in the dry state is a multiple of its nitrogen value in the table by seven. Not only are the relishing and nourishing properties of the vegetables preserved without injury, but there is reason to think that something of a noxious character is drawn out of them, and got rid of by the process, as the preserved onions, when cooked, seem to have a less acrid flavour, and the water in which the preserved cabbage is boiled has not the offensive smell which is perceived with the fresh. This may open a new door of inquiry in hygiene, for as yet of the chemical nature or composition of these emanations nothing has been ascertained. If contagion is connected with fungoid vegetation, as some think, the infected particles may be eliminated and destroyed by the extraction of the moisture in which they are suspended, and the dried vegetables may thus be rendered more healthful than when in the fresh, succulent state.

QUANTITY OF NITROGEN IN ALIMENTARY SUBSTANCES PREPARED BY THE DRY COLD BLAST PROCESS.

NAME.	ORDER.	ANALYSIS.			
		1	2	3	Average.
Beef	Mammals.	14·19	...	...	...
Mutton	,,	14·38	...	...	14·23
Codfish	Fishes.	13·99	13·75	14·01	13·91
Salmon	,,	10 17	9·93	...	10·05
Flour	Cereals.	2·51	2·15	2·34	2·33
Macaroni	,,	3·16	3·18	...	3·17
Oatmeal	,,	2·51	2 28	2·60	2·46
Asparagus	Lilyworts.	6·89	6·59	...	6·74
Onion	,,	2·20	2·48	2 27	2·31
Leek	,,	4·36	4·33	...	4·34
Vegetable marrow	Cucurbits.	2·32	2·36	...	2·34
Watercress	Crucifers.	7·07	6·72	7 15	6·98
Cabbage	,,	4·26	4·77	5·36	4·79
Savoy	,,	4·62	4·96	4·70	4·76
Cauliflower	,,	5·94	5·76	...	5·85
Brussels sprouts	,,	5·67	5·42	...	5·54
Broccoli sprouts	,,	7 21	7·77	...	7 49
Turnip tops	,,	8·75	8·34	...	8·54
,, bulb	,,	1·85	1·84	...	1·84
Seakale	,,	5·84	6·18	6·20	6·07
Rhubarb	Buckwheats.	3·98	3·90	...	3·94
Sorrel	,,	4·95	5·35	5·12	5·14
Beet, garden	Chenopods.	2·89	2·52	...	2·7
Mangold	,,	1·80	1·92	...	1 86
Spinach	,,	6·50	6·32	...	6·41
Green pea	Leguminous.	4 67	4·68	...	4 67
Broad bean	,,	5·54	5·59	...	5·56
Kidney bean	,,	3·72	3·59	...	3·65
Apple	Appleworts.	·30	·29	...	·29
Potato	Nightshades.	1·27	1·24	...	1·25
Tomato	,,	3·22	3·46	3·51	3·39
Jerusalem artichoke	Composites	1·48	1·52	...	1·5
Lettuce, cos	,,	4·94	4·82	...	4·88
Celery	Umbellifers	2·28	2·08	...	2·18
Parsnip	,,	1·28	1·22	...	1·25
Carrot	,,	1·67	1·69	...	1·68
Mushroom	Fungals.	10·04	10·90	...	10·47

COMPARATIVE TABLE OF THE NUTRITIVE VALUE OF ALIMENTARY SUBSTANCES PREPARED BY THE DRY COLD BLAST PROCESS.

NAME.	DRY OR PRESERVED STATE.	MOIST OR NATURAL STATE.
Beef Mutton } 39 per cent. solids	100·	100·
Codfish	97·75	56·77
Salmon	70·62	85·01
Flour	16·37	41·97
Macaroni	22·27	57·10
Oatmeal	17·28	44·30
Onion	16·23	6·13
Leek	30·49	7·52
Vegetable marrow	16·44	3·35
Watercress	49·05	9·38
Cabbage	33·66	9·34
Savoys	33·45	8·69
Cauliflower	41·11	9·21
Brussels sprouts	38·93	14·99
Broccoli sprouts	52·63	21·67
Turnip tops	60·01	21·98
,, bulbs	12·93	3·33
Seakale	42·65	8·32
Rhubarb	27·68	3·18
Sorrel	36·12	4·93
Beet, garden	18·97	8·86
Mangel	13·07	3·94
Spinach	45·04	14·57
Green pea	32·81	21·8
Broad bean	39·07	21·49
Kidney bean	25·65	6·30
Apple	2·03	0·85
Potato	8·78	6·86
Tomato	23·82	6·32
Jerusalem artichoke	10·54	5·52
Lettuce, cos	34·29	5·02
Celery	15·31	3·52
Parsnip	8·78	6·29
Carrot	11·80	4·96
Mushroom	73·57	15·37

The diminution of weight is not one of the least advantages obtained by the drying process. In the case of cabbage, for instance, out of every ten tons of the fresh vegetables, about nine are simply water contained in the tissues of the plant. In other words, of a commodity of little commercial value and great bulk, nine tons have to be carried, perhaps at considerable cost of transport, and over long distances, for the sake of the one ton of aliment. It is true that cabbage, in an eatable condition, requires a due proportion of water to enter into its composition. This, however, the dried vegetable finds in the cooking utensil, and absorbs what it requires in the process of cooking. But the undried vegetable, if it were capable of being transported at all, must necessarily have the water transported with it.

It is much to have a method, such as has been described, successful in effecting the perfect preservation of the culinary vegetables, it is more to have an improved system of operating on substances of great commercial importance; and the principle of the dry cold blast being admitted, there is reasonable hope of a beneficial result from an extension of the process to articles of general produce.

In tea, the favourite beverage of more than half the world, as in other plants, the natural as apart from the acquired excellence of the leaf is probably influenced by the character of the soil, to a greater extent than by the conditions of light, heat, and humidity, though without doubt a fine season must tell favourably on the crop. But whether the variety of soil and climate is sufficient, with the aid of careful and assiduous cultivation, to account for the three species that are known, is immaterial to the present inquiry, which is concerned with the mode of curing only.

Either green or black tea, it is now understood, can be procured at will from the same plant, the variation depending upon the manner of gathering and preparing the leaf, the young leaves only being employed for green tea. Though one kind more than the other may seem to be the growth of a particular district, its more extended production is probably owing to habit and repute in the manufacturer rather than to selection by the cultivator, the whole of the picking, bud, leaf, and stalk, being available for black tea.

Green is the natural colour, and black, or, correctly speaking, brown, is artificial. In preparing the former, no delay is allowed in the process of drying, whilst with the latter the operation is conducted more slowly. The course of manipulation by beating, tossing, roasting, rolling, and twisting is said to be similar in both cases, though modified in the result. Some green tea is also suspected of being put through a second process, when it is doctored with indigo and gypsum, and perfumed with certain flower blossoms, a sophistication practised to make an imitation of the choicest finely-scented teas.

The great difference between the two modes of cure is, however, supposed to be the spontaneous heating or fermentation that the black tea undergoes, by which its peculiar fragrance is developed, and the brownish colour produced. But the flavour of green tea is stronger and finer, denoting that more of deterioration than development is effected by the change, or that the fermentation is preparatory in each kind, but that it is carried further in the black, possibly to make the tea milder by reducing its astringency.

The freshly-gathered leaves are without fragrance, or any particular odour, and it is doubtful if the application of great heat in roasting brings out the aroma, as in the case of coffee berries. Unless the roasting developes a dormant empyreumatic oil, it must be destructive of some of the odorous and volatile properties of the leaf, the most important to be retained for their grateful and wholesome character.

By an experiment made with fresh leaves obtained from the Royal Botanic Society's Gardens, and dried at a temperature of 100° Fahr., no aroma was produced by infusion in boiling water, or by roasting at 300° Fahr. Nor in another trial with leaves dried at 55° Fahr., and roasted at 455° Fahr., did a heat that fully suffice for coffee berries bring out any aroma in the tea-leaves.

An attempt was then made to develop the aroma by fermentation, but the leaves being old, or autumn leaves, their quantity very limited, and artificial heat being necessary to induce the requisite warmth, the result cannot be considered as experimentally decisive. However, from the change that was noticed, the probability is that the fragrance is referable to fermentation altogether, and that, if it is altered, it is not improved by heat. It is possible that in all scentless and tasteless plants, fermentation is necessary to produce the undeveloped savour, and that those which are naturally ordoriferous are injured in flavour by it. Excess of heat in either case, carbonising the substance, causes the loss of some of the volatile essences.

Celerity would thus appear to be the main object aimed at by the use of heat, and the practice is said to be to slacken the fires as the leaves give up their moisture, the difficulty being to maintain uniformity, and avoid scorching in the operation. The circumstance, too, that the mandarin teas, as the finely-scented tea of the choicest kinds is called, are but slightly fired, and not even thoroughly dried when used, confirms the idea that heat is not necessary in the process of curing.

It can therefore scarcely be a theoretical conclusion to come to, that a method preserving the delicacy of the aroma, and requiring no skilled roasters to secure good drying, would be a desirable improvement. And as tea is said to be conveyed partly cured over long distances in China, to be twisted and finished in Canton and other places, it is not impossible that experience of the dry cold blast process in India would find a way to conduct the curing with a division of labour and management. The operation being stopped at that stage when fermentation has taken place, and when the prepared material is dried, so that it will keep without spoiling on the passage home, the labour of manipulation could be completed here by machinery, when the high, burnt flavour approved of, according to some tea-men, can be given for the gratification of those by whom it is appreciated.

Coffee, which takes no secondary place in the estimation of its votaries, is, perhaps in the spirit of compromise, cultivated only for its fruit; and the curing of the berries by sun-drying is so simple and convenient, that it would scarcely be advisable to change the method, except in those places where, owing to the periodic rains, recourse must be had to fans or stoves, to provide against mustiness. But when the time comes for a move to be made in the importation of the leaves for use like tea, the first inquiry will be for the best process of preserving them.

That the leaves should have been so long neglected as an article of commerce is strange, when we are told that a beverage made from them has long been used by the people in Sumatra, and is considered to be less heating, and more refreshing under exposure to the sun than the infusion of the berry.

The organisation of the existing plantations in the colonies, and their position on the mountain slopes, are favourable to the successful culture of a superior quality of berry. For the leaf, therefore, a special cultivation and manufacture would have to be commenced in the lowlands, where the plant grows luxuriantly, producing both leaves and fruit in abundance.

No country offers a better field for such an undertaking than the southern division of British Burmah, where the lower courses of the rivers lie through fine alluvial plains. The moderate width of the territory makes access to the seaboard easy, and the state of the public health is generally good. But the small peasant proprietors of the country cannot be expected to try experiments, they must wait for the initiative to be taken by English enterprise and capital.

Should the leaves prove to contain, as reported, a larger proportion of cafeine than the berries, and to make an agreeable drink, there can be no question of their exceeding value as an article of diet and trade, and it is very desirable that something should be done definitely to clear up the uncertainty that prevails in the matter. If it would be too much of a venture for private parties to expend labour and money in pioneering the way, it is suggested that it might be advisable for government or this Society to offer a prize to the producer or importer of a good sample of leaves cured in a British possession, and suited for trial in the market of Mincing-lane.

Several years ago, Mr. Ward, of Padang, sent home a sample of roasted leaves, which were described by Mr. Hanbury to be of a deep brown colour and fragrant odour, somewhat like a mixture of coffee and tea. They were prepared in the native fashion, by roasting in the clear flame of a bamboo fire, and then separated from the stems, but of any degree of spontaneous heating or fermentation, like what is brought on in tea, no mention was made.

If one may venture to form an opinion upon the trial of a few leaves grown in the Royal Botanic Society's Gardens, and prepared by drying and roasting in a hot-air bath, at a temperature of 450° Fahr., the odour is not altogether empyreumatic, as with the berry, but partly due to previous fermentation, the mingled coffee-tea smell of Mr. Ward's sample being probably the result of carbonising the fermented leaves.

Hops have, from their conservative character perhaps, undergone but little change in the mode of cure handed down from olden times, the operation of drying being performed by heated air ascending through them from fires kindled beneath the platform on which they are laid. Simple as the plan is, practice cannot overcome its inconveniences, and improvement has been sought in many ways, to avoid the disadvantages of irregularity in the drying, carelessness in the fireman, and absorption of smell from the fuel. The great object is to expel the moisture as quickly as possible, for the sake of reducing the expenses of curing and of preserving the quality of the sample. A temperature of 130° F. is mostly used for this purpose, though it is considered by competent observers that a lower temperature would be preferable, in order to save the aromatic and bitter principles now dissipated by the excess of heat, and thus to increase the strength and value of the hops.

The correctness of this opinion is supported by the Bavarian plan of letting the hops dry in the sun on their poles, and is demonstrated by the result of the old and new processes applied to two parcels from the same farm. On triturating a portion between the hands, the compound flavour that manifests the potency and quality of the hops is found strongest in those prepared by the new process, and the difference between the two parcels is equally marked in their infusions. The yellow colour that brightens one of the parcels, and makes it appear to the eye superior to the other is artificial, being produced by the aid of brimstone in the kiln. That the brewer admires this pale and delicate look in the hops is a fair reason for imparting it, although the blanching encourages bad picking, as it affords the means of dressing up over-ripe and weather-beaten hops to pass muster with the best.

Newly-gathered hops are liable to heat and ferment in warm weather, by which a saccharine principle is evolved; and, when they are heaped thickly on the drying-floors, this action is heightened by the fire. A serious diminution of the chief virtues of the plant ensues from the loss of volatile ingredients, which fly off with the vapour, and which reveal their escape by the sweet smell perceived on the leeward side of an oast at work. This loss can only be prevented by the use of a low temperature in drying.

As every hop-farm has now its oast, which could not well be re-arranged without considerable expense, the application of the new process in the existing buildings would be attended with much difficulty, and the multiplying of many drying places would be a waste of capital. A new method requires a new system, and the great advantages to be obtained by the adoption of the cold-blast process recommend its independent employment on an extended scale. The concentration of the work, now so divided and scattered, into a central drying-house or factory for each district, where the produce of the neighbourhood could be dried and packed for market, would economise labour and management, and, by permitting the growers to devote their undivided attention to the cultivation of the plant, would tend greatly to improvement in the production.

DISCUSSION.

Mr. McPherson said he had listened with the greatest pleasure to the reading of the paper, which embraced the treatment pursued in the preparation of culinary vegetables and aromatic herbs, such as mint, sage, thyme, basil, &c., all of which had long been preserved by simply drying at low degrees of heat, and in the most simple manner. Mr. Buchanan had touched upon the preparation of spinach, cabbage, &c., and justly remarked that any good method of preservation would be invaluable. Now, three distinct conditions were necessary to the successful preservation of vegetables; firstly, the expression of the tannic acid or other bitter existing in the raw material; secondly, drying at a sufficiently low temperature; thirdly, the perfect exclusion of the atmosphere. He thought it would be well to consider if the Chinese or the native Assamese plan of preparing brick-tea could not be copied with advantage, namely, first express the undesirable qualities, and then simultaneously express the moisture and exclude the air by great pressure. This plan offered two distinct problems, the one as to what should be retained, the other as to what should be expelled from any particular vegetable. Culinary herbs, such as mint and sage, might be used either raw or simply dried, because they contained scarcely any undesirable quality; but suppose a plant like the mandioca, for instance, containing a highly undesirable and even poisonous property, in such a case heat is employed, not merely to preserve the keeping properties of the roots, but to dissipate and drive off in vapour the acid and injurious juices. By a judicious employment of heat, and a combination of other simple processes, the poisonous mandioca is converted into that highly nutritious substance known as tapioca. There was very much more to be considered than the degree of temperature necessary to the safe yet complete drying, for although it was perfectly true that a high degree of heat would destroy the volatile oils, and even the nitrogenised constituents of plants, yet, on the other hand, a considerable amount of heat would be necessary to expand the disagreeable juices, and drive them off with the vapour, before the particular vegetable was fit to eat. For instance, a raw cabbage, raw tea leaves, raw coffee leaves, and many others, were decidedly most disagreeable in their raw state, and in his opinion they were very little better when they were simply dried at a low temperature. Tea-leaves dried in blotting paper were utter nastiness, and green tea was very little better. If the juices of the plant were imperfectly expressed in the rolling process, it was little better than senna; but as the heating previous to rolling, and the rolling itself is perfect, so in proportion does green tea lose its bitter and undesirable quality, and he had yet to learn that the expansion and expression of the juices could be accomplished by any other method or means than by a great degree of heat and considerable pressure. As for black teas, they were variously modified by the action of the atmosphere. They undergo various degrees of decay, produced by the action of the variously heated atmosphere. It was unfortunate that old leaves were experimented upon by Mr. Buchanan, for it was just possible that some of their feeding properties were converted into woody fibre, or perhaps returned to the roots.

Mr. J. C. Saunders observed that he did not gather, from Mr. Buchanan's paper, in what way the process which he advocated varied from that which had been employed in France, where a very considerable trade had been done in preserved vegetables.

Mr. Buchanan inquired whether Mr. Saunders had seen the French vegetables.

Mr. Saunders replied that he had done so, and had used them for years.

Mr. Buchanan said that, if those which he had exhibited were looked at, the difference between them and the French preserved vegetables would be at once perceived. The French plan was a hot one, whereas his was a cold one.

The Chairman thought it would be well if Mr. Buchanan gave some outline of his mode of treating the vegetables.

Mr. Buchanan said the matter was quite in its infancy yet, and nothing had been done on a large scale. His plan was simply to drive air, under 60 degrees, over the surface of the vegetables. That might be driven by means of a fan, or any other mode. The vegetables were shred up for the purpose of exposing a large surface, and causing quicker evaporation. To prevent fermentation, the air was either warmed up or cooled down; it was artificially dried by passing it through or over materials which absorbed moisture.

Mr. Saunders understood Mr. Buchanan to claim the preservation of the aromatic principle, which he said was driven off by other processes.

Mr. Imray said that he had had the advantage of seeing Mr. Buchanan's process in operation, and therefore he might perhaps be permitted to make a few observations. In drying the air, Mr. Buchanan passed it over chloride of calcium. Chloride of calcium was very handy, for the reason that when it was quite saturated with moisture, that moisture could readily be removed. The air being so thoroughly dry, had all its moisture taken out, and consequently had a great capacity for taking up fresh moisture. That capacity was easily given to air by heating it, but by Mr. Buchanan's process it was not necessary, because the moisture had been extracted from it. The air thus dried, and kept at a moderate temperature, was passed over the vegetables. As to the effect, he might mention that Mr. Buchanan had kindly given him samples. He had put some spinach, of which he had a sample, upon his table, and had found it greatly superior to fresh spinach. He had also tried onions, and found the seasoning which they made greatly superior to fresh onions. He had also tried various mixtures of celery, carrots, onions, turnips, and so on, as flavouring for stews, and he felt bound to say that nothing could be better. It had been said that there was nothing new or remarkable about the process. He would simply ask them why it had not been done before. He had never seen vegetables so prepared. He had seen cakes of vegetables with a great deal of moisture in them, but he had never seen vegetables which, when put into a heating vessel, opened out, took in moisture, expanded in bulk, and when put upon the table were better than fresh vegetables. Such, however, was the case with Mr. Buchanan's, and he did not think they could avoid giving Mr. Buchanan the credit which was due to him. It was a very great advantage to be able to have in your kitchen fresh vegetables at any season, and to have them in stock in small bulk; this advantage was especially great at sea and in warm climates.

Mr. King said the dessication of vegetables was done by Mr. Edwards in 1840; and he had with him a sample of some of the potatoes so dessicated at as low a temperature as would make the air dry. He thought it would be found that the chloride of calcium process would not answer upon a large scale.

Mr. Rodgers said, with regard to the chloride of calcium process, arrangements were always made for the moisture to run off; and as there must, in any manufactory, be very considerable waste of heat, it could very satisfactorily be employed in re-drying the chloride of calcium. The application of steam to vegetables had long been used, and it had been found that when so dressed, they were much finer than when they were boiled.

The Chairman regarded the subject which Mr. Buchanan had brought before the meeting as one of great interest; and if the process to which Mr. Buchanan had paid much attention, with apparent success, were thoroughly matured, it must be of very considerable importance in many ways. There could be no doubt that to dessicate vegetable substances at a low temperature, as rapidly as possible, was the right principle. He conceived that the employment of such agents as chloride of calcium, and even oil of vitriol, might be carried out satisfactorily upon a considerable scale. It was simply a question of manufacturing development; and vegetables dried at an ordinary temperature must become of great importance, especially in connection with the naval service. Nature had led us to select certain classes of vegetables as those most wholesome and palatable, and thus it was important to keep them as nearly as possible in the condition of nature. They must seek to remove the large bulk of water, which, no doubt, was a great objection in connection with the transport of such materials. He thought Mr. Buchanan had effected what was most desirable in the preservative process, and if such a process could be worked out on a considerable scale, it would be a very great desideratum. The acrid matters could probably be removed from particular vegetables, for instance, the cabbage and the onion. The most acrid matters were the most volatile, and they would at once be carried away by a rapid current of air. He felt much pleasure in asking the meeting to pass a vote of thanks to Mr. Buchanan for his valuable paper.

Sir William Bodkin cordially seconded the motion. He thought the Society of Arts entitled to great credit for the attention which it had given to the important subject of providing cheap and wholesome food for the people of this country. The subject of food having occupied the attention of the Society for a very long time, and a large amount of useful information having been collected, it was quite natural that any analagous subject should receive consideration; and he was quite sure that Mr. Buchanan merited the vote of thanks which had been proposed.

The motion was unanimously adopted.

INDIA COMMITTEE.

A Conference was held on Friday evening, January 27th, Hyde Clarke, Esq., Treasurer to the Society, in the chair. The subject was:—

ON PEAT AND ITS PROFITABLE UTILISATION IN INDIAN LOCOMOTIVES, AND FOR OTHER PURPOSES.

By Lieut.-Colonel Romaine Wragge.

The subject which I have the honour to bring to your notice this evening is one of considerable importance to the railway interests of India at the present moment, when they are suffering greatly from the high price of fuel in that country, coal, coke, and patent fuel being there more than three times as costly as they are in England, which unfortunate circumstance, of course, greatly increases the working expenses of the railways; and consequently, if a cheaper fuel could be provided for consumption on those lines, a much smaller percentage of their gross earnings would be consumed, and greater profits realised.

All the Indian railways are dependant either upon England, Australia, or Labuan for their supplies of coal, &c., with the sole exception of the East Indian Railway, which is provided with collieries of its own at Raneegunge, but, even with this advantage, coal costs that line a very large sum annually in excess of the price which is paid by English railways for that fuel, and these collieries cannot be rendered available for the supply of the other Indian lines owing to the extremely high rate of freight, both by rail and by the coast, round the Peninsula of India, and therefore Indian coal cannot compete with that brought all the way from England or

Australia, although such has to be transported fully 6,000 miles; and from the inferior quality of the Indian as compared with that of English coal, even the steamers leaving Calcutta to go round the Peninsula ~~find~~ it more to their advantage to consume English than Indian coal.

The East Indian Railway and Great Indian Peninsula Railway use respectively Indian and English coal, and their relative consumption is 150 tons of Indian coal as compared with 75 tons of English coal, showing that Indian coals are only capable of doing about one-half the amount of duty performed by English coal.

Attention has, therefore, been drawn to the increased use of wood fuel as an economical substitute for the expensive coal, coke, and patent fuel, and with reference to its more general use I will quote the remarks of Juland Danvers, Esq., Government Director of the Indian Railway Companies, who, when reporting on the "traffic and working" of those lines to the Secretary of State for India in Council, remarks as follows, in paragraphs 59, 60, 61, and 62, for the year 1866-67:—

"59. Various questions connected with the traffic and working of the railways have engaged the attention of the government and the railway companies during the past year. The most prominent were those relating to the supply of fuel; the use of iron or wood for sleepers, and the employment of steel for rails, the formation of roads as feeders, and the rates and fares.

"60. The importance of the fuel question can hardly be exaggerated. Cheap and dear fuel may, in some cases, be almost equivalent to success or failure. It will be seen by the following statement that the high rate of freights from this country at the present time makes the value of coal and coke, before it is landed in India, something like 50s. per ton. When to this is added the landing charges, and the cost of conveyance down the lines, the average cost of coal for the railways on the western and southern sides of India may be taken at about 60s. per ton. Thus, while the cost of coal per train mile on the East Indian Railway was 3¼d., on the Great Indian Peninsula it was 1s. 6¼d. last year.

Coal Exported from England.

Railway.	Coal and coke sent out during 1865.		Cost in England	Freight, &c.	Average cost per ton on arrival in India.			Estimated average cost over the line.		
		tons.	£	£	£	s.	d.	£	s.	d.
Great Indian Peninsula ...	Coal	37,569	20,952	58,623	2	2	4	3	0	0
	Coke	13,376	15,324	19,454	2	11	3	3	12	0
	Patent fuel	8,404	5,427	14,370	2	7	1	3	8	0
Madras	Coal	7,140	3,861	13,919	2	9	9½	3	0	0
Bombay and Baroda	"	37,219	19,462	60,585	2	3	0	2	18	0
Scinde	"	7,952	4,235	16,704	2	12	8	3	0	0
Great Southern	"	3,663	1,996	7,541	2	12	0½	2	18	0

"61. A recent report by Mr. Oldham, the superintendent of the Geological Survey of India, on the coal resources of the country, does not encourage the hope that coal will be found in many parts of India where it could be of very great value to the railways. 'Viewed as a coal producing country,' Professor Oldham says, 'the British territories in India cannot be considered as either largely or widely supplied with this essential source of motive power. Extensive coal-fields do occur, but these are not distributed generally over the districts of the Indian Empire, but are almost entirely concentrated in one (a double) band of coal-yielding deposits which, with large interruptions, extends more than half across India, from near Calcutta towards Bombay.' He adds, further on in his report, 'there still remains, however, much to be surveyed, and, until careful mapping has been carried out of all the fields, any estimate of the coal resources and productions of British India must be defective. . . . Up to the present time, it may be said, that little more than surface workings have been carried on in India. . . In parts of the Raneegunge field these open workings are of marvellous extent and size, covering hundreds of acres.'

"62. We may conclude from these remarks, that a supply of coal will be available for the lines passing through Bengal and Central India. The Bengal railways have, indeed, already obtained their fuel from the collieries near Raneegunge. The Central India coal has not been used by the Great Peninsula Railway, as the line is not yet sufficiently near the collieries, and the cost of conveying it by road would make it too expensive. In the upper, western, and lower parts of India it may be presumed that the railways will not possess the advantage of native coal. The importance, therefore, of obtaining other sources of supply increases every year. Coal from Australia and Labuan is being tried. But wood is what we must look to chiefly, if economy is to be secured. The subject has engaged the serious attention of government, both at home and in India. Several despatches, pointing out the importance of the subject, and suggesting the necessity of adopting immediate measures for increasing the plantation of suitable timber, have been addressed to the Government of India by the Secretary of State during the year. It has been calculated that a plantation of 20 acres will be the average proportion required to meet the requirements of every mile of railway, and Lord Cranborne observed that it was 'evidently necessary that planting on an extensive scale should take place annually for several years to come.'"

From which it will be seen that, although the 7,140 tons of coal sent to Madras were shipped for about 11s. per ton, or the sum of £3,861 for the whole quantity, yet the freight, &c., of them outwards amounted to about 3½ times their original cost, or £13,919, so causing their estimated average cost over the whole line to rise to about £3 per ton; and coal was equally dear on the Great Indian Peninsula and Scinde railways, and cost nearly as much, or 58s. per ton, to the Bombay, Baroda, and Central India, and the Great Southern of India Railways.

Again, in paragraphs 50 and 51, in his report for 1867,—1868, he shows that the price of fuel had still further increased on these lines, and approves of the more general use of wood.

"50. A marked difference will be observed between the expenses in the locomotive departments of the Bengal and the Bombay lines, showing the great importance of the fuel question. On the Madras lines the difference is not so great, although they are as dependent upon England for coal as the lines in Western India. This is partly due to the more general use of wood, but partly also to an economical system of management, which reflects credit on the railway authorities in the Madras presidency. With regard to wood fuel, measures have been taken by the government for planting and preserving forests for the purpose. With respect to coal, an abundant supply is obtained in Bengal; but the beds in Central India have not yet been made available for railway purposes, access to them having been delayed by the tardy operations on the Great Indian Peninsula Railway. A short branch to the mines will be required when the trunk line to Jubbulpore is completed; and it is to be regretted that arrangements have not already been made for carrying out this work, so that the coal may be ready by the time it is wanted. Other places in the neighbourhood of the Great Indian Peninsula Railwan, where coal is known to exist, have been explored, but the result of the exploration has not yet transpired.

"51. The following table (see p. 203) shows the amount of fuel sent from this country during the year.

A patent fuel, it will be observed, has been tried, and hitherto the reports have been favourable as to its suitableness for locomotive purposes. The cost of coal at Bombay was very much enhanced by the great demand for it, as well as for shipping, at the commencement of the Abyssinian expedition. Australian coal has been supplied at Bombay at 25 rupees, or 50s. a ton. No report has yet been received of its quality."

Fuel Exported from England.

Railway.	Coal, coke, and patent fuel sent out during 1867.		Cost in England.	Freight, &c.	Average cost per ton on delivery in India.
		tons.	£		s.
East Indian	Coke	1,665	3,886		46
	,, ...	980	3,579		73
			£	£	
Great Indian Peninsula	Coal	49,354	27,418	98,708	51
	Coke	18,329	21,855	34,882	62
	Patentfuel	11,361	8,031	22,763	54
Madras	Coal	3,778	2,075	8,131	54
	Coke	8,142	6,319	17,825	59
	Patentfuel	5,351	3,903	11,825	59
Scinde	Coal	5,348	2,850	11,335	54
Great Southern	Coal	2,847	...	...	57
	Coke	440	...	...	76
Bombay and Baroda* ...	...		...	...	...

And again, in his report for 1868-69, at paragraph 48, he makes the following remarks on fuel:—

"48. The next item of expenditure which presents the greatest contrast on different lines is that of the locomotive department. While the train-mileage cost of this department on the East Indian is 16·4d., on the Great Indian Peninsula it is 29d., and on the Scinde, 39·5d. The reason of this is plain. The East Indian pays, on an average, about 20s. a ton for native coal. The lines on the Western coast are at present dependent for coal upon England or Australia, the cost of which comes to from 60s. to 80s. a ton. The railways on the Madras coast are, however, equally deficient in a supply of native coal, and have, during the past year, paid even a higher rate for English coal, and yet the cost of their locomotive department is less than those in Bengal, amounting only to 13·4d. on the Madras, and to 13·5d. on the Great Southern. This may, in some measure, be accounted for by the lowness of wages, and the lightness of their trains compared with the East Indian; but it is also due to the use of a considerable proportion of wood fuel, and also to good management. Fuel must always be a source of great expense on those lines which are at a distance from coal-producing districts or from forests. It is therefore most important, in the interests of Indian railways, to develop the coal resources of the country, and to regulate and preserve the forests. The government is very anxious to promote both these objects. I have referred to Australian coal; it has been tried on some of the lines of Western India, and has been well reported on; the experience of the locomotive superintendent of the Scinde Company is that 'it is equal to Welsh coal in all respects, its evaporative power is nearly equal to Welsh coal, but the consumption per mile is less than with Welsh coal.' The price hitherto has been under that of English or Welsh coal. Fuel made of compressed coal-dust and certain cohesive ingredients has also been used, and found to answer well. Experiments have lately been made in this country by Mr. F. C. Danvers, of this office, with the view of devising means for the manufacture in India, with materials on the spot, of blocks of this kind of fuel."

But I cannot agree with him in his remark that "fuel must always be a source of great expense on those lines which are at a distance from coal-producing districts or from forests," because coal and wood are not the only combustibles that can be used for locomotive fueling purposes; and another fuel, which is a much more economical one than either, is locally obtainable, and ready at hand.

It is doubtless of importance to utilise the services of the broken coal by compressing it with cohesive ingredients, and such has been found highly useful as a fuel for many years past, and, weight for weight, occupies less space than coal, a great advantage in transport; but then it is more costly than coal, and therefore objectionable on economical grounds; what is really wanted is a more economical fuel than either coal or wood.

Now, when Mr. Danvers said, "but wood is what we must look to chiefly, if economy is to be secured," he most certainly had no idea that matters would so speedily change, and that from the inability of the Forest Department to supply a sufficiency of wood-fuel at a moderate charge, he was not aware that it would prove such a broken reed to rely upon, for, since he recommended its increased use, its price has risen in the Madras Presidency as much as 166 per cent. within two years—rather a heavy blow to economy.

It is true that government have issued orders for the formation of extensive plantations for railway fuel reserves, but past experience does not tend to give us a hope that such will be economically produced, or that there is any certainty of a sufficiency of supply for railway purposes being thus obtainable, or that it will be disposed of to the railways at a cheaper rate than it is at present; and, moreover, it will be many years before such sources of supply can be drawn upon to provide fuel, so that during their progress towards maturity, the railways will suffer greatly unless some remedy be devised.

Knowing the anxiety that several successive Secretaries of State for India have experienced with regard to this question of fuel, I felt assured that if a remedy could be discovered, it would be received with satisfaction, and therefore I resolved to try if I could possibly find one. I therefore instituted inquiries as to the various descriptions of fuel that were in use in different Continental and American lines; and, after much trouble and research, I discovered that some of them used condensed peat as a locomotive fuel, and were enabled to reduce their working expenses by its aid, as proved by the following quotations:—

I. *The Use of Peat as a Locomotive Fuel on Continental Railways, &c.*

Mr. Baillie, her Majesty's Secretary of Legation, in writing an official report with regard to coals, from Carlsruhe, on 15th February, 1865, having reference to the Wurtemberg Railway, stated as follows:—

"The railway consumption (exclusive of the south line, where the locomotives are heated with turf, and coal only exceptionally used, &c.), shows that turf is there supplanting coal."

Again, Mr. Fenton, in reporting, as her Majesty's Secretary of Embassy and Legation, on the manufactures and commerce of the country in which he resides, says, at p. 35 of his report on Bavaria, dated Munich, December, 1867, that, with reference to the different descriptions of fuel consumed by engines on the Bavarian railways in 1864-65, and 1865-66, "It will be seen that, whilst the quantity of ordinary turf employed fell off considerably during the latter year, that of pressed turf was more than doubled. The use of coke appears, on the other hand, to have been discontinued."

Does not the above show that ordinary turf is becoming antiquated, and that a more dense peat is superseding both coal and coke?

At p. 35 of the same report he states that the respective prices of fuel, in 1867, in Bavaria, were as follows:—

	s.	d.	
Coals per centner, and equal to	14	5	per ton.
Pressed peat	12	9	,,

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* No coal was sent out by this Company during the year, a plentiful supply having been provided the year before. The Company has a contract for 10,000 tons of Australian coal, but no ship had arrived at the close of 1867.

Only 1s. 8d. per ton difference in price between these two fuels, while there would be about 35s. per ton difference in price between these respective fuels on the four Indian Peninsula railways.

Surely this is a matter for very grave consideration, and should settle all question as to the advisability of employing condensed peat as a locomotive fuel in India.

II. *The Practicability of Reducing the Working Expenses of a Railway by its Instrumentality.*

Mr. Bonar, her Majesty's Secretary of Legation at Munich, in reporting on Bavaria, for 1862, says:—"In the year 1860 it was found practicable to reduce the cost of fuel by the employment of a better prepared peat or turf."

The following is taken from an official copy of a report sent to me by the authorities of the Belfast and Northern Counties Railway of Ireland, on the result of a trial of condensed peat on that line:—

Report.

"At your request we, this day, superintended a trial of condensed peat, on the Belfast and Northern Counties Railway, with the view of testing its qualities as a fuel for locomotives.

"In order carefully to watch the power of the fuel in the generation of steam, we rode upon the foot-plate from Carrick Junction to Ballymena, a distance of 27 miles.

"During the whole of the journey we had an excess of steam, notwithstanding that the fire-door was constantly open, and the damper down for the greatest portion of the distance.

"The pressure was 100 lbs. to the square inch.

"The commencement of the journey was up an incline of 1 to 80,* four miles long, with double curves, and whilst going up the incline the pressure rose to 110 lbs., and afterwards to 120 lbs.; fire-door open all the time.

"The speed, when this was permitted, was 40 miles per hour.

"We noticed, when travelling, the fuel emitted no smoke, and little, if any, when standing at stations.

"The fire-box was examined at Ballymena, and a small quantity of clinker was found, considerably less than from best coal.

"On looking into the smoke-box, we found it perfectly free from cinders or dust, thus proving that the fuel stood the blast perfectly well.

"Having carefully noted all these facts, we have no hesitation in saying that we consider the condensed peat in every way adapted as a fuel for locomotive purposes.

"(Signed)

"A. Yorston, Local Superintendent, Belfast and Northern Counties Railway.

"W. H. Atkinson, Resident Engineer, Ulster Railway.

"C. K. Domville, Resident Engineer and Locomotive Superintendent, County Down Railway."

I have received the following memorandum from Belfast, in connexion with the above trial:—

"The weight of the train, including engine and tender, was 70 tons.

"Ordinary weight of coal per mile used by the same engine under the same circumstances was $25\frac{1}{4}$ lbs.

"The total quantity of peat consumed during the journey was 14 cwt. 1 qr. 14 lbs., being at the rate of 21·47 lbs. per mile.

	Miles.
"Actual distance run was	64
"Allowed for $1\frac{1}{2}$ hours for engine standing in steam	10
"Total mileage............	74

Or consuming only at the rate of only 1 ton of fuel per 100 miles run.

"N.B. The average number of pounds for the last three months, using Welsh and Scotch coals, at a ratio of 2 of Welsh to 1 of Scotch was 25·25 lbs. per mile. The average for the month of May was 26·39 lbs. per mile.

"(Signed) Wm. Gilmore, Driver."

The general opinion of the result of the trial is made mention of in the following letter received by me:—

"Belfast and Northern Counties Railway,
"Locomotive Department,
"Belfast, 21st May, 1868.

"Sir,—I have the honour to enclose copies* of the "Report on Condensed Peat" you refer to.

"I regret not being able to give personal information on the subject, as my predecessor, Mr. Yorston, made the experiment.

"The general opinion was, that if the cost could be made† moderate enough to compete with coal, that it had certain advantages over coal, and the drivers prefer cubical blocks to cylindrical.

"A very important element of success is, that it should be sufficiently dried.

"I have, &c.,
"(Signed) Edward Leigh.

"Lieutenant-Colonel Wragge."

Results of Peat as a Locomotive Fuel at the Grand Trunk Railway at Canada.

1. 1 ton of well-dried peat-fuel conveyed a train of 12 loaded cars $40\frac{1}{3}$ miles.

2. An express train, consisting of 6 passenger cars, ran 177 miles, consuming 7,936 lbs. of peat-fuel, or about 45 lbs. per mile run, travelling at the rate of $25\frac{1}{2}$ miles average speed; so that $50\frac{1}{2}$ miles was the distance run per ton of fuel, $3\frac{1}{2}$ dollars (14s.), was the cost per ton of fuel, making 7 cents the cost for fuel per mile run.

3. Upon the Three Rivers and Arthabraska Branch of the Grand Trunk Railway, the engines with wood-burning fire-boxes, and without any alteration or adaptation whatever, have been burning peat-fuel for some time, with results quite equal to those arrived at on the above experimental trips, the average distance run per ton of fuel being 50·37 miles. The weight of fuel used per mile was 44 lbs.

4. Work performed by an engine burning peat-fuel, and drawing a mixed train of 18 cars, from Montreal to Prescott Junction, 112 miles; the junction being 260 feet higher than Montreal. The train consisted of 16 freight, 1 passenger car, and 1 van, making a total of 18 cars:—The weight of freight was 320,000 lbs; ditto of cars, 345,000 lbs; total weight of train, cars, and freight, 665,000 lbs., or 296 tons; distance run, 112 miles; total weight of fuel consumed $3\frac{1}{2}$ tons, 7,450 lbs.; value of same at $3\frac{1}{2}$ dollars per ton (14s.), is 11 dollars 65 cents = 48s. 3d.; fuel consumed per mile run, $66\frac{1}{2}$ lbs.; cost of fuel per mile run, 10 cents = 5d.; number of car miles run, 2,016; fuel consumed per car mile run, 3·69 lbs.

Now, I felt that the above were important points gained, if peat could only be found handy in India; but on making inquiries as to the probability thereof, I was much ridiculed for supposing that such vegetation was to be found in the tropics; but it occurred to me that, perhaps, some of the elevated plateaux therein, having mild temperatures and heavy rainfall, might possibly be favourable to its formation in India; so I hunted for such spots, and read every author that I could learn had ever written about such localities; and at last I was gratified by the discovery that peat of a really good description was to be found in various parts of India, and was moreover well placed for utilisation by the railways, especially on the Neilgherry hills, to the foot of which a branch line is now being constructed, of about 29 miles in length, to place them in communication with the Madras Railway, which branch will leave that railway at Poothanoor, and terminate at Metapolliem, about five or six miles from Kullair, at the foot of the hills.

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* As the steepest incline on the proposed branch railway to the Neilgherries is only 1 in 81, there is no doubt, therefore, of the capability of condensed peat to overcome such ascent.—*Note by Colonel Wragge.*

* Those which I have given above.—A. R. W.

† With what force this applies to India, where it can be supplied at less than half the price of coal.—A. R. W.

The plateaux of these hills are formed of a multitude of undulations, extending over an area of about 420 square miles, or 268,494 acres, only about 30,000 of which are under cultivation, and their configuration is highly favourable to the formation of peat in the various valleys between the undulating ground, through which numberless streams meander, tributaries to the rivers Moyar, Bhowany, &c., which course the foot of the hills, the first to the north, and the latter to the south, ultimately effecting a junction with the River Cauvery, which discharges itself on the East Coast, about 50 miles north of Negapatam.

The elevation of Ootacamund, the chief place on the hills, and situated about the centre of the plateaux, is about 7,360 feet above the level of the sea, having a rainfall of between 40 and 50 inches annually. That of 1867-68 was 40·54 inches; rain fell in 147 days, and there were 219 without rain. The warmest month was that of March, when the thermometer's maximum in the shade was 75½°, and its minimum in the shade was in the month of February, where the temperature was registered at 39·37°. There are good roads crossing the hills in various directions. The drainage on these hills is in every variety of direction, and the swamps are always traversed by a stream of clear water, and springs arise from every hill-side.

Now, the distance from Coimbatore, the nearest large town to the Neilgherries, and which is situated on the Madras Railway, from a central position on the hills, say Ootacamund, is only 54 miles, as under:—Coimbatore to Metapolliem, 27; Metapolliem to Coonoor (or crest of hills), 15; Coonoor to Ootacamund (a metalled road), 12; total, 54 miles. There are six or seven passes, or ghauts, leading down to the plains from the hills, so that communication with the plains is readily maintained all over the different parts of the plateau.

The Coonoor Ghaut, leading from the plains to the hills, the nearest ghaut to the railway, has an average slope of one in eleven, while a slope of one in nine is well adapted for the transit of bullocks; and as far back as May, 1855, no less a number than 29,000 laden bullocks passed up this ghaut, being nearly 1,000 a day; and in the previous October, 82 loaded bhandy carts and 94 empty ones passed up; and since then, the traffic has much increased, and the road has been greatly improved.

The extreme length of the hill plateau is about 48 miles, and its greatest width about 20; and the population numbers over 38,000; so that there will be no difficulty about transport; and there having been 219 dry days, or three in every five of the year, afforded every facility for the working of the bogs, so that plenty could have been obtained for railway purposes; and therefore these bogs but require skilful management to turn them to profitable account. The range is about 40 miles distant from the West Coast.

III. *The existence of large Deposits of Peat on the Neilgherry Hills, &c.*

Dr. R. Raikie, in his book, "The Neilgherries in 1857," at page 53, says:—

"The surface of the table land on the summit of the hills is much undulated, and presents various characteristics in the different divisions; the only circumstance common to the whole is the occurrence of swamps of various extent in the valleys, formed by the undulations. The soil in these swamps is of considerable depth, and very rich; in some it forms large beds of peat bog, from which Ootacamund is abundantly supplied with an excellent substitute for coal."

Burton, at page 280 of his "Goa and the Blue Mountains," remarks that:—

"There is a small swamp, formed by the soaking of some arrested stream, at the bottom of almost every declivity.

"Before you have been long on the hills, you will witness many amusing accidents occurring to new comers, who attempt to urge the steed through the shaking bogs of black mud, treacherously lurking under a glossy green coating of grassy turf.

"This anecdote much reminds me of the Bog of Allen."

The peat moss above Wellington is 30 feet deep, which shows that bogs have formed of considerable depth in these hills; and Wellington is but 2¼ miles from Coonoor, which is situated on the crest of the hills.

In the *Gazetteer* of Southern India, published in 1855, with reference to the Mailoor Ghaut on these hills, occurs the following passage:—

"The remains of a very good road still exist from the top of this ghaut, all the way to Ootacamund, but it has become impassible in many places, owing to bogs having formed in the hollows, and closed over it."

There are a number of bogs on the Rivers Pykara and Pooratty, on these hills.

Sir Robert Kane, in his "Industrial Resources of Ireland," at p. 35, makes the following remarks with reference to the formation of mountain peat:—

"In mountain districts the progress of the phenomenon is similar. Pools, indeed, cannot in so many instances be formed, the steep slopes facilitating drainage, but the clouds and mists, resting on the summits and sides of mountains, amply supply their surfaces with moisture, which comes, too, in the most favourable form for vegetation, not in a sudden torrent, but unceasingly and gently, drop by drop. The extent of such bogs is also affected by the nature of the rock below them. On quartz, they are shallow and small; on any rock yielding by its decomposition a clayey coating, they are considerable," &c.

Mountain peat offers greater facilities for cutting, and is generally of much better quality than bog-peat of low levels.

In trying some peat charcoal at Wellington, about 14 years ago, it was ascertained that its radiating heat was 50 per cent. greater than that of wood charcoal.

An acre of peat, 3 feet in depth, contains about 3,000 tons of wet peat, having about 75 per cent. of moisture in it, and will therefore yield about 750 tons of dry fuel.

In the Administration Reports of the Madras Presidency for 1860-61, appears the following:—

"Wellington.—The peat bog has been worked whenever the weather permitted. During the year, 178 tons of fuel were made, and conveyed to the cantonment, besides 94 tons supplied to the Commissariat Department. No difficulty was experienced in obtaining labourers," and plenty can now be procured at 7 rupees per month (or 14s.), or about 6d. per day.

Mr. Thomas, who was the collector of Coimbatore, and knew the Neilgherry Hills well, says that the Neilgherry peat is well adapted for fuel, and that it can be easily procured without much expense in cutting. It was found very useful in burning bricks on these hills, and was used all over Ootacamund in private houses, and burnt well.

Now, there is plenty of peat to supply the railways with fuel, while the new fuel plantations are maturing, so that they need not be suffering from a scarcity of wood; and a cheap transport is easily procurable for the conveyance of the peat, as cattle, carts, forage, and drivers are to be obtained at small cost, but such a transport would have to be inaugurated for the occasion, as a wealthy carrying company, routing competition, have nearly driven the native carriers off the road, charging three or four times as much as it could be profitably done for; in fact, I have gone into the cost of transport, and find it could be done for about 4d. or 5d., but we will say, for a certainty, 6d. per ton per mile. The question of transport generally all over India requires looking into, and I have devoted much attention to the subject, and, if consideration is not paid to this question, the highways, instead of being the feeders to the railways, will soon become the stoppers of the supplies, and the lines will consequently suffer greatly in their traffic.

A large sum might be saved annually if the four Indian Peninsular railways would use condensed peat in lieu of coal. I have made up an estimate of what might have been so saved in their consumption of fuel in 1867, which I will give you; and you must bear in mind that the consumption is now very much greater, owing to the extension of the lines.

IV. *The Saving that might be effected by the introduction of Condensed Peat in the Working Expenses of the four Indian Peninsula Railways, in lieu of using coal, coke, and patent fuel.*

The following consumption of fuel is taken from the railway returns of 1867 :—

	£	s.
The Madras line consumed 17,271 tons, cost	50,088	0
Its equivalent of condensed peat, 17,271 tons, would have cost, at 24s. per ton	20,726	0
Or effecting a saving of	29,362	0
The Great Southern Railway consumed 4,804 tons, cost	14,109	0
Its equivalent of condensed peat, 4,804 tons, at 28s. per ton	6,725	12
Or a saving of	7,383	8
Saving effected on the above two lines :—		
Madras Railway	29,362	0
Great Southern of India Railway..........	7,383	8
	36,745	8
The Great Indian Peninsula Railway consumed 79,044 tons, cost	223,657	0
Equivalent of condensed peat, 79,044 tons, at 40s. per ton	158,088	0
Saving on Great Indian Peninsula Railway of	65,569	0
The Bombay, Baroda, and Central India Railway consumed, during the last half-year of 1867, 6,667½ tons, cost	24,194	10
Equivalent of condensed peat, 6,667½ tons, at 40s. per ton	13,335	0
Saving of Bombay, Baroda, and Central India Railway of	10,859	10
And presuming that its consumption for the whole year, 1867, was double that of the last half-year, the saving would consequently have been	21,719	0
Total saving on the four lines :—		
Madras Railway, of	29,362	0
Great Southern Railway, of	7,383	8
Great Indian Peninsula Railway, of	65,569	0
Bombay, Baroda, and Central India Railway, of	21,719	0
Total......	£124,033	8

The total consumption, therefore, annually of coal, coke, and patent fuel of the above four lines amounts to about 107,786½ tons. But when the branch railway is completed to Metapolliem, condensed peat could be supplied to the Madras Railway there at £1 a-ton, and by that line conveyed to the junction of the Great Southern of India Railway at Errode for about 24s. a ton.

V. *The Cost at which Condensed Peat could be supplied at various places.*

	Per ton. s.	d.
At the Neilgherry Hills depôt, at..............	10	0
If delivered at the foot of the hills (20 miles) 7s. extra for transit, at	17	0
At Coimbatore, Madras Railway (20 miles further), another 7s. for transit, where coal is 54s. per ton	24	0
At Errode, for Great Southern Railway, 4s. additional for railway freight, where coal is 57s. per ton	28	0
At Beypore, for Bombay, Baroda, and Central Indian Railway, and Great Indian Peninsula Railway and coasting steamers	30	6
At Bombay, per coasting vessels, from Beypore, where coal is 75s., say......................	40	0

VI. *The importance of such a Cheap Fuel to various commercial undertakings in India, such as ironworks, sugar factories, coasting steamers, &c., is also manifest.*

In the evidence given before the Select Committee of the House of Commons, in 1858, on the Colonisation and Settlement of India, Mr. Fenwick, engineer to an ironworks company, stated that the company had to discontinue operations on account of the scarcity and high price of fuel. Now, peat is better adapted for smelting purposes than coal, from its freedom from sulphur; and the cheapness with which government, or a railway company, could supply commercial works with peat fuel would resuscitate a stagnant trade, and one which is greatly needed in the country; in fact, by the aid of condensed peat, a good rail could be made in India, and the cost of freight, so heavy on iron rails from England, would be thereby saved, an object of great importance in view of the extension of the various lines.

Beypore was probably selected for the terminus of the Madras line on the west coast of the peninsula, on account of the iron company there, which the existence of extensive beds of hematite in this locality called into being some years back, and whose works, now in a semi-ruinous condition, stand as costly proof that, in the absence of a local supply of fuel, the manufacture of iron is not a profitable speculation.

The consumption of firewood at some of these iron works is enormous, and the Conservator of Forests, in one of his reports, mentions as an instance thereof, "that at Tirunamallai, a circle of some 12 miles diameter (where the iron works are), which abounded in small wood, is now almost entirely denuded of every tree, and this in the course of some seven years." The Madras sugar factories consume 60,000 tons of firewood annually. It is, therefore, evident that condensed peat, from its cheapness, will be a most useful auxiliary to wood.

VII.—*The general Advantages derivable from the Use of Condensed* * *(not compressed) Peat.*

1st. The economy it will effect in the working expenses of the railways, by introducing it as an auxiliary to wood fuel, and also to the coasting steamers, which might be supplied with it at Beypore. It is now in general use (only air-dried peat) in the steamers in the Shannon, and is found to answer admirably as a marine fuel, at about half the cost of coal there (*see* Sir R. Kane's "Industrial Resources of Ireland," p. 57).

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* Compressed being a failure.

2ndly. That its manufacture will afford new source of revenue to the government, and relieve the great pressure on the forests while their growth is extending, and the railway fuel reserves maturing.

3rdly. That it will create a new traffic for the Madras Railway, so much wanted to make the branch line a paying one.

4thly. That it will occupy but one-third the space of firewood in a truck, for one ton of it will stow in about forty cubic feet, while its equivalent in calorific effect, viz., one cord of wood, requires 128 cubic feet of space, thus enabling the trains to travel three times the distance with a truck of it that they could with one of wood, and thus saving them the expense of numerous fueling stations, as wood-fuelling necessitates one every 30 or 40 miles.

5thly. That it is not liable to spontaneous combustion, like coal is, which burnt down a large shed but recently from this cause at Royapooram, and might have done a larger amount of mischief. Its use would therefore increase the security of railway property.

6thly. That it will travel so much better than coal, and will not disintegrate and deteriorate like it in value every time it is subjected to removal.

7thly. That it deposits very little clinker, so destructive to the fire-bars where coal is used, and makes no smoke.

8thly. That it will afford a protection against, and tend to hold in check, the incessant encroachments of coal, the insidious nature of which has been so strongly evinced in the working expenses of the Bombay, Baroda, and Central India Line, which have increased without a break to such an extent in seven consecutive half years, from the half-year ending 31st December, 1864, up to that ending 31st December, 1867, that they were 50 per cent. higher at the latter than they were at the former period, being at the rate of 14 per cent. per annum increase.

9thly. That the reduction of the working expenses, by its use, will lighten the onus of guarantee on the part of government, as there will be a smaller deficiency to make up.

10thly. That its supply to the railways of Bombay will give an impetus, and profitable freights to the native coasting trade as well as the coasting steamers.

11thly. That the introduction of so cheap a fuel will admit of the re-opening of various iron-works, which the dearness and scarcity of fuel caused to close some years back.

12thly. That it is, in fact, the alternative source of supply, so greatly needed for locomotive purposes, and, moreover, has the advantage of being instantly available, it having already matured, whilst the railway fuel reserves have yet to be grown, and will be years before they produce a supply.

Owing to the rise in the price of wood-fuel, which in some stations of the Madras line is as much as 18s. per ton, and as it requires 3·39 tons of wood to perform the duty of one ton of coal, the cost of an equivalent of wood-fuel to effect the performance of a ton of coal is more than 61s. in such places; this surely cannot be called an economical fuel. And it is, moreover, an unfortunate circumstance for the government, as its revenues will suffer greatly in consequence; for I understand the authorities of the Madras Railway are so dissatisfied, that it will be a question with them if they should not altogether, in the interests of economy, give up the use of wood, while the Great Southern of India Railway, who cannot get more than enough wood to run a single train daily, have, in their own protection, been obliged to procure coal from Australia, 6,000 miles away, which they actually find cheaper to use for locomotive purposes than the wood locally produced. But, further, this rise in price of wood-fuel is paralyzing all commercial undertakings dependent upon a supply of firewood, such as sugar factories, &c., and the ryots in general are loud in their complaints, while the manager of the Asker Sugar Factory, consuming 10,000 tons of firewood annually, says that, if the newly-imposed duty be levied, the Company will have to close its operations, a most unsatisfactory state of affairs, which is needlessly inflicted, as the use of peat would remedy all this distress.

Government is now taking a leaf out of Germany's book, which will be remotely beneficial, in sending students to that country to study forestry; but the result of such study will have to be utilised at a very considerable outlay, making no returns for years; while I would recommend for consideration another leaf out of the book, which will give them fuel at once, and at a very small outlay.

Reading a work of De Luc's (the great geologist) the other day, I was much struck with a remark contained in it, which forcibly illustrates the present fuel crisis in India, and shows how to meet it successfully; it was as follows (in reference to the North of Europe):—In these countries indeed, at least in many parts of them, it was only about 30 years ago that the neighbouring forests having been mostly cleared away, peat was thought of as a substitute for wood, and none of the inhabitants knowing how to prepare it, people were sent from other countries to instruct them. . . . They have since continued the use of it," and are now using it on their railways.

Were not, I would ask, their circumstances, then, precisely similar and identical with the present state of the fuel question in India, but they fought and conquered; and cannot India do the same?

There are many peat bogs on the Neilgherries belonging to private individuals, whose names I have; but those belonging to government have been conserved for some two or three years.

The *Universal Review*, at page 564, says:—"Peat was discovered on the Neilgherries. It is generally distributed over the entire range of the hill tract, and is so abundant, that it is sold at the bog-side at one shilling per cartload of 1,000 lbs. (about 2s. 2d. a ton), and at about 2s. 6d. a ton at the principal settlement, Ootacamund."

Now, since its conservation, it must greatly have improved in quality, for its price there now is 33s. a ton, a slight increase of over 1,200 per cent., and where labour is but quarter the price it is in Ireland, in which country it is conveyed for 60 miles, and sold in Dublin for 16s. a ton; nevertheless, I could produce it on the Neilgherries for the railways, if they wish to have it, for the sum of 10s. per ton at the hill depôt, or delivered to the Madras Railway for £1 a ton, and Metapolliem and to the Great Southern of India Railway for 24s., per Errode.

The use of peat will also save the railways from the great expense to which they are occasionally put by the trains being fired, owing to the sparks thrown off by wood-fuel, which sometimes destroys valuable merchandise in transit, the destruction of which has to be made good by the railway companies; no sparks being thrown off during the combustion of peat.

There are large deposits of peat that I know of in various parts of India, and the distress caused by the present state of the fuel question there should be at once moved by their immediate utilisation, and I have studied carefully how to insure a successful remedy for this crying evil; and as government cannot supply the railways with a sufficiency of firewood, even at a high cost, it is time for the railway companies to take into consideration whether it may not be desirable, in the interests of economy, for them to take the necessary steps to provide themselves with a cheap locomotive fuel; should such be their determination, it would afford me much pleasure to give them any information they may require in the furtherance of such a beneficial measure.

To further support my arguments, I would remark Mr. Danvers observes, at paragraph 38 of his "Report on Indian Railways, 1869-70," that:—

> "It will be observed that the proportion of working expenses to gross receipts in some cases was above 80 per cent., while in others, viz., the East Indian and the North-west line of the Madras, it was about half that proportion. The average expenses of the 13 lines which realised profits were, in 1868, 61·77, and in 1869, 64·05 per cent. of the gross receipts. It may be expected that, when the lines have more fully developed the traffic which they ought to command, and when by the use of cheaper fuel from native sources the present heavy charges in the locomotive department are reduced, the average rate of expenditure will be under 50 per cent. If this had been the case during the past year of depression, nearly £350,000 would have been added to the net receipts. Strenuous efforts are being made, both by the government and the companies, to reduce expenditure in every way, and to bring the working and establishment charges as low as is compatible with efficiency."

The utilization of the peat-bogs will alone provide the "cheaper fuel from native sources," which the Government Director of Railways thinks justly of such great importance in the economic working of the lines; and they are immediately available to effect that object; and I trust that I have been able to show to the satisfaction of all, that there ought to be no difficulty whatever in rendering them immediately useful.

A discussion followed the reading of the paper, which will be given in a future *Journal.*

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

As already announced, the Council in aid of this object will give six concerts in the Albert Hall, and a guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed, announced in last week's *Journal,* was £2,418.

The following gentlemen have since guaranteed the amounts set opposite their names respectively:—

	£	s.
James Austin	10	0
Henry Briggs	10	0
Sir Daniel Cooper, Bart.	25	0

The number of tickets taken, as announced in last *Journal,* 508.

C. E. Austen	4
James Austin	2
R. D. Baxter	2
W. H. Bishop	2
J. P. Bull	5
J. J. Carreras	2
Sir Daniel Cooper, Bart.	5
J. Da Silva	2
John Draper	2
A. J. Ellis	2
W. J. Gwynn	2
A. Haines	2
T. W. Hutton	2
F. H. McLaughlan	2
R. McKerrall	3
J. McMillan	2
William Newmarch, F.R.S.	2
A. B. Pearce	3
W. Pickstone	2
M. E. Rodocanachi	3
James Scott	2
C. W. Slee	2
John Taylor	2
F. Wrentmore	2

The first concert will be given on April 12th, and it will be the first public performance in the hall after the opening ceremonial by Her Majesty the Queen. The dates of the other Concerts are April 19th, July 5th, 12th, 19th, and 26th.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

A subscription of one guinea entitles a member of the Society of Arts to a transferable numbered and reserved seat at each of the six concerts.

The Musical Education Committee met on Monday, the 21st January. Present, Lord Gerald Fitzgerald in the chair, Mr. Henry Cole, C.B., the Hon. Seymour Egerton, Sir John Harington, Bart., Mr. Samuel Redgrave, Lieut.-Col. Scott, R.E., and Mr. Seymour Teulon.

The Committee took into consideration the arrangements for the Society's Concerts in the Royal Albert Hall; and with reference to the accommodation which would be available for the audience, they were informed that the Executive Committee of the Hall intended that only such numbers should be admitted as would enable every person to be seated with great comfort, and to enter and leave without any crushing. It was thereupon resolved:—

That the prices to be charged to the public for admission to reserved seats at the concerts should be as follows:—

Arena for one concert	£0	7	0
Or subscription for the six concerts	2	2	0
Balcony for one concert	0	7	0
Or subscription for the six concerts	2	2	0
Amphitheatre for one concert	0	10	6
Or subscription for the six concerts	3	0	0
A box holding five persons for one concert	3	3	0
Or for the six concerts	15	15	0

In letting, preference to be given to a subscription for the six concerts.

Members of the Society of Arts will have the privilege of subscribing for a set of six tickets (transferable), admitting the bearer to a reserved seat, at each of the six concerts, as follows:—

The Arena	£1	1	0
The Balcony	1	1	0
Amphitheatre	2	2	0
Box holding five	10	10	0
Ditto " for one concert (if vacant)	1	15	0

It was also resolved—

That all subscriptions must be paid in advance for reserved seats, and that after the 15th of March the special privileges of Members, of obtaining tickets at the reduced price, should not be continued.

It was further resolved—

That a sub-committee be appointed to confer and arrange with Sir Michael Costa the programmes of the music.

OPENING OF THE ALBERT HALL.

Tickets to admit to the ceremonial at the opening of the Royal Albert Hall by the Queen, on the 29th March, can be obtained of Mr. Samuel Thomas Davenport, the financial officer:—Arena, 3*l.* 3*s.*; Balcony, 2*l.* 2*s.*; Picture Gallery, 1*l.* 1*s.* each.

CANTOR LECTURES.

The second course of Cantor Lectures for the session will be delivered by Dr. Crace Calvert, F.R.S., and will treat of "Dyes and Dye-stuffs other than Aniline." The course will consist of four lectures, and will commence on Tuesday evening, the 7th of February, and be continued on the subsequent Tuesday evenings till completed. These lectures are open to members, who have the privilege of admitting two friends to each lecture.

Lecture I.—Tuesday, February 7th.

Red Colouring Substances.—Madder; composition of the root—Alizarine—Purpurine—Xanthine—Artificial alizarine—Commercial alizarine—Garancine—Extract and flour of madder—their preparation and applications to calico printing and Turkey-red dyeing.

Lecture II.—Tuesday, February 14th.

Red Colouring Substances (*continued*).—Alkanet root—Campeachy, peach, sapau, cam, and bar woods—Cochineal—Lac-dye—Orchil—Cudbear—Litmus—Murexide—Safflower; their applications in dyeing and calico printing.

Lecture III.—Tuesday, February 21st.

Blue Colouring Substances.—Indigo; how prepared, and how to determine its commercial value; its applications in dyeing and calico printing—Prussian blue; its properties; how produced on wool and silk, and how used in calico printing—Ultramarine blue.

Lecture IV.—Tuesday, February 28th.

Yellow Colouring Substances.—Quercitron-bark—Flavine—Fustic—Persian berries—Annatto.

Black Colouring Substances.—Gall-nuts—Shumac—Divi-divi—Mirabolam—Catechu.

ART-WORKMANSHIP PRIZES.

The articles sent in competition for these prizes are now arranged for exhibition at the Society's Rooms, and are on view for members and their friends between the hours of ten and four, up to Saturday, the 11th instant. A catalogue of the articles exhibited may be obtained on application to the attendants at the Society's House.

The Catalogue with the awards of the Judges, as soon as they are completed, will be published in the Society's *Journal.*

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

Amount of subscriptions received, £21 15s.

Postal Pneumatic Tube.—A large party of visitors were invited, on Saturday, to the General Post-office, to see the working of a new line of pneumatic tubes for the telegraph service, between Telegraph-street, in the City, and Temple-bar, upon the Siemens' principle, originally brought out in Berlin some five or more years ago, but now for the first time adopted in this country. Pneumatic carrier-pipes, upon Mr. Latimer Clarke's system, have long been in use at the Telegraph-street station for short distances eastward, but the present line is the first coming thence westward. In the Clarke system, the two sets of pipes are open at their terminal ends, and are both worked by a steam-engine at the head station, which forces air into one stationary cylinder or receptacle there, and exhausts a vacuum in another. The carrier-box, in which the messages are placed, is thus blown through the "down" tube and sucked back through the "up" tube. The service is admirably conducted in this way from one place to another, but no intermediate station is practicable. In the Siemens' system, the "up" and "down" tubes are continuous, the engine pumping air into the one end and exhausting the other, so that a continuous circulation is maintained, and which can be cut by any number of intermediate stations. These "stations" are formed by short lengths (about two feet) of double tubing, placed parallel side by side, inserted in the main pipes, and working backwards and forwards on a rod or hinge. One of these, the "siding," is covered with a glass top, and has a perforated stop at one end, against which the carrier-box is "trapped" or stopped, the perforations in the "stop" allowing some of the current of air to pass through, so as not to arrest the circulation of the air-current, which is further completed by a bent tube passing over from one end of the main tube to the other across "the station," and actuated by a throttle-valve. The "main line junction pipe" and its companion "siding" are worked on the same "block" system as the metropolitan lines of railway. A signal-bell or gong denotes that a "carrier" has been dispatched by the "up" or "down" tube respectively, and the number of the sounds struck indicate the station it is intended for. That station immediately puts on its "siding," and as soon as the carrier arrives it is duly "trapped." The "siding" is then brought over, and a straight rod inserted forces the carrier-box out, and the messages are duly received. In passing intermediate stations, the carriers strike the stud of a bell inserted in the main tube junction-pipe, and notifies its transit; the object of the "block" system being that two "carriers" shall not be in the same length of tube at the same time, for fear of stoppages at any sharp turns or bends; for, although if any such accident occurred it could be readily relieved by reversing the air-current, it is desirable in a public service to have no chance of any, even temporary, interruption. The length of the new pneumatic line is about a mile and a quarter. From Telegraph-street to the General Post-office, 880 yards; thence to Temple-bar, 1,330 yards. The system was explained by Mr. R. S. Curley, C.E., the engineer-in-chief of the telegraph lines. Working with pressure and vacuum, or by the proper circulation, the time taken by the "carrier" from Telegraph-street to the General Post-office was a minute and a-half; then to Temple-bar, 2½ minutes; or right through the whole distance in four minutes. Worked by vacuum only, the "carrier" took 8½ minutes for the same total distance.

The New Postmaster-General.—The *City Press* says:—"Mr. Monsell, we may suppose, is now in harness. He cannot alter the law, but he can administer its provisions with a view to the public benefit, and in contempt of the trammels of red tape, in which, we fear, he now finds himself involved. We counsel him to be determined in behalf of broad justice to the public, to the officials, and to himself, remembering always that a postmaster has his duties as well as his rights. If he can succeed in putting his office in order some time in advance of the re-assembling of Parliament, he may then find time to prepare for substantial reforms which are imperatively necessary, but which can only be carried into effect by the aid of the Legislature. It is desirable that the post-card should vanish, and a simple form of closed message take its place at the same rate. The parcel-post, known hitherto as the sample and pattern-post, needs to be simplified, and freed from all qualifications except such as are needed for safety and convenience in the transit of parcels; and, to pass over fifty requirements, it is high time that money-orders were issued at a reasonable rate, for the present tariff is exorbitant, and presses especially on the humble and the thrifty, who deserve better accommodation."

Pigeon Post.—The *City Press* says:—"About the centre of the third column of page 10 of a late issue of the *Times* occurs a piece of intelligence to this effect:—'Thirty thousand messages have arrived by your pigeon in a good state.' For pigeon, singular, perhaps we ought to read pigeons, plural. But if we take the text to be correct, it conveys in a startling manner an idea of the capability of the pigeon-post. We are to suppose the 'thirty thousand messages' to have been photographed so minutely, that a page of the *City Press* would, on the same system, occupy a square inch or less. What weight can a pigeon carry? Perhaps an ounce; scarcely more, and surely not much less would be the weight, however compressed, of thirty thousand messages on a delicate film of silk. Accustomed as we are to hear about balloon and pigeon-posts, this little story is full of wonder, and not destitute of practical suggestion. It is a question worth considering, whether we might not revive the pigeon-post, not with any particular view of the possibility of needing it for maintaining our communications during an invasion, but for ordinary business purposes, and to compensate for the shortcomings of the telegraph system and all other branches of our postal service. A system of communication which accomplishes such remarkable results in war cannot be altogether unworthy of attention in time of peace."

Postal Reform.

Sir,—In the present agitation for the above, we should not content ourselves by demanding from the postal authorities all in their power, but we should also set them the example by doing all in our power.

It would undoubtedly vastly facilitate the sorting of the thousands of letters that daily pass through the Post-office, if the public would only take the trouble of addressing them just the very reverse of the way it now does. For instance—all that those at the prime office require to know is the post-town; that, therefore, should be the first and most prominent thing in the address. When it arrives at the post-town, the street or locality is the next thing wanted. When it reaches the street, then, and not till then, is the name of the receiver required.

This was proposed some years ago, but the public could not be got to carry it out. If, however the postal authorities were empowered to charge, say, double postage on all letters not addressed as proposed, it would certainly be the general practice before even the first week had transpired, and no one would ever dream of complaining.—I am, &c.,

No Matter Who.

Edinburgh, January 21, 1871.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

India.—The Bombay local committee, to further the objects of the International Exhibition in London, have met in the Town-hall, Bombay. There were present the Hon. Sir Jamsetjee Jejeebhoy, Bart., in the chair, Dr. Bhau Daji, the Hon. Byramjee Jejeebhoy, Col. J. A. Ballard, Capt. Hancock, Mr. A. T. Crawford, Mr. G. W. Terry, Mr. F. F. Lidderdale, Mr. F. F. Arbuthnot, and Mr. C. R. Ovans, honorary secretary. The committee selected several of the articles to be exhibited. In the Fine Arts Department they selected articles of blackwood furniture made in Bombay, Bombay and Surat work, Ahmedabad and Surat kinkhobs, Bombay gold, silver, and silk embroidery, and toys of various kinds and materials. Some gold necklaces and other ornaments were exhibited by a Bania.

Class X. (Educational Works and Appliances).—Committees of Selection.—The following are the Committees appointed to select, from the objects sent in, those thought worthy of exhibition in the several divisions of this class, viz.:—

Section A.—School Buildings, Fittings, Furniture, &c.

The Rev. Canon Cromwell (Principal of St. Mark's College, Chelsea).
D. R. Fearon (one of Her Majesty's Inspectors of Schools).
Walter Macleod (Upper Master of the Royal Military Asylum, Chelsea).
E. Carleton Tufnell (one of H.M. Inspectors of Schools).
The Rev. Dr. Unwin (Principal of Homerton College).

Section B.—Books, Maps, Globes, Instruments, &c.

Rev. Dr. Adler (Chief Rabbi).
Professor D. T. Ansted, F.R.S.
Rev. W. H. Brookfield.
Dr. Buchheim (King's College).
Hon. and Rev. F. Byng.
Dr. G. H. Davis (Religious Tract Society).
J. G. Fitch (one of H.M. Inspectors of Schools).
Professor Wm. Hughes, F.R.G.S. (King's College).
Rev. Muirhead Mitchell (one of H.M. Inspectors of Schools).
Rev. A. Wilson, M.A. (National Society).

Section C.—Appliances for Physical Training, including Toys and Games.

G. C. T. Bartley (Science and Art Department).
Dr. Archibald Campbell.
Rt. Hon. Wm. Cowper Temple, M.P.
Rev. J. H. Edgar (Science and Art Department).
Sir Duncan Gibb, Bart.
Wm. Hawes, F.G.S. (Vice-President of the Society of Arts).
Rev. Muirhead Mitchell (one of H.M. Inspectors of Schools).
E. G. Ravenstein (President of the German Gymnastic Society).
Rev. T. W. Sharpe (one of H.M. Inspectors of Schools).
Henry Vaughan (Member of Council of Society of Arts).
R. G. Wylde (Science and Art Department).
Major Waddington.

SECTION D.—SPECIMENS AND ILLUSTRATIONS OF MODES OF TEACHING FINE ART, NATURAL HISTORY, AND PHYSICAL SCIENCE.

Sub-Section Fine Art.

W. H. Boughton.
H. A. Bowler (Science and Art Department).
F. S. Cary.
Richard Redgrave, R.A.
Dr. Schlesinger.

Sub-Section Music.

Jules Benedict.
A. S. Cole (Science and Art Department).
Otto Goldschmidt (Royal Academy of Music).
John Hullah (one of the Society's Examiners).
G. A. Macfarren (one of the Society's Examiners).

Sub-Section Natural History.

Professor D. T. Ansted, F.R.S.
H. Bauerman.
Hyde Clarke (Treasurer of the Society of Arts).
Professor W. H. Flower, F.R.S. (Royal College of Surgeons).
David Forbes, F.R.S.
Dr. Hogg (one of the Society's Examiners).
J. F. Iselin, M.A. (Science and Art Department).
W. Matchwick (Science and Art Department).
St. George Mivart, F.R.S.
Thomas Moore, F.L.S. (one of the Society's Examiners).
Professor Ramsay, F.R.S. (Royal School of Mines).
Dr. P. L. Sclater, F.R.S. (Zoological Society).

Sub-Section Physical Science.

F. A. Abel, F.R.S. (Laboratory, Royal Arsenal, Woolwich).
W. F. Barrett, F.C.S. (one of the Society's Examiners).
Charles Brooke, M.A., F.R.S.
Major-Gen. F. Eardley-Wilmot, R.A. (Member of Council of the Society of Arts).
Professor Fuller, C.E. (University College).
C. W. Merrifield, F.R.S. (Royal School of Naval Architecture).
Rev. Arthur Rigg, M.A.
W. W. Smyth, F.R.S. (Royal School of Mines).
Rev. J. Twisden (Royal Military College, Sandhurst).
Professor A. Williamson, F.R.S. (University College).
Professor Willis, F.R.S.

SECTION E.—SPECIMENS OF SCHOOL WORK SERVING AS EXAMPLES OF THE RESULTS OF TEACHING.

Professor D. T. Ansted, F.R.S.
Rev. G. C. Bell (Head Master of Christ's Hospital).
Alfred Bourne (Secretary to the British and Foreign School Society).
Rev. J. S. Brewer (one of the Society's Examiners).
H. A. Bowler (Science and Art Department).
Lieut.-Col. Ewart, R.E.
J. G. Fitch (one of H.M. Inspectors of Schools).
Mrs. P. Le Neve Foster.
W. G. Larkins (Editor of the *Journal of the Society of Arts*).
Miss Mason.
Miss J. Mason.
F. Pitman.
E. Carleton Tufnell (one of H.M. Inspectors of Schools).
L. Schmitz, LL.D. (Principal of the London International College).

THE BLIND.

All matters connected with the Education and Training of the Blind.

Dr. T. Armitage.
Rev. R. H. Blair (Worcester Proprietary College for Blind Sons of Gentlemen).
Rev. J. Evans (Chairman of House Committee, School For Indigent Blind).
Rev. J. B. Johns (School for Indigent Blind, Southwark).
Edmund C. Johnson (*Chairman*)
T. G. Sambrook.

All objects for exhibition must be delivered at the Exhibition Building, at the entrances specified, on the days named below:—

		Entrances.
Feb. 1 „ 2	Machinery for pottery..	Exhibition-road.
„ 3 „ 4	Machinery for woollen and worsted fabrics	Prince Albert's-road.
„ 6 „ 7	Scientific inventions	Prince Albert's-road.
„ 8 „ 9	Educational works and appliances (except Section E, Results of Teaching, which must be delivered at the house of the Society of Arts)	Royal Albert Hall.
„ 10 „ 11	Pottery and raw materials	Exhibition-road.
„ 13 „ 14	Woollen and worsted fabrics and raw materials	Royal Albert Hall.
„ 15 „ 16	Sculpture not applied to works of utility	Prince Albert's-road.
„ 17	Painting applied to works of utility	Prince Albert's-road.
„ 18 „ 20	Sculpture applied to works of utility	Prince Albert's-road.
„ 21	Engraving, lithography, photography, &c.	Royal Albert Hall.
„ 22	Architectural designs, drawings, and models	Royal Albert Hall.
„ 23	Tapestries, carpets, embroideries, &c.	Prince Albert's-road.
„ 24	Designs for all kinds of decorative manufactures	Royal Albert Hall.
„ 25	Copies of pictures, mosaics, enamels, &c.	Prince Albert's-road.
„ 27 „ 28	Painting not applied to works of utility	Prince Albert's-road.

EDUCATIONAL NOTES.

Training College for Schoolmasters.—On Wednesday, the 25th ult., a deputation from the College of Preceptors waited upon Mr. Forster, M.P., to urge the establishment of a training college for teachers engaged in middle-class education. There ought, it was contended, to be such a college established, in which both masters and mistresses might obtain some acquaintance with the science and art of education. Mr. Forster said he was quite aware that the gentlemen before him represented to a considerable extent the views of many of the masters of secondary schools in the kingdom; but he did not think the principle they advocated would be accepted very soon, either by government or by the country. It would introduce a new principle, not only of government interference, but of government aid to secondary education. There was no doubt that to the training carried on for teachers in the elementary schools the state had subscribed largely; but that was a very different thing from the establishment of training colleges for secondary schools. Moreover, the School Commission had reported against the proposition, and he could not hold out any hope of the assistance of government in the present state of public affairs. It was urged by the deputation that the principle had been acknowledged with regard to universities, and three ways were suggested in which the matter might be dealt with—by the establishment of professorships in universities, with a training-school in London; by a college with training-schools attached, where students might hear lectures, the students going back to be examined and certificated; or teachers might be required to join or form a scholastic institution. Mr. Forster observed that the view suggested by the last alternative was one which was brought before the Schools Inquiry Commission, and contemplated turning the educational profession into a close profession. He was aware that there were strong arguments in favour of such a course, but, on the whole, he thought there was a balance against it. What they must rely upon was, first, a hope that, partly by parents throughout the country becoming more desirous for the good education of their children, and partly by the effect of the reformation of endowed schools, there would be a higher standard raised throughout the country; then demand and supply would take care of themselves. It was different in endowed schools, inasmuch as the State took care of the endowments.

Irish School Teachers.—On Tuesday last, a deputation of Irish national-school teachers waited upon Mr. Gladstone, to draw his attention to their condition, and to solicit that their profession might be placed more on an equality with the English system. They stated that the associated teachers, at the end of 1868, numbered 8,620, and had under their care 967,563 pupils, but the scanty remuneration they received was wholly inadequate to the decent maintenance of themselves and families, their salaries averaging only £35 a-year for men, and £38 10s. for women, as compared with £91 5s. 11d. and £56 1s. 7d. respectively in England. They submitted that they ought to receive retiring pensions, and in many cases, free residences, and in the absence of any local enactment to enforce regular attendance, and having regard to the comparative thinness of the population, and other circumstances peculiar to Ireland, they deprecated the introduction of the principle of paying the teachers by results.

Physical Training.—A long and interesting discussion took place at the meeting of the London School Board on Wednesday last, upon a motion by Mr. Hepworth Dixon, to the effect that it is highly desirable that means should be provided for physical training, exercise, and drill in public schools, established under the authority of the Board. An amendment, moved by Mr. Lucraft and seconded by Lord Sandon, for omitting the word "drill" was lost, and the original motion was carried. The Royal Humane Society is moving in favour of the introduction of instruction in swimming into all elementary schools.

CORRESPONDENCE.

INDIA'S RICHEST FIELDS.

SIR,—In the memorandum of tea exports from India, in the last number of the *Journal*, there is a misprint. For 18,434,000 lbs., exported in 1868, read 8,434,000.

The enclosed account (from the *Homeward Mail*) of the Kangra Valley, which is the furthest north-western tea-producing district in India, is so clear and concise, that it will interest all who are looking to the settlement of Europeans in the Himalayas exceedingly. I doubt not you will find room for it. Major Paske looks farther than I ventured to for a great market for Indian teas, and if the Indian Government shares his expectations for supplying the Russians with tea, as well as the Central Asians and Thibetans, we may now look with good hope for its attention being directed to the removal of existing obstacles.—I am, &c., ARCHIBALD CAMPBELL.

January 31st, 1871.

A valuable and interesting memorandum has been issued by Major E. H. Paske, Deputy-Commissioner, Punjab, on the products and trade of the Kangra district —a tract of country which, as many of our readers know, on account of the capabilities of its soil, the richness and variety of its products, its facilities for trade, and the genial and temperate nature of its climate, is adapted, beyond most parts of India, for the further extension of European enterprise and capital.

Kangra proper, with its outlying subdivisions of Kooloo, Spitti, and Lahoul, which together comprise the district of Kangra, in the Punjab, is an extensive tract of mountainous country, situated on the outer ranges of the Himalaya mountains, covering an area of about 12,861 square miles, and containing a population of 752,419 souls. The northern extremity touches upon Ladakh, and the southern limits of the district rest upon the plains of the Baree Doab.

The late Mr. G. Barnes, in his Settlement Report, gives the following very accurate and graphic description of the Kangra valley:—

"I know no spot in the Himalayas which for beauty or grandeur can compete with the Kangra valley and its overshadowing hills. No scenery presents such sublime and delightful contrasts. Below lies the plain, a picture of rural loveliness and repose. The surface is covered with the richest cultivation, irrigated by streams which descend from perennial snows, and interspersed with homesteads buried in the midst of groves and fruit-trees. Turning from this scene of peaceful beauty, the stern and majestic hills confront us. Their sides are furrowed with precipitous watercourses, forests of oak clothe their flanks, and higher up give place to gloomy and funereal pines. Above all are wastes of snow, or pyramidal masses of granite too perpendicular for the snow to rest upon."

Beautiful as is the Kangra valley, thus so well described, it is even surpassed by the loveliness of the scenery in the Kooloo valley, one of the subdivisions of the district.

From Major Paske's memorandum we condense the following:—

Climate.—The climate of Kangra is mild and genial, and in most parts well suited to the constitution of Europeans. Its mountain ranges, standing at high elevations, are free from the intense heat and scorching winds that prevail in the plain country; and in the northern extremities only, where the snow falls to great depth, are the rigours of winter felt with so much severity. But, like most hill tracts on the outer ranges of the Himalaya, Kangra has the disadvantage of excessive damp and moisture for three months during the rainy season. English gentlemen, who have followed the occupation of tea planters in the Kangra valley for the space of ten years, appear to have enjoyed the health they might have expected had they resided in an English climate.

Soils.—The soil throughout that part of the district called the Kangra valley is generally most favourable to vegetation, and wherever this soil prevails trees abound and attain a luxuriant growth. In the vicinity of what are called secondary ranges, the soil, though not so rich, is still of excellent quality, and capable of yielding some of the most valuable staples.

Agricultural Products.—Among the indigenous products of the soil throughout the Kangra district may be enumerated wheat, barley, lentil, peas, beans, rape seed, flax, and safflower crops of the spring harvest, and rice, maize, millet, buck-wheat, cotton, sugar-cane, and turmeric among the products of the autumn harvest. Among miscellaneous products may be noticed the poppy, tobacco, spices, potatoes, and a considerable variety of vegetable and other garden products. The upper valleys of Kangra are granaries of rice. Here are combined abundance of water with suitable temperature, and a peculiar soil which makes rice so exclusive a product. The people recognise upwards of sixty varieties. The Kangra rice is produced so extensively as to have become a great staple of export trade all over the Punjab and in parts of the North-West Provinces. Sugar-cane is largely cultivated in certain tracts in Kangra, and is said to be of excellent quality, containing a large proportion of saccharine matter. The cotton plant is extensively produced, its yield not sufficing for home consumption.

New Products.—These products are tea, China grass fibre, and cinchona bark.

Tea.—Since 1850, the government has established a plantation on a large scale at Holtah, a large tract of waste land in a desirable locality, about 4,200 feet above the level of the sea. The Holtah garden was commenced in 1852, and by 1854 became a promising plantation, with about 400 acres of land under cultivation. The position was found all that could be desired, soil and climate very suitable for tea, and there were ample facilities for irrigation. In 1860, several English gentlemen commenced the formation of tea plantations, with the assistance of a government officer, who was deputed to facilitate the transfer of waste land to European settlers. In 1868, there were 19 private estates held by European settlers, the aggregate area of these comprising about 8,800 acres, with 2,700 acres actually under tea cultivation. In the season of 1868, the aggregate produce of all the plantations amounted to about 250,000 lbs. of tea. Throughout the Kangra valley there are extensive tracts well suited for tea cultivation, and doubtless some portions of these will be rendered available as soon as the lands now in occupancy of the planters have been fully planted out.

Kangra is so situated that the tea-planters enjoy considerable facilities in securing markets for the sale of their produce. It may be said that there are four markets available for the sale of Kangra teas :—

The home or London market.
The local European market in India.
The local native market in India.
The Central Asia market.

From all the principal plantations in Kangra, teas are shipped for the London market. The Kangra teas, as well as all other Indian teas, are becoming better known in London. The local European market absorbs a large proportion of the better qualities of teas manufactured in the Kangra plantations, and the demand continues to increase. The use of tea as a beverage is spreading among all classes of natives in India. The local native market absorbs the coarser qualities of black teas, the tea-dust, and the green teas manufactured at comparatively small cost, and which are roughly packed in cloth.

A very important outlet for the sale of Kangra teas is the Central Asian market. In Persia, in Affghanistan, and throughout the provinces of Central Asia, the use of tea, green tea especially, is very common among all classes; in these countries the consumption is so great, and so continues to increase, that tea has become a great staple of trade. From Umritsur the tea-trade flows through Peshawur to Cabul and on to Khiva, Bokhara, and Samarkand, the great centres of trade in Central Asia. Lastly, teas are now being imported from Umritsur by the route through the Indus valley, *viâ* Kurrachee, for ports in the Persian Gulf.

In the foreshadowings of the future, there is the prospect of an inexhaustible market for the sale of Indian teas in Russia. At present, China provides all the teas consumed within the limits of the Russian Empire. These teas are conveyed by two routes :—1st. The sea route from China to England, and from thence, on transshipment, to ports in the Baltic. 2nd. The route termed the overland route, that is, partly by land and partly by inland water-carriage, through countries bordering on provinces in Central Asia. But both these routes present difficulties, delays, and risks which necessitate the sale of the teas in Russia at prices almost prohibitory for the bulk of the people. In the opening of the Suez Canal, however, a new route is presented, which offers many advantages for the establishment of a tea-trade direct between China or India and Russian ports in the Black Sea. M. de Lesseps, when responding to the address presented to him on the occasion of his recent visit to Liverpool, intimated that a Liverpool vessel had been chartered from Hankow to Odessa, carrying tea at a freight of £8 per ton, and he pointed out that this was the commencement of a revolution in the Russian tea-trade.

China Grass Fibre.—The second important industry introduced into the Kangra district is the China grass fibre, which promises to become a staple of vast commercial importance.

Cinchona.—The third important industry recently introduced into the Kangra district is the cultivation of the cinchona plant. To Major Nassau Lees, a talented and enterprising officer of the Bengal army, is due the credit for having originated the undertaking. At considerable expense and trouble, that officer formed a small experimental plantation in a suitable locality in the Kangra valley; his operations commenced as recently as 1864. As the results of his experiments, there are now four promising cinchona plantations in different parts of the Kangra valley. Bark has been produced from some of the trees, and, on analysis, has been found to be fairly rich in produce of the alkaloid, although the bark was from the branches of trees only two and a-half years old. It is a question for consideration whether some attempt should not be made to secure the necessary apparatus for the manufacture of the alkaloids in the neighbourhood of the plantations in Kangra.

Wool.—Brief notice may be given of the wool produced from sheep and goats in the Kangra district. A remarkable tribe, inhabiting the Kangra hills, are the Guddees, a semi-pastoral, semi-agricultural race. The greater portion of their wealth consists of vast flocks of sheep and goats, which they feed, during the winter months, in extensive grazing grounds in the lower Kangra hills, and which, during the summer months, they drive to the pastures in the higher range of mountains. The wool produced from these flocks is of good quality, and is available in such quantities that it might become a staple for export trade for the manufacture of woollen fabrics in England.

Mineral Wealth of Kangra.—Lastly, among the products of Kangra, the mineral wealth of the district is not to be overlooked. Hard and durable stone for building purposes is procurable all over the district, and extensive slate quarries have been opened out in different localities. The mountain ranges of the outlying sub-divisions of Kooloo are rich with mines of valuable ores. The writer of the present paper recently brought to England a few specimens of ores from the mines in Kooloo that Mr. Calvert has commenced to work. On analysis, while these specimens contain some trace of silver, they have been found rich in lead, copper, cobalt, antimony, and arsenic.

The paper then details the trade routes which are outlets for Kangra produce, also the importance of the Palumpore and Peshawur fairs, and the advantages of a fair at Umritsur, and State Railways from Lahore to Peshawur, and from Moultan to Kotree. The immediate effect of the Suez Canal and the merits of the Euphrates Valley Railway are also noticed, and the improvement of the Kurrachee harbour.

In conclusion, Major Paske says :—"Commerce and politics are inseparably connected; traders, pioneer soldiers, and trade routes are lines for the march of armies. What has been written above, in regard to trade and trade routes, bears some relation to trade between India and Russia, and has connection, therefore, with the political aspect of the Russo-Indian question, a question of vital and growing importance in the interest of England and the British Empire in the East. But it is not the purpose of the writer to make this paper a medium for the expression of political views; suffice it to observe that, in seizing commercial advantages, we possess ourselves of political opportunities. By fully adopting the several routes and means that have here been pointed to and briefly dwelt upon, we cement the bonds of union between England and India. While increasing our commerce we improve our political influence, and while we materially strengthen our position we facilitate the peaceful solution of the coming and all-important Russo-Indian questions."

THEORIES OF COLOUR.

Sir,—Although Göethe's hypothesis, which Mr. Herdman favours, has not been accepted by scientific men, the facts of the spectrum do lend a certain colourable pretext for the notion that colours are the sensations resulting from the degradation of the force or forces producing the sensation of white light; for every point in the elongated and greatly extended area of the prismatic spectrum must, in various degrees, be less in force than white light, or the sum of all these forces when concentrated would be greater than that of the original beam before refraction.

The two great stumbling-blocks, however, in the way of a proper understanding of the theory of light are:—First, the erroneous belief that colour is a property of the nature external to us; and, secondly, that light travels. Neither light nor sound travels. These are only sensations which are produced—if the undulatory theory be true—by the last of a series of waves on the retina and auditorium. The wave which produces the sensation of light or sound, and caused by some distant source of activity, is no more the primary or original wave travelled from that source of activity than if the original impulse had been communicated in waves by wire or cord extended from the object to the nervous system. If light were emitted, travelled, or passed through matter, as language in common use would lead one to suppose, we should have to revert to the abandoned hypothesis of Newton, or of the projection of particles. But the popular science of light and colour makes a "hash" of the hypothesis of "propulsion" and "undulation."

The titles of "primary" and "secondary," would appear to be mere arbitrary distinctions, as, according to the Germans, every ray of the spectrum, secondaries as well as primaries, are homogeneous, and cannot be resolved. You may bring two together, to produce a different sensation than from either singly, but the combination is as mechanical as when two powders producing different sensations of colour are mixed, and can be again separated or resolved.

As regards the compensating colours, the science of harmony—that is a science which every man with healthy vision has within himself. The greatest colourists worked before any science of colours was enunciated. The "accidental" or "complementary" colours, as they have been called, I have shown to be after-sensations, or reactionary states of the retina, which have no external existence whatever, and occur if the eyes be closed after the primary sensation, though these reactionary sensations may be modified by various external circumstances if the eye be kept open.*

I am, &c., Cave Thomas.

ROUGH SHOES FOR HORSES ON ICY ROADS.

Sir,—This severe winter brings to our minds an old grievance, the want of some simple appliance for preventing horses slipping and falling on the roads covered with ice. The old method of high calkins is barbarous, requiring the shoes to be removed every third day, to the great injury of horses' feet, besides causing strains and other accidents, both on the road and in the stable. Of the spikes screwed in the heels of the shoes, there is one with a pyramidical head and a sharp point, another has a head the shape of a blunt wedge, with a sharp cutting edge; these sorts are both improvements on the high calkins, but they require constantly renewing. The last invention is a head three-eighths of an inch square; this lasts longer than the sharp-pointed or sharp-edged ones, but its square head does not so easily gain a foothold on the ice.

I think a valuable hint may be taken from the blade of a skate; used longitudinally, it glides over the ice; used transversely, it affords great resistance. Following out this idea, the head of the screw should be like the blade of the skate, with this difference, that the great weight of a horse will drive the blade so firmly in the ice that a very short blade will give a very firm foothold. I have no doubt a blade half-an-inch long will procure the resistance required. The blade should be a quarter of an inch wide and three-eighths of an inch deep, fixed upon the present sort of screws of three-eighths of an inch long, and three-eighths of an inch wide. The improvement will be, instead of a sharp point and sharp edge, that will not last effectively above two or three days, it will have a bar of hard steel that will last three weeks or a month. The wearing away will not render it useless for a considerable time, the perpendicular sides of the blade still giving a secure foothold.

I hope this idea may lead to a further improvement, and suggestions by other persons more qualified to write upon the subject.—I am, &c., R. H.

THE DEPUTATION ON DRILL.

Sir,—My few words at the deputation on drill are scarcely explained at p. 187. What I said was, that military drill had a value, because it is the result of the thought and exertions of many men in Europe, from the time of Frederick the Great, at least to produce the greatest effect in movement with the utmost economy of labour. Thus, too, the manual exercise is valuable in this respect, and its principles are available in civil life. I might have said that another drill, that of the compositor in picking up types at case, is founded on the like principles.—I am, &c., Hyde Clarke.

32, St. George's-square, S.W., 27th January, 1871.

MR. JONES' PAPER ON "HOW MEAT IS PRESERVED."

Sir,—On reading the above in your last issue, it occurred to me very forcibly that we are, in this country, invariably troubling ourselves about minor matters, and leaving out of sight the most vital questions touching the people's bread.

My object is to point out to the readers of the *Journal* that, as the meat spoken of in Mr. Jones's paper is the produce of cereals, roots, and grasses of tropical soils and climates, it would be more in accord with material, sanitary, physical, and commercial economy, to consider the question of importing the said cereals in bulk as return cargoes for ships taking out emigrants or merchandise, as the case may be. A merchant, the other day, told me that two cargoes of wheat from Australia had recently been sold in the Corn Exchange, Mark-lane, which, from the peculiar hardness imparted to it by the extreme dryness of the climate where it had been raised, had been imported in bulk without damage. This fact was considered a very remarkable phenomenon; for wheat to come so long a voyage in the bulk in the ship's hold, especially through the tropics, without damage, was always thought impossible. This alone is sufficient to point out that wheat or corn is the right thing to import, in order to cheapen the people's meat in England. For example, let us assume—which is not impossible—that wheat or Indian corn, or both, are so cheap in our colonies or Indian possessions that return ships, being in want of cargoes, could take it in as ballast, say at 6d. to 1s. a bushel, it would then be placed on our shores at from 1s. to 2s. a bushel; what would be the result to the people at home and in the colonies? Some persons would say it would be ruinous to the agricultural interest here, but the farmers would reap the largest benefit directly, inasmuch as they would have laid down at their doors, at 2s. 6d. per bushel, that which they were labouring to produce, and which costs them in labour and capital at present 4s. 6d., or, in some cases, 5s. to 5s. 6d. Thus they would be able, by the abundance of the raw material, to produce and manufacture meat of various descriptions, beef, mutton, veal, pork, fowls, and especially turkeys, &c., at one-half the present price. Thus a recuperative spirit would flow through the whole body politic. Let me give a case as evidence that wheat can be produced at the prices I have named. In a paper reprinted from the *Manchester Courier* occurs the following, viz.—"At Hingunghat (in the Godavery district) wheat worth 6s. per bushel in England, and 4s. at the coast in India, was selling there (Hingunghat) at 5d. a bushel." Again, for Indian corn (or maize), a friend of mine wrote me that in Illinois he was getting only 1s. a bushel, whereas I was at that moment giving 5s. here. Thus it seems to me clear that what is required to be done to get *fresh* meat cheap and good—preserved meat being kept for the army and navy, on long voyages and expeditions—is this:—First, construct works of irrigation and cheap transit in the tropical colonies and India, as suggested. Secondly, do away with all fiscal impediments that obstruct the freedom of exchange of commodity. We should then be in a condition to dispense with the trade that introduces the rinderpest to our farmyards; we should then be able to feed our children on good and wholesome milk, and butter (not Thames mud), and bacon, and fowls; and the result would be plenty of work, and plenty of meat for the masses, which is the motto of,

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* Paper before the Paris Academy of Sciences.

Yours truly,
T. Briggs.

NOTICES OF PUBLICATIONS.

A Civil Service Short-hand.—Mr. Stanford, of Charing-cross, has recently published a pamphlet, which, under the title of a "Proposal for a Civil Service Short-hand," really contains suggestions for very extensive modifications of Pitman's phonography. The object of the proposed changes is, to secure legibility without the necessity of making additional dots and strokes to indicate the vowels, as is necessary in Mr. Pitman's system. The author claims that by his method each word can be written free from ambiguity in one outline, without the need, except in very rare cases, of making separate strokes to represent the vowels. The principal features of the suggestions are the following:—1. A scale of vowel sounds indicated by the position of the consonant characters with reference to the horizontal lines. 2. The use of small ticks, incorporated in the outline, to indicate exactly the first vowel sound in each word, and approximately intermediate and final vowels. 3. A uniform rule of doubling consonant characters, straight and curved, with a fine stroke for the addition of T, and with a heavy stroke for the addition of D. This is instead of Mr. Pitman's halving principle, whereby T and D are added indiscriminately, and in which half-length straight consonants are apt to be confounded with grammalogues. 4. A uniform rule of doubling the doubled characters, to add R to the T and D, with variations of thickness to show whether it is TR, DR, or THR which is added to the original letter. The author pays ample tribute to the superiority of Pitman's phonography to all existing systems of short-hand, and expresses his belief that his suggestions will greatly add to its easy legibility, and therefore to its suitability for use in ordinary correspondence and for business purposes, without in any material degree increasing the time required for writing and learning to write. A section of the pamphlet, headed the "Indian Civil Service—Dialects and Foreign Languages," treats of a method by which the writer considers that variations and shades of pronunciation can be readily represented by the short-hand characters, in combination with the proposed vowel scale.

GENERAL NOTES.

Hill Progress in India.—It may be taken as a measure of English progress in the upland regions of India, that the tea crop increased 25 per cent. last year, being 11,434,000 pounds, or an increase of 2,500,000 pounds. Taking local consumption and hill trade, the increase is most likely 30 per cent. over the previous year.

Railways in Turkey.—The railway system in Turkey is gradually developing iself. In a few weeks, a line will be opened from Kutchut to Tchekmedje, and it is the intention of the company to extend it as soon as possible to Constantinople and Adrianople. A line also is just commenced by an Italian company from Salonica to Uskuss, the engineering staff for which left Milan last December. This line is ultimately to be extended to Banjaluka, in Bosnia, passing through Novi Bazar.

International Maritime Exhibition at Naples.—It is now finally decided that the maritime exhibition is to be held in April next. Although this exhibition is entitled "maritime," it is not intended to be exclusively devoted to articles connected with naval matters, but it will embrace all articles of Italian export, such as stuffs, furniture, glass, pottery, jewellery, &c. The exhibition is to be opened on the 1st of April.

Science Teachers at South Kensington.—Regulations have been issued by the Science and Art Department with regard to science teachers who wish to attend the special (six weeks') courses for training in teaching at South Kensington in June, July, and August, in accordance with the circular of September, 1870. These applications are so numerous that it is impossible for the Department to make the selection of teachers to attend, as was originally proposed. The Department has, therefore, decided to make the selection by competition at the next May examinations. The teachers who answer best, probably to the number of about forty-five in each group, will be allowed to come to London for the six weeks' course of training. They will receive their travelling expenses, namely, second-class railway fare and 30s. a week while in London. The results of the teachers' examination will not be published, but if a candidate wishes his success recorded, it will be done in the ordinary way. The biology course will commence on the 14th June, and the course on experimental physics on the 5th July.

Paper-making Materials.—Messrs. Manning, Collyer, and Co., write as follows:—"There is little chance of any important quantity of cotton-fibre for paper-making being obtained from the seed. A new process is in operation in New Orleans (which was not referred to by the speakers during the discussion on paper-making materials on the 25th January), which separates the cotton from the seed in a condition so good that it is fit for spinning, and, consequently, will realise a price too high for paper material. As the price at which raw fibre or bark can be economically used for paper-making is under £20 per ton, the bulk of the supply must be obtained from those fibres, &c., which cannot be used for textile or cordage purposes. Some such association as that referred to by the chairman would very greatly assist the introduction of new fibres, &c., by affording a ready and reliable means of ascertaining their values for paper purposes, and giving encouragement to shippers and importers, who at present, in addition to the expense of importation, have either to incur large additional expenses to demonstrate the value of the material, or trust to the chance of someone risking the outlay necessary for the preliminary experiments. By co-operation, individual manufacturers would be relieved from the present costly experiments, often leading to no successful result, and would give to every subscriber the benefit of any experiments which were successful, information as to which is now too often withheld from the parties interested.

A New Oil.—The *Food Journal* reports a new oil as being in use in South Russia. It is said to have wonderful healing properties, and also the merit of simplicity, being made of the yolk of hens' eggs, which are first boiled hard and the yolks removed, cooked, and placed over the fire. Here they are carefully stirred until the whole substance is on the point of catching fire, when the oil separates and may be poured off. The yolk will yield nearly two teaspoonfuls of oil. The *Food Journal* adds, "with all our enormous consumption of eggs, it is extraordinary how little we know about them, and of the manifold uses—nutritious, medical, scientific—to which they may be put."

Tobacco.—The quantity of unmanufactured tobacco imported into the United Kingdom every year is very great, and the countries are many from whence it is imported. The United States sent us last year 37,046,032 lbs., while the Hanse Towns, Holland, Greece, Turkey, Japan, Cuba, New Granada, and other countries, together contributed 15,542,558, making a total of 52,588,590. The largest importation during the last ten years was in 1865, when we imported 66,084,857 lbs., of which immense quantity the United States sent us 46,649,768 lbs. But the supply of this article from the United States, especially from the Southern States, has fallen off very much since the War of Secession. There has been a rise of nearly 100 per cent. in the general importations of last year, which has raised the supply of both stemmed and unstemmed qualities from the United States from 28,681,443 lbs. to 37,046,032 lbs., a rise of 39 per cent., owing in a great measure to the increased importation of a quantity of tobacco, the "stemmed" variety, commonly called in the trade "Western Strips." The import of tobacco from all other countries continues to fall off, as it did in 1867 and 1868, and has now reached the lowest point it has ever occupied since 1860, the year before the American war began. As an article producing revenue, it may be mentioned that during the last financial year tobacco brought into the Customs' Revenue Account the sum of £6,608,716, or as much as the duties on tea, coffee, cocoa, fruit of all kinds, refined sugar, and molasses, all included. In fact, the net total of the entire Customs' Revenue produced £21,449,843 for the year 1869, nearly one-third of which was raised on tobacco and snuff alone.

Ostrich-farming.—Considerable attention, says *Land and Water*, has of late years been bestowed upon "ostrich-farming." On these so-called farms numbers of ostriches are kept solely for the growth of feathers for commercial purposes; the enclosures in which the birds are confined vary in size from 15 to 20 acres, encircled by low stone walls, over which the ostriches never attempt to leap. A novel plan, we learn, has been adopted near Grahamstown for hatching the eggs of these valuable birds artificially, by means of an incubator; the eggs are kept up to a temperature of from 100 to 105 degrees of Fahrenheit's thermometer, by the aid of an oil lamp, at a cost of a trifle more than 1d. for the 24 hours; the natural period of incubation in struthious birds (ostriches) is about 49 days. Ostrich feathers are in constant demand, being employed for a great many purposes, and their value, commercially, varies considerably in accordance with colour and quality; the long white feathers which are plucked from the wings are esteemed the finest, and are worth, on the average, from £32 to £40 per lb., which usually comprises about 80 feathers. These finer white feathers are mostly used by the Court plume-makers. The process of cleaning consists in careful washing with soap and clean water, a softish brush being, at the same time, employed judiciously; after the scouring, the feathers are well rinsed and shaken out to dry. Next in value follow the long black and grey feathers; and, lastly, the small ones, which fetch only about 40s. a pound. Feathers obtained from the wild birds are reckoned to be more valuable than those plucked from the "farmed" birds. The mode of hunting ostriches by the regular hunters has been thus described:—The finest adult male bird is singled out of the flock of perhaps six or eight, at the season when the feathers are in the finest condition; that is, when the quills have not arrived at their full hardness or development; the plume of the feathers is then beautifully delicate and soft; these feathers are then called blood feathers, and are considered of the greatest value. The hunter then follows it at a sharp trot, so as not thoroughly to alarm the bird, but follows it up perhaps ten miles or more at the same rate of speed, and then stops and off saddle, letting his horse feed and rest a little for about twenty minutes; the ostrich also stops. The hunter then mounts again, and follows up the bird at a fast gallop. The ostrich is now, however, stiff and tired after his previous exertion, and does not go along so fast, so that his pursuer soon runs him down, and knocks him on the head with a "sjambok" (a thick thong of hippopotamus or rhinoceros hide), and kills him at once. An ostrich in good plumage is worth about £16, and each bird has from 2½ oz. to 3 oz. of the finest white feathers. Some hunters will get from 50 to 80 birds in a season.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

February 8.—On "Ornamentation considered as a 'High Art.'" By Dr. Christopher Dresser, F.L.S.

February 15.—On "The Commerce of India." By Dadabhai Naoroji, Esq. On this evening Sir Bartle Frere, K.C.B., G.C.S.I., will preside.

February 22.—On "Water Meters." By Frederick E. Bodkin, Esq. On this evening John Hick, Esq., M.P., will preside.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal Institution, 2. General Monthly Meeting.
Farmers' Club, 5½. Mr. J. Coleman, "English Cheese Factories."
Social Science Association, 8. Adjourned discussion on Professor Leone Levi's paper on "Proposals for a plan of Arbitration and Mediation for the Settlement of International Disputes, to be submitted to any European Conference which may be held at the conclusion of the present War."
London Institution, 4. Prof. Huxley, "On the First Principles of Biology." (Educational Lectures.)
Royal United Service Institute, 8½. I. Commander W. H. Brent, R.N., "On Fleet Signalling."
Society of Engineers, 7½.
Entomological, 7.
British Architects, 8.
Medical, 8.
Asiatic, 3.
Victoria Institute, 8. Rev. B. W. Saville, M.A., "On the Evidence of the Egyptian Monuments to the Sojourn of Israel in Egypt."

Tues. ...**SOCIETY OF ARTS, 8.** Cantor Lectures. Dr. Crace Calvert, F.R.S., "On Dyes and Dye-stuffs other than Aniline."
Civil Engineers, 8. 1. Renewed discussion upon "Train Resistance on Railways." 2. Mr. Wilfred Airy, "On the Archimedian Screw for Lifting Water."
Royal Institution, 3. Dr. Foster, "Nutrition."
Pathological, 8.
Ethnological, 8.

Wed. ...**SOCIETY OF ARTS, 8.** Dr. Christopher Dresser, "On Ornamentation considered as a 'High Art.'"
Geological, 8.
Graphic, 8.
Microscopical, 8. Annual Meeting.
Royal Literary Fund, 3.
Archæological Association, 8.

Thurs...Royal, 8½.
Society for the Encouragement of the Fine Arts. Miss Emily Faithful, "On the Best Society."
Antiquaries, 8½.
London Institution, 7½. Mr. F. S. Barff, "On the Action, Nature, and Detection of Poisons."
Royal Society Club, 6.
Mathematical, 8.

Fri.......Astronomical, 3. Annual Meeting.
Royal Institution, 9. Mr. E. J. Reed, C.B., "On Some Fallacies connected with Ships and Guns."
Quekett Club, 8.
Architectural Association, 7½. Members' Soirée.

Sat ......Royal Botanic, 3¾.
Royal Institution, 3. Rev. W. H. Channing, "Laws of Life revealed in History."

Journal of the Society of Arts.

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FRIDAY, FEBRUARY 10, 1871.

PROCEEDINGS OF THE SOCIETY.

TENTH ORDINARY MEETING.

Wednesday, 8th February, 1871; William Playfair, Esq., M.D., in the chair.

The following candidates were proposed for election as members of the Society:—

Cressell, William, Thurlow-terrace, Lower Norwood, S.E.
Glynn, Edward, 68, Thistle-grove, West Brompton, S.W.
Knell, William Adolphus, 329, Kentish-town-road, N.W.

The following candidates were balloted for and duly elected members of the Society:—

Alexander, Louis Charles, LL.D., 17, New Bridge-street, E.C.
Austen, Francis, 1, Prince's-gate, S.W.
Cox, John A. D., 11, Royal-crescent, Notting-hill, W.
Dillon, Charles Coleman, care of Mr. Nuttall, Hartley Institution, Southampton.
Foster, Frederick, 316, Essex-road, N.
Moor, Robert Henry, Ph.D., 145, Packington-street, N.
Rowsell, F. W., Admiralty, S.W.
Sharpley, Charles John, 20a, Vincent-square, S.W.
Smith, George, 151, Strand, W.C.

The Paper read was—

ORNAMENTATION CONSIDERED AS HIGH ART.

By Dr. Christopher Dresser, F.L.S.

I come here on this occasion with the view of asking you to consider with me an art which I regard as of the highest nature, and as second to none in its power of appealing to our wants, feelings, and passions; and this I do with a strong feeling of earnestness of desire, as the art of which I have to speak is often slighted, and placed beneath its legitimate sisters even by those whom we should expect to extol it. But this is done through ignorance of its nature and powers. My simple endeavour this evening will be to reveal its true character, and to show that ornamentation, as an art, is of the very highest, and that it has claims upon our sympathy, affections, and regard which no other art has.

It is not for me here to trouble you with a thousand proofs, such as I might offer, of the low esteem in which the art of ornamentation is held by many; how the works of the ornamentist are spoken of as unworthy of comparison with those of the pictorial artist, or, as it is generally put, with those of an artist. I will not bring before you proofs of this feeling, nor will I illustrate how it lingers in high places. But allow me to say that I believe the story of "Cinderella" is in this matter being acted before us, and that when the story is read on we shall find that the despised sister has become the chosen one, and that the drudge, through innate greatness, has taken the highest place.

All the fine arts have one quality in common, which would appear to give them affinity with that for which the alchemists sought, which is this—they possess in a marvellous degree the power of converting base material into precious gold.

A block of marble has a certain money value. In the hands of the sculptor, it becomes a work of beauty and of grace, and the marble is now worth more by a hundredfold than it was prior to the exercise of the sculptor's skill upon it. A plain canvas, a few pigments, and a brush are comparatively worthless, but, by the painter's skill, a work is formed with them that is convertible for money-changers' nuggets; and in like manner mere earth or clay, under the hand of the ornamentist, is shaped into a vase, which, by the addition of a few colours, becomes a work having those qualities which render it transmutable into a pile of gold.

I might notice other particulars in which all the fine arts exert a like power, but I will not at present do so; and I have named this one quality which they possess in common with the view of showing that it is eminently desirable that art, in all its forms, should be fostered by the country; for whatever enables the nation to draw to itself wealth, without involving it in any great impoverishment or expenditure of its native material, it should always encourage by all legitimate means in its power.

What is art? It may be said to be the disposition or modification of things by human skill or taste, in a manner which secures the awakening of pleasurable, or desirable, emotions of the passions, intellect, or soul of those to whom the art addresses itself.

But this is art in its broader sense, including that of the musician as well as what we may call, for distinction sake, fine art. What, then, is fine art?

Fine art is that which affects the passions, intellect, or soul pleasurably, by the aid of form and colour. But I claim for ornamentation that it is not simply art—that it is not fine art merely—but that it is high art. What, then, is high art?

High art may be said to be an instructive hieroglyph of beauty. It is symbolised imagination or emotion, such as is calculated to teach some moral lesson or impress some important truth. It is that which appeals in forms of beauty to the passions, intellect, or soul of those to whom it is addressed, in such a manner as to induce the ennobling of their nature through the gratification of the eyes. It is the moral principle of art set forth in harmonious combinations of shapes and colours.

I must now ask you to inquire with me into the difference between pictorial and ornamental art, and to consider what each of these branches of art has done and may do; and then I will leave you to judge whether or not ornamentation is a high art.

Upon pictorial art I will leave a pictorial artist to speak; I therefore make an extract from the "Report on Design," prepared with reference to the International Exhibition of 1851, by Richard Redgrave, Esq., R.A., a work which, as an expression of those principles which should govern the production of decorated works, has never been equalled, to my knowledge, although it was written at a time when a true form of decorative art could scarcely be said to have an existence in England. Hear what Mr. Redgrave says:—Pictorial "art has its childhood in a careful imitation of nature, and grows into an abstract imitation or generalisation of nature's highest beauties and rarest excellencies—still, however, imitatively rendered—and nature, thus selected, becomes the vehicle for impressing men with the thoughts, the passions, and the feelings which fill the imaginative mind of the artist. The generalised imitation of nature is the language in which these imaginative abstractions are embodied and expressed, and this whether the artist be sculptor or painter; the landscape painter even proceeds on the same principle, and endeavours by a selected imitation to reproduce the aspect of nature, in harmony with certain feelings which fill his mind and which he wishes to impress on the mind of others. In its lower phases, art relies more and more on imitation, seeking to give pleasure only by the reproduction of beautiful objects or beautiful combinations, until, in its lowest development, art, if it can be so called, rests contented with mere imitation."

Mr. Redgrave thus tells us that, in its childhood, art consists in the imitation of nature, and in maturity of generalised imitation, employed as a means whereby one man impresses the mind of another with the thoughts, passions, or feelings which fill his own mind.

This is apparent in Mr. Redgrave's remarks just quoted, that he regards that as the lowest art in which imitation merely is achieved, and that as a higher form in which generalisation and other mental operations have so acted upon the imitations of natural objects as to reduce them to a common harmony, or as to cause them to utter some common sentiment.

Probably all artists will agree with Mr. Redgrave in his view of the more exalted and more degraded forms of art. Indeed, Mr. Redgrave is obviously right, for a merely imitative work is an attempt at a lie, as it seeks to make us believe that it is that of which it is but an imitation. Such works I detest.

But to this fact alone I wish to call attention—that that work which embodies, if I may thus express myself, the greatest amount of mind, or thought, or intellect, provided the mind is highly cultured, the thought judicious and carefully arranged, and the intellect refined, is the best or most noble.

This is obviously a correct position, for it is mind which makes man, while yet an animal, greater than a mere animal—it is mind which links man with the spiritual Creator of all things. Mind is, in a sense, the image in man of the Creator by whom he was called into being. Further, it is God-like, and therefore noble to create. The monkey can imitate, but it cannot create. The Creator has bestowed upon man powers of creation which it is his duty to employ wisely and well, and for the proper exercise of which powers he must be held responsible.

The creative power of the mind, like all other powers with which man is gifted, is capable of cultivation, development, and refinement; and that work is most noble, if of man's creation, which is wholly of mental origin—that is, which is to no extent imitative, and which presents the greatest manifestation of refinement, knowledge, and judicious culture on the part of its creator.

It is an interesting fact that the mind of an artist can hold communion, through his works, with people of all nationalities, and of all times after him. Yet so it is. The artist, then, holds in his hands a power greater than that of any other who addresses himself to the world, and happy is that man who faithfully uses the power at his command.

In the "Report on Design," already alluded to, Mr. Redgrave says, when speaking of stained window glass:—"It would seem, indeed, that the painters (of the 12th and 13th centuries) did not intend to simulate a picture, but rather to symbolise a sacred text or thought, and the figures, therefore, were not so much pictorially arranged as composed with extreme monumental simplicity; thus they not only partook of the general effect of the window, but the attention of the spectator, impressed with the solemn yet beautiful light, was at the same time filled with the holy thought conveyed by the subject, without being distracted by too great an individuality of parts."

It must be noticed respecting these early windows that they were works intermediate in character between true pictures on the one hand, and an ormanental composition on the other; they were pictures so far as they represented idealised reality, but they were works of ornamentation so far as the pictorial elements were sacrificed to the decorative effect of the window; and while thus intermediate, as works, between pictorial and ornamental art, they are yet undeniably illustrations of a true high art, as they cause the soul to be absorbed in holy thoughts when contemplating them.

We have seen what constitutes pictorial fine art, and we have seen that pictorial works of an ornamental character may be works of high art. Let us consider, then, what constitutes ornamentation.

In order that there may be no confusion of ideas, mark particularly the difference between such works as these early windows and those so-called decorations which I may describe as consisting of pictorial scraps employed as ornament—such, for instance, as some of the Roman and Pompeian painted decorations—the arabesques of Raphael, and naturalistic decorations of all kinds, as floral wall papers. The former alone I desire to regard as works of high art, for the latter are to me but so many detestable falsities, such as we could but expect to see when one art endeavours to supplant another, while it has not the necessary qualifications for so doing.

Ornamentation, as I understand it, is symbolised imagination or emotion, simply and purely; and herein it differs essentially from pictorial art, which in its highest development is symbolised imagination or emotion, representing idealised reality. I need not refer in detail to the past great national developments of art to show you that this is the case, and to illustrate the manner in which imagination or emotion was symbolised in various ornaments. In those grand temples which were raised in Egypt under the Pharaohs, ornamentation may be said to have had its infancy, its birth having occurred in a prior age of comparative barbarism. But notice that the amount of true ornament created by the Egyptians was small, the major portion of their decorative forms consisting of plants conventionally represented. Mark this—the lotus flowers and papyrii which they portrayed on their temples, mummy cases, and domestic articles, were in character precisely similar to the coloured windows of the twelfth and thirteenth centuries—that is, they were works of symbolised imagination or emotion, representing idealised reality.

Such Egyptian ornament as consists of idealised plants is ornament in its infancy. Yet in its infancy it is precisely similar in character with the highest works of pictorial art, for every form which was portrayed, whether that of a lotus or a papyrus, or whatever it might be, told of some duty to be performed, some object to be adored, some spirit affording protection, or of some hope in the future. Hence they were not only so many forms of idealised reality symbolising imagination or emotion, but were also forms calculated to teach some moral lesson, or to inculcate some important truth.

Egyptian ornamentation was followed by that of Greece, where every form expressed, or was a symbol of, the refinement and knowledge of the age which called it forth. The Greeks were feelingly alive to the bounteous gifts of nature, and "conceiving God in the image of man, they made men like gods;" and by thus believing that man could attain to the attributes of a god by culture, refinement, and heroism, they devoted themselves to the highest intellectual improvement, and sought to embody their utmost subtleties of refined conceptions in the ornament which they created. Greek ornamentation is not meaningless—it is a noble expression, in beautiful form, of knowledge and refinement, such as manifests a marvellously high state of intellectual culture; and be it remembered that this, the first true national development of a purely ideal form of ornamental art of which I have spoken, had to a great extent an independent growth, for Egyptian ornament could not have supplied it, not having itself attained to such lofty ideality; and Assyrian art, to which it bears some faint resemblance, was coarse and vulgar, being totally devoid of tenderness of expression or delicacy of form. I regard Greek ornamentation as a beautiful expression of a true form of art, as it consists purely of symbolised imagination or emotion.

I have not time in which to notice the gorgeous ornament which developed itself in India, Formosa, China, and Japan, and can merely mention one or two forms which ornamental art assumed, as it descended in a more or less direct line from the Greek period to our own time.

Notice, first, Arabian ornament, with its dialects, as I may call them, the Moorish or Alhambraic, and the

Turkish. In these associated forms of ornamentation we have displayed before us a perfect mystery of beauty. In some of their compositions there is a breaking up of the decorated surface into parts, such as bear to one another a proportional relation of the most subtle order. There is an intricacy of plot in the design which is of the most ingenious character, a simplicity of detail which causes us to marvel when we contemplate the art effects achieved with such material, and a general harmony of all the parts, both in form and colour, into one great concordant whole, which is perfectly charming. Thus the cultured intellect in this case, as well as in that of the Greeks, impressed itself upon time through the instrumentality of beautiful forms.

Again, then, we have a true development of ornamentation, for we have here also symbolised imagination or emotion, and have not any setting forth of idealised reality.

The next great style to which I must refer is the Celtic, a form which arose subsequently to the Christian faith, and was practised by the early monks. On it I will not dwell, but it is another form of ornamentation, and on no works ever produced were more labour and more love expended than on some of the ancient manuscripts which were enriched with Celtic ornament.

I have said sufficient to enable us clearly to see certain facts:—

1. Ornamental and pictorial art have been united, in order to the production of certain works, as the decorated windows of the 12th and 13th centuries, and the conventionally-treated floral subjects (and, I might add, figure subjects also) which adorned the Egyptian temples.
2. That when thus united they constituted, in the truest meaning of the expression, works of high art.
3. That those works which are most fully of mental origin, provided the impress of mind which they bear is holy and pure, are those which are most noble.
4. That pictorial art can, in its highest development, only symbolise imagination or emotion by the representation of idealised reality.
5. That true ornamentation is of purely mental origin, and consists of symbolised imagination or emotion only.

I therefore argue that ornamentation is not only fine art, but that it is high art, and that it is, indeed, even a higher art than that practised by the pictorial artist, as it is wholly of mental origin.

This being the case, it is worthy of notice that ornamentation in its higher forms has always been the handmaid of religion, waiting upon it and serving it with a purity of purpose. The faith of the Greeks was expressed in their ornaments, and with the decorative forms of Arabian, Turkish, and Moresque art passages from the Koran have always been richly interspersed; in the latter case the aim of the artist has been to call attention to the sentiments uttered, by giving to them beautiful surroundings, and to convey an idea of the value of the truths recorded by placing them in contact with such work as is most beautiful and most true. It is so also with Celtic ornament. The finest patterns are here formed surrounding texts from our Scriptures, and thus calling attention to them; and these, by the intricate, yet beautiful, entanglement of lines which they present, symbolise the mystery to be unravelled by searching into the meaning of the scriptural expression. Religion will go hand in hand with a pure development of that creative mind which God has given to us; but, directly purity of purpose is replaced by any low or sordid motives, then religion departs and leaves man to work out his own degradation; while it is a high art, and while a high art only, will religion continue to associate itself with it in the work of moral teaching.

There is one fact which I must now ask you to notice—a fact in which I take the utmost pride, which is this—that ornamentation has ever united itself with works of utility, whereby it has attained to universality of power.

I take pleasure in this thought, I say, that ornamentation has even joined itself with works of usefulness, and this I do because it is pleasant to me to feel that I am ministering to other things in a manner that bestows upon them qualities such as ennoble them, and make them better than they would be without such ministrations. It has been said that "It is not good for man to live alone;" so I think it may be well that art should not live alone, and as it is right that the child be ministered to by those who give to it education of the intellect, grace of manner, and general attractiveness, and as it is right that the sick be ministered to in such a way as shall induce the bestowal of the charm of health, so I think it right and pleasant for our art to minister to common objects in such a manner as gives to them excellent qualities.

Especially do I take pride in this association of my beloved art with works of utility, when I think it has lent an exalted charm to that which would without it be merely an article of usefulness, and that it has taught many an earnest lesson, as it has appealed from the wall, which, without it, would merely keep out the weather, from a mat on which the knee has been bowed, or from a simple object of domestic service, as a cup or a bowl. If ornamentation is a high art, and consequently a moral teacher, as it certainly is, how interesting is the thought of its universality, both as regards time and geographical area. Ornamentation is the first art which man originates. The savage carves his war-spear, and the paddle with which he propels his canoe, into ornamental devices, and this he does long before he seeks to imitate, in a pictorial or sculpturesque manner, the forms of nature; and this ornamentation which he produces is not a form of art which is to lead up to pictorial work, as something which is higher than it, and then be abandoned; on the contrary, it is an art the highest developments of which have been contemporary with the highest forms of civilisation. It arose in a far-off antiquity, as a sort of natural outgoing of man's mind; it developed itself with the civilisation of the Pharaohs; it flourished in Greece during the period of its highest refinement; and it has been the unvarying accompaniment of every marked period of mental or moral refinement.

Notice also its universality, as regards geographical distribution. In England, we have ornamentation of some sort, or attempts at its production, associated with every object to which it can be applied. There is scarcely a carpet, a lamp, a bowl, a wall-paper, a window-hanging, on which some sort of pattern is not found. And England presents no exception to the general rule, for it is so, not in England only—not in Europe only—but wherever civilisation is found, and even further yet, for the wandering and savage tribes employ it on the few simple articles which they make. Works of ornamental art are not confined, then, to the few; they are not the inheritance of the rich merely, for it is amidst them that we live, and move, and have our being. Ornamental, beyond all other arts, is cosmopolitan in character. This being the case, what a power it might become for good if always employed as high art—if always utilised as the teacher of morals, and the handmaid of religion. I rejoice in its universality, as it may become a mighty instrument of good.

These considerations are all-important to us, as England is the manufactory of the world's goods. Believe me, that it is not sufficient that our art minister to the caprices of the uneducated, or the depravity of patrons, nor even to those who seek after beauty merely; if a true art, it is above all this, and the artist—the producer of art—is unworthy of the name which he bears if he does not use his every influence to so employ form and colour as to elevate his fellow men. Think, my brother artists, of the vast area over which your works may spread, in these days of quick transit. Think of the good which you are sowing broadcast, if your works are but noble and pure, and then, I pray you, devote yourselves earnestly to the good work at which you labour.

These considerations lead me to notice that ornamentation as a high art must be *truthful*, *beautiful*, and *powerful* in expression, for if not so it cannot be a moral teacher.

There is no expression of which man is capable which is more god-like than that of truth. Truth, how noble, how beautiful, how righteous to utter it, and how degrading is falsehood; yet we see falsehood preferred to truth—that which debases to that which exalts—in art as well as morals; and I fear that, as now practised, there is almost as much that is false, degrading, and untrue in my beautiful art, as there is of the noble, righteous, and exalted, although art should only be practised by ennobling hands. It is this grovelling art, this so-called ornamentation which tends to debase rather than exalt, to degrade rather than make noble, to foster a lie rather than utter truth, which brings about the abasement of our calling, and causes our art in many instances to fail in taking hold of and clinging to the affections of the noble and great. If it were but invariably truthful in its utterance, we could then reasonably expect that it would prosper, having the sanction of the Most High.

All graining of wood is false, as it attempts to deceive, the effort being made at causing one material to look like another, which it is not. All "marbling" is false. A Brussels carpet that imitates a Turkey carpet is false, so is a printed fabric that imitates one which is woven, a gas-lamp that imitates an oil-lamp, and a flat ornament that imitates carved or relief forms of any kind. These are all untruths of expression, and are besides vulgar absurdities, which are the more lamentable as the imitation and the false representation are always of a lower order than the works imitated.

To some present a portion, at least, of the falsities which I have mentioned may appear as little matters, but this is not the case. I cannot believe in little sins and big sins, and even were there such, the little leads to the greater. The thief commences his downward career by little thefts. Mark this—if not truthful in little things, there is but a small chance of a man remaining so in great matters. To the ornamentist I say, and this I do earnestly, that if our art is to prosper, and to take hold of the affections of the noble and the pure,—if it is to have the sanction of that Being who has given to man the power of producing the beautiful, it must be truthful in its minutest utterance.

Away, then, I say, with those detestable decorations which are now beginning to falsify the ceilings of the South Kensington Museum, and are teaching the public that a lying art is that which is worthy of their consideration and of national regard. Away with that, I say, which does not conform to this the first of all requirements—truth. Do you not know that whenever art has nationally departed from truthful utterance—when it has sought to deceive, rather than lead the mind upward to the fountain of all truth, that then has come its final overthrow. Pompeian art was false, and Pompeii was destroyed. French art, with all its prettiness, was not truthful, and France has fallen. Unless there is a noble aim in the productions of our art—an aim beyond that of merely pleasing the beholder, it cannot be a high art, and it cannot maintain a prolonged existence.

I must now notice my second statement, which is, that ornamentation must be beautiful in its expression. I need not enlarge upon this assertion, for that which is not beautiful can rarely be ornamental; but this I may say, that which is beautiful manifests no want, no shortcoming. A composition that is beautiful must have no parts that can be taken from it while the composition yet remains equally good or better. The perfectly beautiful is that which admits of no improvement. The beautiful is loveable, and as that which is loveable takes hold of the affections and clings to them, binding itself firmer as time rolls on. If an object is really beautiful we do not tire of it, fashion does not induce us to change it, the merely new does not displace it. It becomes as an old friend, more loved as its good qualities are better understood.

My third statement was this—that ornamentation must be powerful in its utterance. If power is absent from a composition, weakness is the result, the manifestation of which cannot be pleasant. Weakness is childish, it is infantine; power is manly; power is God-like. With what power do the plants issue from the earth in spring! With what power do the buds develop into branches! The powerful orator is the man we admire, the powerful thinker the man we esteem. Even the simple power, or brute force, of animals we involuntarily approve, for power is antagonistic to weakness. Power also manifests earnestness; power means energy; power signifies a conqueror. Our compositions, then, must be powerful.

But besides all this, we, the professors of the art of ornamentation, must manifest power in our works, for being sent as teachers to instruct, ennoble, and elevate our fellow-creatures, we shall not be believed if we do not utter our truths with power. Let truth, then, be uttered with power, and in the form of beauty.

Here, again, we find the new ceiling decorations at the South Kensington Museum wanting, for they are not only without truthfulness, but they are as feeble in expression as a new-born babe. Look at the sketch decoration of the refreshment room, or at the finished ceilings in the Majolica Court, and you will be astonished, I think, at the almost total absence of all that is beautiful, true, and ennobling in art. If a selection of the deformities of the most debased styles of ornamentation had been made, and that when these styles were in their worst periods, I cannot conceive of more unworthy results being achieved. In the name of Truth, in the name of Beauty, in the name of Power, I protest against such.

I can only account for this national fostering of a quasi-Romanesque or Renaissance art in this way. Such a style does not consist of true ornament at all, but of pictorially treated fragments, as I have before said. It is, therefore, misapplied pictorial art, and has no association with true ornamentation. This being the case, and the authorities of the South Kensington Museum being either pictorial artists or men with pictorial tastes, this fostering of a detestable mongrel art can be understood, yet it is none the less lamentable.

One great aim of the ornamentist must ever be the production of repose. The great ornamentists of past ages have been those men who achieved this most desirable result. To spend life where this is not achieved is, to the informed and sensitive mind, to be subjected to continued misery. The production of this repose cannot be arrived at by any Romanesque or Arabesque treatment, for these involve the production of pictorial fragments, each of which must be a "spot" in the composition, as it is a centre to which the eye is called. For this reason, were there no other, I should object to these styles; but, beyond all this, such treatments are untruthful in their expression.

In this one fact, however, I rejoice. The authorities of the South Kensington Museum, if I rightly understand their characters, are men who have only to be shown that they are wrong in order that they put matters right. I hope, then, that my remarks this evening may reach their ears, and cause the much-desired enlightenment of their understanding.

My time has gone, or I should have sought to show you that the art for which I now plead can soothe, as does sweet music, can cheer, as does the merry air, can hush to reverie, as does the solemn anthem; in short, that it can express and minister to all the various emotions of the passions or soul.

Let me draw one parallel, and I have done. Contemplate with me a great picture, say "The Light of the World," by Holman Hunt, and listen to its teachings, for it is a work of high art. There is the door which has long been closed against all good influences, and this door is almost inapproachable by reason of the thorns and brambles which have grown up outside, and even the path to the door is well nigh impassable by reason of weeds—tall weeds—weeds that have run to seed in their rankness. But at the door there stands One knocking and asking admittance, One who has brought with him a light, in order that the uncleanness of the house may be seen, and the occupant led to seek assistance, which He who has brought the light is willing to give, in order that his abode may be cleansed and set in order. We all know the picture, and we all feel that it is a beautiful expression, in form and colour, of a most beautiful parable. But let us leave this picture, and turn to the contemplation of a simple Mahommedan mat, and hearken to its teachings. The nature of the pattern which it presents is simply this—its proportions are beautiful, the general treatment is true, its forms are most refined; its parts are "composed" in a simple yet powerful manner; and interwoven with the ornament is a passage from the Koran, inviting to prayer. Mark all the beauty which this simple work presents—the beauty of composition and detail, the refinement of expression, the careful employment of best material, and above all, the perfectness of the harmony between the parts of the work; a harmony which causes this little carpet to appeal to the eye as a burst of soft concordant sounds does to the ear. When I look at such a work I feel its full and rich general harmonious utterance; and I am not dead to the more subdued, yet not less beautiful, secondary and tertiary harmonies of the secondary and tertiary parts, for these are like the varying notes of the rippling brook, when mingled with the deeper music of harmonious voices. And to what is all this harmony—yea, this concord of harmonies—dedicated? To the service of the Mahometan's God; for the pattern of his prayer carpet—for this it is—points in one direction, and the devotee sets the point towards Mecca, the sacred city of his spiritual king. Think you not that this carpet is a work of high art? It truly is, and yet it is a work which contains no portrayal of natural forms, but is purely a creation of that intellect with which God has endowed his creature, Man.

DISCUSSION.

The Chairman said he was sure that all must feel indebted to Dr. Dresser for his very interesting and suggestive paper. The subject was one which, unfortunately, had not attracted so much attention in this country as its important merits deserved, but he was happy to think it was becoming, year by year, more highly appreciated and thought of. He had been told recently, by one of the largest importers of French wall-papers, that he was in the habit of having his designs prepared in this country at the South Kensington Museum, and sent to France to be manufactured, because he found that the patterns were better done in this country than in France, and more highly appreciated. He hoped, therefore, that somebody would say a word in behalf of South Kensington; but whether everything in the paper was adopted or not, all present must feel deeply indebted to Dr. Dresser for the time and pains he had bestowed on this most interesting topic.

Mr. George Wallis congratulated the Society on the subject being taken up, inasmuch as it was one which required more ventilation in this country than it had received of late years. It was his good fortune to take it up thirty years ago, and at that time it attracted much more attention than it did now. At that period schools of art were about being established, and it really became a question whether the hideous wilderness of profound ugliness which prevailed in every class of manufacture and decoration at that period, and which his friend Dr. Dresser was too young to have seen, was to last for ever. However, a great deal of that had been got rid of, and a considerable number of phases had been gone through with respect to ornamental art. First of all, there was a kind of imitation of French art, nearly all English designs being then made in France. In metal work, the idea was to put as much brass and iron as possible into the work rather than as much artistic skill as could be employed in its production, for instance; chandeliers were made in Birmingham the ponderosity of which would surprise people in the present day. Again, in textile fabrics, in which the French at that time were pre-eminent, the patterns produced would astound any one now. The ultra-imitations of nature which were printed and woven for furniture chintzes and ladies' dresses were something marvellous; and, of course, when they were cut up, as they had to be by the upholsterer or the dressmaker, the whole symmetry of the thing was destroyed. After a while, the question came up, "What is ornamental art?" and on that point he should preach the same doctrine as he did at the time he had referred to, viz., that the highest art was that in which the greatest and most expressive symbolism was displayed, whether in pictorial representation or in simple ornamentation. The ancients, having a knowledge of symbolism, and having something to express by the merest lotus flower or the simplest detail which they used in their ornament, could make ornament where the moderns could not; they could read it as a language, in fact, they had no other, and this art, which had now become so degraded, took its place as a teacher of the people, and there was in all these things an exoteric meaning for the initiated. All this was now gone; and in his early lectures on the subject, from 1844 to 1849, he endeavoured to show, that by some means or other, all decorative art should endeavour to bring some pleasant association to the mind, in short, that something in the shape of symbolism should be arrived at. It was taken up to a certain extent, and tea and coffee pots and potato bowls were decorated with the representation of tea, coffee, and potato plants. This kind of thing had its day, but it was now fortunately gone out, although it was certainly a step in the right direction. Then came a later period, and a feeling arose in favour of a style of which Dr. Dresser was a very profound and learned disciple, about the time of the publication in this country of Mr. Owen Jones's work on the Alhambra, and it was discovered that there was something in geometry as applied to ornament, and that the true proportion of various parts was an essential element in its nature. Something had been done in this way, though but very little before the Exhibition of 1851, when everything was to be Indianised. An endeavour, too, was made to find some means by which the pine pattern, which had been used by the Indians for a couple of thousand years, could be superseded. One enterprising Frenchman solved the problem, by decorating a shawl in such a way as to bring in the requisite amount of colour without using this pine decoration; but the form he adopted was the façade of a great temple, and, of course, when the shawl was in use, the minaret came up to each shoulder, and a dome to the wearer's neck, and the base of the structure was arranged to hang about her feet. This gentleman showed all the enthusiasm and earnestness of a deeply-injured Frenchman, because the Jury of the Great Exhibition of 1851 would not give him the Council Medal for his grand discovery. Comparatively little was being done at the present day by our schools of art in such direction. The application of ornament was more at a discount than ever, but he must say be believed the public was principally at fault. The public still continued to believe that nothing was true art except pictorial art, and the result was, that the students of our schools, instead of devoting themselves to studying ornamental art, and making themselves acquainted with the simple principles which prevailed in early times, going to nature and that science—botany—of which Dr. Dresser was so distinguished a professor, were led away to landscape and pictorial art generally. From 17 years of hard work in these schools, concluding in 1858, he might say that his difficulty always was to impress his students with any love whatever for ornamental art. They would study figure and landscape art, and go through a great deal of hard work in its pursuit, but nothing else than compulsion could induce them to study earnestly and truthfully the principles of ornamental design. This was a bad sign, and, therefore, he hailed the appearance of such a paper as that which they had just heard with satisfaction, although, at the same time, he was not prepared to endorse everything which Dr. Dresser had said. He would not take upon himself to defend South Kensington Museum in everything, but he must say that, if buildings were erected in a Renaissance style, they ought to be decorated with Renaissance ornaments. At the same time, he did not at all advocate importing foreign forms from any country in the world into England. He believed England had an architecture of her own, and an art of her own in past times, specimens of which might be seen in our old mansions and cathedrals. What was wanted, in his opinion, was an English art for England, and this was, after all, one of the great points to be considered. What were the characteristics of our own country, and what was required for our own domestic uses, whether in the construction of our houses, whether in the decoration of our furniture, or for the production of the simplest utilities of life. He believed all these things could be thoroughly English in their character, and in that way only would they call forth and appeal to the natural desires and feelings of Englishmen.

Mr. Burchett said he could not remain silent or refrain from making some remarks upon the observations he had heard. With regard to South Kensington ornamentation, he would leave that to stand on its own merits, but the question of narrowing ornament, which really lay at the root of the matter, to floral treatment, was a mistake. While listening to Dr. Dresser's paper he could not help being reminded of the old legend of the town which a shoemaker proposed to fortify with leather, and he hoped Dr. Dresser would forgive him for making what might appear a personal observation; but he remembered him as an extremely clever student, particularly in the matter of plants and floral forms, and his having distinguished himself in that way, not only at Somerset-house but also at Kew, where he made a high reputation. He was bound to say, however, that Dr. Dresser never was a student of the figure, and that, he believed, had a great deal to do with the views he entertained on the subject. There was no doubt of the infinite beauty that nature possessed and suggested in the vegetable world, but he could not consent to say that all those noble works that antiquity had left, beginning with the pediments and friezes of the Parthenon, and all that Raphael and Michael Angelo had done, was not ornamental art. It was ornamental art, or nothing, for certainly it was not dramatic. It was subjected to every condition of ornamental art, and it was structural and belonged to the building; and he took it, if ornamentation and what was called high art were to be defined, the line must be drawn very carefully between them. He did not like the term "high art," as it had been most frightfully abused; but when all was said that could be said as to the beauty of floral and vegetable nature, he saw no reason for excluding the human figure, which was, after all, the noblest of God's created works. Mr. Wallis said that ornamentation was now at a discount, but he felt that he had a right to say that, at any rate with regard to London, during the last twenty-five years, all of which time he had been engaged as a teacher, that was not the case. The Schools of Design were started under most extraordinary limitations and difficulties, such as were known only to those who had to work them. He remembered the time when it was really a question before the governing council whether it would be legitimate for a mason to make designs for chimney-pieces in the school; and there were questions of clashing with trade influences which had not altogether disappeared at the present day. And so with the study of the figure. When he was at Somerset-house, twenty-seven years ago, he believed that he obtained a sort of illicit admission to the figure class, on the plea that he required a knowledge of the figure for sign painting. There was very little steady study of ornamental art at that time, but it had gone on increasing in an undiminished ratio down to the present. Mention had been made of designs being purchased for the French manufacturers from the South Kensington Schools, and this was quite true; and he might say the class for the study of botanical forms, which Dr. Dresser long conducted at the school at Kensington, was still in operation, and was more numerously attended than ever. The results of these schools could be seen by anyone who inspected the annual competition specimens, or those which were constantly on view in the corridors, and this would show that that branch of study was by no means neglected. He thought the public ought to know what was really the nature and scope of the schools and their work; and above all things, they should learn not to be drawing little narrow lines, saying this was ornament and this was not, and this was true and that was not true. There was plenty of room for discussing what was true ornament and what was false without eliminating from it such a noble thing as the human figure. There were certain things that no floral ornamentation could touch in the human mind; and all must allow that that art which appealed to the sympathies and to the stronger feelings of human nature must be the highest and the noblest. That certainly was not in floral forms, for they certainly did stop short of this, in their highest limit of development of beauty, and all must admit that mere beauty was not the highest quality in human nature.

Mr. George Augustus Sala thought it but an act of justice to South Kensington, which had been so valiantly assailed by Dr. Dresser, that all middle-aged men should record their remembrance of the fact that, nearly twenty years ago, when the institution at South Kensington was at Marlborough-house, in Pall-mall, there was organised an exhibition, not only to teach what was beautiful, but to show that which was ugly. He recollected very well seeing on the staircase at Marlborough-house the most astonishing collection of ugly designs perhaps ever seen in the civilised world—the most hideous carpets, horrible floor-cloths, and frightful wall-papers there hung up, as a bat is nailed to a barn-door, to serve as warnings and examples. Certainly, he who showed the wrong way was entitled to a proportionate meed of commendation with him who pointed the other way. With regard to the question, what was high art, he thought it would be simplifying the task had Dr. Dresser distinguished between ornamentation and decoration, for albeit they might be convertible terms, and were apt occasionally to confuse the mind, he thought there was a distinction between them. To him, a magnificent chimney-piece was decoration, because it was an integral part of the structure of the house in which it was placed, whereas ornamentation might be a clock on the chimney piece, or the lustres or vases thereon. The magnificent and historic pictures around that room were decorations, but a picture or photograph hung up simply by a nail to the wall he should call ornamentation. Again, Dr. Dresser had gone into the question whether ornamentation could be considered as fine art; or rather, as high art; or rather, as the highest class of high art. To him, the "Transfiguration" of Raphael, the "Assumption of the Virgin" of Titian, and "The Bull" of Paul Potter, each and all were of the highest kind of art, simply because in every one of these performances he recognised the highest achievement of human genius. Each had done whatever it was possible for human genius to do, making the most of its endowment by God, by the assistance of sedulous study and industry. There was a high and low status in art, but the lowest and meanest article, a pot or pan, or brass-kettle, might, by industry, skill, ingenuity, and the employment of those gifts which the Almighty had given us, be ennobled to the highest and most exalted degree. With regard to the other point which Dr. Dresser took up, which was that of truth in art, he had started a vexed and perplexing question. He objected to anything in the shape of falsity in ornamentation, and said we must have strict literal puritanical truth. But what was truth? Pilate once asked this question, and did not stay for the answer, and, in his opinion, Pilate acted wisely in so doing, for had he stayed he would have received so many definitions that it might have driven him mad. According to Dr. Dresser, to be truthful in ornamentation, you must not introduce marbling; you must not present a flat surface as a round one; you must not imitate the graining of wood. But why? What was a picture? What was pictorial art but one course of simulation of the grain of marble, of the texture of flesh, of the fluff of velvet, of the sheen of satin, of the texture of leaves and flowers, and everything beautiful in nature, including even the clouds? Were simulation to be excluded from art, it must die at once, or be reduced to the miserable proportions of a Chinese tea-chest. In conclusion, he would record his opinion that decoration and ornamentation might become a high art, but was not necessarily so. For instance, the first ornamental art was embodied in the pleasant old legend of the origin of the Corinthian column. A child died; the nurse took a basket full of the toys the child was wont to play with, and placed it on the tomb, with a tile to keep the toys down; the *Acanthus* beneath sprang up, and twined around. So the Corinthian column was formed; the basket was the beginning of the structure, the *Acanthus* that sprung up was the ornamentation. As Mr. Burchett had so admirably said, they should by no means narrow ornamental art, but let it be as wide as the universe. Let flowers, figures, everything be represented, but let us always remember that our great aim and end in ornament and in art was not merely truth, as Dr. Dresser exemplified it, but also the development of every resource within us with the most sedulous industry, and also to endeavour that whatever we do shall be calculated to elevate, to refine, and to ennoble society.

Mr. Edward Hall, F.S.A., said he should be sorry if a gentleman of so much influence as Mr. Sala were allowed to disseminate, without correction, a doctrine which certainly did not meet with the approval, at any rate, of the bulk of architectural artists. He thought he might say, without fear of contradiction, that the object of art was not imitation; he would indeed go so far as to say that in any work of art, whether high art, as it was generally termed, historic art, in sculpture, or in ornamental or decorative art, the object was not imitation. He should rather adopt as the definition that which appeared on the front page of one of the Royal Academy catalogues, from the pen of Dr. Johnson, something to this effect:—"That works of art give pain or pleasure, not because they are likely to be mistaken for realities, but because they bring realities to mind." If the object of high art was imitation, the highest art would be that of Madame Tussaud. He was inclined, therefore, to go cordially with Dr. Dresser, inasmuch as he felt that ornamental art, which he considered was principally connected with his own branch of it, was high art, because it depended more upon the embodiment of mental emotion than that in which a deal of imitation was exhibited, the object being to produce a *fac-simile*. The question of coloured sculpture had been frequently discussed, and all would recollect the reasons given for preferring untinted sculpture. If time permitted, he could say a great deal on the question of imitating wood and marble, but it was recognised by even the most vulgar that the object of the painter was not imitation but representation. In the picture by Mr. Holman Hunt, to which allusion had been made in the paper, it was not the object of the artist to imitate, but to embody that which should suggest a train of thought and feeling to the mind of the spectator. There were, he believed, important principles which ought to be recognised both in decorative art and in that which Dr. Dresser called high art. The use of the object must be considered, and the intellect ought as much to be satisfied as the eye to be delighted, and that could only be done by observing perfect truthfulness, by imitating no material in such a manner as to make the work of art a sham. For instance, if the wall of a room were decorated with painted imitations of pillars, such a thing would be utterly bad from an architect's and an artistic point of view. Some years ago, Mr. Pugin put forth what he considered the correct principles of Gothic architecture, but in so doing he really promulgated the principles of all architecture; and in his opinion the main reason for the practice of imitating cornices by painters' and paper-hangers' work had been that painter-artists had had too much influence, and architect-artists too little. Undoubtedly, the human form ought to be introduced where suitable, and he had no doubt that Dr. Dresser would agree in this view; but if a wall, a carpet, or a floor were to be decorated, where the surface was absolutely flat, it ought not to be treated on the pictorial principle, but simply as a flat surface, as was done by the Arabs and Moors in their fine specimens. On the other hand, when a frieze like that of the Parthenon was to be decorated, an entirely different principle came into operation; there you might have relief; and either the human form, animals, or whatever was suitable and appropriate might be employed.

Mr. Hyde Clarke said the value of such a paper as that read by Dr. Dresser had been well exemplified by the differences of opinion which it had elicited; but after careful consideration, most persons would agree rather with Mr. Wallis, Mr. Burchett, and Mr. Sala, than with the doctrine of falsity which had been laid down with so much learning by the author of the paper. The standard of truth from Dr. Dresser's point of view was altogether artificial, and the facts and arguments put forward would not be found on close examination to bear out the doctrine which they were intended to support. Putting aside the word "imitation," which he had tried to frighten them with, and looking at the actual facts which Mr. Sala had brought forward, they all knew that pictorial art, which was decorative and imitative, did exist to a great degree, and gave a great deal of satisfaction. If there had been an abuse of imitation that was no reason why its proper application, including the imitation of the human figure, should be discountenanced. What was to be said of sculpture, especially the works of Phidias, the very merit of which consisted in their being an imitation of the human figure, although of course illustrated and elevated by the best properties of the human mind? It might be said that the models used in these cases were eclectic, but after all it was in reference to the human figure that some of the highest attributes of art depended. Some other of Dr. Dresser's views would hardly stand the test of examination in the light of facts. For instance, he had said that in ancient, and even in mediæval and modern times, everything in decoration and ornamentation depended on its religious character and purity. He was surprised that the author, with his knowledge of art and the details connected with it, could put forward such a statement, because it was well known to many that works by most religious persons had been of an impure character; indeed, it had been recently mentioned that in our cathedrals there were objects of this kind, the work of religious men, executed perhaps with some very religious motive, but still this did not eliminate the element of impurity. Dr. Dresser had given a very animated description of a Turkish prayer-carpet, and explained how it excited the feelings of the worshipper; and it was true that some of these carpets did contain an invocation or a prayer, but the general composition did not differ from that of an ordinary rug or carpet, except that, being made for a specific purpose, it had one end cut in a particular form, and the worshipper laid it down, if possible, by the aid of a compass, so that it should point towards the Kebla; still, the principles of ornamentation were the same as in an ordinary rug, and he was not aware that there was any religious idea in the mind of the dervishes when making them, or that any such was communicated to those who used them. It might also be a question whether some of the geometrical designs exhibited really suggested that repose which, it was said, was absolutely inseparable from those forms of art. For his own part, he must say that he often felt disturbed, in looking at one of those beautifully decorated ceilings which were to be found in the East, and he thought probably the design of the artist was in some degree to divert the mind, and so break it up, as it were, rather than to lull it into repose. He had not been convinced by Dr. Dresser that evening any more than he had been by his learned exhortations in former years. Mr. Wallis had brought forward one very important matter in connection with this subject, which had not been touched upon in the paper, viz., that there was a want of symbolism, which was afterwards defined to be a want of nationality in our works of art. In the present day, we certainly ought to be capable of producing something national, instead of running about picking up bits and scraps from every part of the world. There was no doubt a great want of nationality, but this was owing in great measure to the limited instruction of artists; they so devoted themselves to the study of their art that they left no time for, and often had no sympathy with, the other pursuits of the community. Notwithstanding, however, that he had opposed Dr. Dresser on some points, he could not but bear witness to the great value of his paper, especially in connection with the important subject of art-instruction. He had referred to the great economic value of communicating some mental expression to the common products of the country, and this could not be insisted on too strongly, particularly at a time like the present, when we were contending for the trade of the world, and when, from certain circumstances, there seemed a probability of England acquiring a greater share of foreign commerce than she had ever enjoyed before. It depended entirely on the degree of instruction given to our workmen whether the opportunity could be taken advantage of. The economical value of art could not be too much insisted upon. As to the study of the figure, it was in his view of the highest importance; and although it might tend to lead away some few pupils, that was rather attributable to defects in our system of school education than to any evil in the study of the figure itself. If, in every school, where, as he trusted would soon be the case, drawing was taught, instead of beginning to copy from drawings, the children were taught to copy from plants and flowers, Dr. Dresser's favourite subjects, they would be prepared, when they became workmen students in the schools of art, to make a proper use of the instruction given them in drawing from the human figure, having been already prepared in the study of nature. Mr. Hyde Clarke concluded by moving a cordial vote of thanks to Dr. Dresser.

Dr. Dresser, in reply to the remarks which had been made, said he was placed in rather a peculiar position, inasmuch as several of the speakers were personal friends, and one was his first instructor in art; nevertheless, after having studied art for 25 years, he had arrived at certain conclusions, which he earnestly believed to be correct, and which, therefore, he was bound to advocate, although, at the same time, he was quite ready to be convinced if he was wrong. He had objected to certain decorations at South Kensington. In order that he might be set right if he were in the wrong, he had requested the Secretary to invite all the different authorities connected with that institution to be present, in order that they might have an opportunity of fully replying to his objections. He was very glad to see that two or three of his friends, especially his old instructor, were present to take up the cudgels for South Kensington. He would add that there was not a man connected with it for whom he had not the greatest respect, and from most of the authorities he had received the most marked kindness. He had been somewhat surprised to find that the remarks of some of the speakers seemed to bear no relation to the arguments which he set forth, but simply to the incidental observation he had made with reference to the South Kensington decorations. He said that ornamentation was high art, and none of the remarks he had heard contraverted that position. Mr. Wallis was one of the first engaged in art-teaching in this country, for he remembered attending his lectures when quite a boy; he believed Mr. Wallis was one of the first to cause manufacturers to interest themselves in art work; and many years since he received the special thanks of the Board of Trade, under which the Schools of Design were then established, for the admirable manner in which he had introduced these art-schools to the notice of manufacturers. Mr. Wallis said that art was best which contained the most perfect symbolism, and he would go so far with him, provided always that the work was wholly of mental origin, for he could not help regarding mind as superior to matter. Symbolism might be of a low order, as for instance that of a potato on a vegetable dish, and such symbolism as that he did not care about. Even in the South Kensington Museum there was preserved to this day a glass water cup by Mr. Redgrave, which that gentleman produced in the infancy of art, which simply represented a water-lily. There, no doubt, was a symbol, but it was comparatively worthless, because there was nothing of an elevating character in its contemplation. He quite agreed with Mr. Wallis in his dislike of Indian and Moresque art being introduced into this country, and in his desire to see a truly national art which should respond to the wishes and feelings of Englishmen. Mr. Wallis blamed the public for the low state of decorative art, and justly so, no doubt; but he did not go quite so far in that respect. He did not know of any institution in the kingdom which afforded real instruction in ornamental art. The schools of design had done an incalculable amount of good, he knew perfectly well, but they did not train ornamentists, and comparatively few students educated in these schools ever devoted themselves to artistic ornamentation. He accounted for that in this way. Unfortunately, there was a gap, which some day no doubt South Kensington would supply, between what was produced in the school and the requirements of manufactures. He had known many who had failed from that reason. A student went to the Kensington Schools for seven years, and there he learnt to draw, and to draw beautifully. He knew of no institution or private studio in the kingdom which could give a student the same power of learning, but there his training ended. The manufacturer's requirements were not considered, and the mental development which was there induced was not commensurate with the drawing powers elicited. At the end of his term, a student might go into a manufactory, and he was tripped up at once by a thousand technicalities which restricted him in his design. Many years ago, there was an experiment made, of which he could personally speak, to remedy this neglect. Three special classes were organised, one to train young men to design for calico printers, wall-paper, and the decoration of all kinds of surfaces, another for the decoration of porcelain and ceramic art, and another for metal chasing. These classes were presided over by three gentlemen of great renown in every way, the professor of the first class, in which he was placed, being Mr. Hudson. That which was devoted to the decoration of earthenware was entrusted to Mr. Simpson, from Minton's; and the metal chasing was under the direction of Professor Semper. With the exception of Mr. Simpson's class, he thoroughly understanding the technicalities of applying colour to porcelain, the other two men knew nothing whatever about the practical operation of their duties, though they were all men of marvellous skill. Professor Semper was a man of profound knowledge—a French refugee, but he was certainly a man in the wrong place, inasmuch as he was not a metal chaser. In the same way, Mr. Hudson never saw a yard of calico printed, and never knew anything of the restrictions under which such work was conducted, until he was appointed to that class. He did not know how a carpet was woven, but he was sent to study these matters. Of course there was a great difficulty, and the authorities of South Kensington were not able to find men who had art-knowledge and technical knowledge combined. It was doubtless considered easier to give to an artist technical training than to find a technical man and give him art training, and perhaps they were right. But, nevertheless, as these professors did not combine these two kinds of knowledge, the classes were a thorough failure. He might say, without egotism, that he was more largely connected with the manufacturing art of this country than any other person. There was not a single branch of applied art that he had not some kind of supervision over; and every article that bore the impress of decorative art he was called upon, in his ordinary professional duties, to superintend or advise upon in some way or other. In consequence of this position, cases of young men failing in the manner he had described came before him almost weekly, and caused him many sad moments. When a young man had been trained as an artist, he went to a manufacturer, and because he had not that technical training which he ought to have, he failed to produce designs which were practically useful. The manufacturer could not afford to pay him while he did not provide what he wanted; and, on the other hand, the student could not afford to go through a second period of apprenticeship in order to make up the deficiency of his earlier education. The great aim of art schools seemed to be to make men what had been hitherto called artists, but what he should call pictorial artists. If a young man wished to learn drawing, let him by all means go to a School of Design at South Kensington. But if he wanted to become an ornamentist, he would say, as Mr. Crace once said, let him study nature, and stop at home, or go somewhere else. Renaissance art was pictorial in its character, but he was not abusing pictorial art. He could enjoy a good picture exceedingly, but, at the same time, in his opinion Renaissance decoration contained more of pictorial elements than any other style, and for that reason he thought it was followed by the authorities at South Kensington, who were for the most part pictorial artists. On the one hand, it required all the energy of which a human mind was capable to produce a great picture; but, on the other hand, it required just as much energy to produce a great ornamental scheme. These were two branches of art, and he thought they ought to be kept separate. He had the highest respect and regard for Mr. Burchett, from whom, down to the present moment, he had always received the most unvarying kindness; but still that gentleman was a little under a misapprehension about his own studies, inasmuch as he seemed to think that he had a horror of figure drawing. This was not so. Although during the last two years he had been to a great extent laid aside through illness, yet during that time he could refer him to large decorative works of figure subjects which he had put up. He had very recently, in Halifax, decorated a building which contained over the mantelpiece a large recess panel intended for a cartoon, and he had had the pleasure of filling that with a figure subject. But as a wall was essentially a flat surface, unless covered with modelled ornament, and as he felt bound to acknowledge the flatness of the surface, he had treated this figure in a flat manner, viz., in the same way as those which had been prepared for the mausoleum at Frogmore, to commemorate the late Prince Consort. The old Greek vases had figures delineated upon them, but there was no painting to imitate rotundity, or give falsity of appearance. The body might be of one colour, and there might be several flat tints introduced, and on that plan these works of art always proceeded. It was very curious that he should be charged with being a mere imitator of floral forms, when the fact was that he might challenge any one to point to a single ornament he had ever produced which was floral in its character. Notwithstanding that, he held for some time a lectureship on botany as applied to the fine arts at the South Kensington Museum, and five other professorships of botany as a pure science, but he never produced, since he commenced the practice of his profession, one single floral pattern. On the wall were a series of his own original designs, which, if he could claim no other merit for them, were sufficient to rebut the insinuation that he was an advocate of floral forms. He held that the principles of plant growth, if properly applied, gave to ornament a feeling of life and energy, but imitation of any kind was always very feeble compared with the more noble expression of a purely ideal thought. Further, the works at the South Kensington School ought not to be publicly criticised, and it was not fair to say that they were the ripe developments of art. It might be that a student could produce a good work, but still a student was only a student, and you did not find a master-hand displayed in his performance. In the Exhibition of 1862, there was a design shown by one of the great West-end houses, which had been prepared by a student at South Kensington under Mr. Burchett. That design was for a chintz, and all he would say of it was that it was passable, but still it might be supposed that, as the producer was still a student, he could not make his living as an artist; nevertheless, it was thought, because it was a good design for a chintz, that it would do very well for a wall-paper and also for a carpet, where it was utterly absurd, but to both these purposes it was applied. He believed that the explanation of some of the remarks which had been made was, that the speakers had not the power of appreciating decorative art. There were some men who enjoyed a picture to the utmost, but they could not understand or appreciate a work of decorative art. He did not understand Hebrew, and the finest Hebrew poem would convey no impression to his mind; and in the same way, those who could not appreciate decorative art of course formed a different opinion with regard to it from those who were capable of understanding it. Everyone could understand a picture, for it came home to them, and that accounted no doubt for many of the remarks which had been made. The room of horrors which Mr. Sala had alluded to was a great institution; and he also agreed with that gentleman, that the whole of a man's energy must be directed to whatever branch of art he devoted himself, but he could not go with him in what he said with regard to imitation. Persons liked to see the performances of a magician, simply because they knew all the time they were being deceived. In the same way, if they went to Madame Tussaud's, they did not mistake any of the works there for realitty, and, if they were so deceived, they were immediately offended. Mr. Hyde Clarke, he thought, appreciated pictorial art more than decorative, for which he did not blame him. No doubt he could enjoy the works of Correggio, Michael Angelo, Phidias, and could understand the language which they spoke. Those artists infused a soul into their works, which, after the lapse of centuries, was able to speak to the soul of the intelligent observer, and that, no doubt, produced the highest sense of enjoyment; but still that was no reason why he should take from another the enjoyment which he had in seeing a simple prayer-carpet, and this, if it were a true work of art, he contended, did differ from a common Turkey carpet. It was more correct in all its proportions, more beautiful in its colours, more harmonious in its colours, because the workman desired to dedicate his best energies to the service of his God. Mr. Hyde Clarke had spoken of the impure works of religious people, but he would venture utterly to deny such a position. False or assumed religion might produce impure works, but pure religion never could produce impurity.

The Chairman, in putting the vote of thanks to the meeting, expressed the pleasure he had felt in listening to Dr. Dresser's paper; and the vote of thanks being carried unanimously, the meeting separated.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

As already announced, the Council in aid of this object will give six concerts in the Albert Hall, and a guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed, announced in last week's *Journal*, was £2,463.

The following gentlemen have since guaranteed the amounts set opposite their names respectively:—

	£	s.		£	s.
Henry Fielder	10	0	W. Pitman	10	0
A. Webb Miles ..	10	0	L. Van Oven	10	0

The number of tickets taken, as announced in last *Journal*, 367.

R. W. Bartram	3	George Lyons	3
L. King	1	J. B. Mackey	2
A. M. Brown	2	James Matthew	3
Thomas Dixon........	2	G. R. Matthews	2
H. Fielder	2	A. Webb Miles	3
J. J. Figgins	2	W. Pitman	2
F. Filliter............	1	J. Revell	2
W. J. Gwynn	2	G. T. Saul	2
T. W. Hart	1	C. H. Strachan	2
F. Le Breton	5	A. E. Taylor	2
R. Lewis	2		

The first concert will be given on April 12th, and it will be the first public performance in the hall after the opening ceremonial by Her Majesty the Queen. The dates of the other Concerts are April 19th, July 5th, 12th, 19th, and 26th.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

A subscription of one guinea entitles a member of the Society of Arts to a transferable numbered and reserved seat at each of the six concerts.

The Musical Education Committee met on Monday, the 21st January. Present, Lord Gerald Fitzgerald in the chair, Mr. Henry Cole, C.B., the Hon. Seymour Egerton, Sir John Harington, Bart., Mr. Samuel Redgrave, Lieut.-Col. Scott, R.E., and Mr. Seymour Teulon.

The Committee took into consideration the arrangements for the Society's Concerts in the Royal Albert Hall; and with reference to the accommodation which would be available for the audience, they were informed that the Executive Committee of the Hall intended that only such numbers should be admitted as would enable every person to be seated with great comfort, and to enter and leave without any crushing. It was thereupon resolved:—

That the prices to be charged to the public for admission to reserved seats at the concerts should be as follows:—

Arena for one concert	£0	7	0
Or subscription for the six concerts..	2	2	0
Balcony for one concert...........	0	7	0
Or subscription for the six concerts..	2	2	0
Amphitheatre for one concert	0	10	6
Or subscription for the six concerts..	3	0	0
A box holding five persons for one concert........................	3	3	0
Or for the six concerts	15	15	0

In letting, preference to be given to a subscription for the six concerts.

Members of the Society of Arts will have the privilege of subscribing for a set of six tickets (transferable), admitting the bearer to a reserved seat, at each of the six concerts, as follows:—

The Arena	£1	1	0
The Balcony	1	1	0
Amphitheatre.....................	2	2	0
Box holding five..................	10	10	0
Ditto „ for one concert (if vacant)........................	1	15	0

It was also resolved—

That all subscriptions must be paid in advance for reserved seats, and that after the 15th of March the special privileges of Members, of obtaining tickets at the reduced price, should not be continued.

It was further resolved—

That a sub-committee be appointed to confer and arrange with Sir Michael Costa the programmes of the music.

OPENING OF THE ALBERT HALL.

Tickets to admit to the ceremonial at the opening of the Royal Albert Hall by the Queen, on the 29th March, can be obtained of Mr. Samuel Thomas Davenport, the financial officer:—Arena, 3*l.* 3*s.*; Balcony, 2*l.* 2*s.*; Picture Gallery, 1*l.* 1*s.* each.

CANTOR LECTURES.

The first lecture of the second course for the Session was delivered by Dr. Crace Calvert, F.R.S., on "Dyes and Dye-stuffs other than Aniline," on Tuesday evening. The course will consist of four lectures, and will be continued on the subsequent Tuesday evenings till completed. These lectures are open to members, who have the privilege of admitting two friends to each lecture:—

Lecture I.—Tuesday, February 7th.

Red Colouring Substances.—Madder; composition of the root—Alizarine—Purpurine—Xanthine—Artificial alizarine—Commercial alizarine—Garancine—Extract and flour of madder—their preparation and applications to calico printing and Turkey-red dyeing.

Lecture II.—Tuesday, February 14th.

Red Colouring Substances (*continued*).—Alkanet root—Campeachy, peach, sapau, cam, and bar woods—Cochineal—Lac-dye—Orchil—Cudbear—Litmus—Murexide—Safflower; their applications in dyeing and calico printing.

Lecture III.—Tuesday, February 21st.

Blue Colouring Substances.—Indigo; how prepared, and how to determine its commercial value; its applications in dyeing and calico printing—Prussian blue; its properties; how produced on wool and silk, and how used in calico printing—Ultramarine blue.

Lecture IV.—Tuesday, February 28th.

Yellow Colouring Substances.—Quercitron-bark—Flavine—Fustic—Persian berries—Annatto.

Black Colouring Substances.—Gall-nuts—Shumac—Divi-divi—Mirabolam—Catechu.

These lectures are open to members, who have the privilege of admitting two friends to each lecture.

ART-WORKMANSHIP PRIZES.

The following is the Report of the Judges invited by the Council to award the Prizes :—

It will be remembered that the proposals last issued by the Council of the Society of Arts took a shape different to those previously adopted by them in offering prizes for Art-workmanship. Desiring that the art-workmen of this country should stand well and be individually recognised in the coming International Exhibition, the Council announced their willingness to give rewards "for special excellence on the part of all concurring in the production of works of industry of the highest character," offering to manufacturers and designers under whose direction and through whose means these works were produced the highest distinctions the Council were able to confer, and to the various workmen concerned proportionate money premiums. They required, of course, that with the works submitted the names of those who had been engaged in their production should be sent. In addition to inducements for such combined operations, premiums were offered for meritorious works executed single-handed.

In reply to these proposals, 75 articles have been forwarded to the Society's House, including about a dozen produced by a single metropolitan firm.

It might have been expected that a larger number of manufacturers would have taken advantage of the liberal offers made by the Society than is the case. One reason may be found in the unwillingness felt by some manufacturers to make known or give prominence to the men working for them—an unwillingness which would probably not exist if mutual trust and confidence were as complete as is wished for by all who desire the general welfare and advancement. The man who designs a beautiful form, forges well a scroll of iron, puts up a sound, honest piece of work, may find reward and incentive to further efforts in his own mind. The wish of the Society, however, has always been to give to such men the further inducements of public credit and personal reward; and we believe the wish a wise one, and that the furtherance of it will be for the advantage of all.

We append below a complete list of the awards it has been thought right to make, after an examination of every article *seriatim*, and we confine ourselves in such further observations as we offer to works that seem more particularly to call for or justify them. One strong impression that is left on us after examination is the want of knowledge of the living figure that is manifested. It will scarcely be thought that we are leaving our province if we express a hope that English art-workmen may be led to see the necessity for study in this direction. The younger men, at any rate, amongst them might avail themselves more largely than they do of the Government Schools of Art, at this time very generally accessible throughout the country. Opportunities for study, at small cost, are now not wanting in this country, and the inducements for perseverance are not few.

The principal specimen submitted on the present occasion, the inlaid "loo-table," by Mr. Thomas Jacob, may be viewed as the result, to some extent, of the right use of such existing facilities, Mr. Jacob, the designer and producer, having studied in one of the schools of art. In respect of both design and execution this is an excellent work, and we have awarded to the producer the Society's silver medal and £25. The marqueterie-cutter, Cornelius Riech, has executed his part of the table with great precision and feeling. To him and others engaged we have given premiums. We further award to Mr. Jacob the North London Exhibition prize, offered "for the best specimen of skilful workmanship at the Society's exhibition."

We have given the Society's silver medal and £10 to Mr. J. Daymond, for his friezes. These are elegant in design, and skilful in execution. Under the same heading—"Modelling in Plaster"—Mr. J. W. Gould's "Figure of a Child" calls for good reward, both for its real merit and as an exception to our statement above, and we give him also the Society's silver medal and £10. Naturalness and fidelity to nature, which distinguish this model, though not the only qualities nor the highest required in sculpture, must always be regarded as important in judging the productions of an imitative art.

Under the head of "Metal Work," we find a thoroughly good production in the shape of a wrought-iron gate, executed by Mr. T. Winstanley, from the design of Mr. F. Porter, to both of whom we award the silver medal. To the two apprentices who helped in the execution we give money prizes. This gate affords excellent evidence of the great improvement in the working of iron that has been brought about in England. Some smaller productions, the hammered bracket, by Mr. W. Morris (the halving good and the curves elegant), and a bracket by Mr. W. Robson, speak to the same effect, and entitle their producers to premiums.

A gas standard in brass, and an inkstand in the same metal, both designed and executed by Mr. Joseph Taylor, show considerable skill. The damascened steel-bladed trowel, regarded as a piece of workmanship (the design being more quaint than beautiful), is highly creditable to Mr. T. R. Rice. The art of damascening, valuable as it is for the appropriate ornamentation of metals, is much less practised in this country than it should be. We have awarded Mr. Rice a premium of £5.

The portrait in *repoussé*, from a carving by Jean Goujon, is very creditable to Mr. Robert Tow. The "Head of a Satyr," *repoussé* in copper, is skilfully blocked by Mr. Theuerkauff; the chasing being executed by Mr. G. Deere.

From amongst the carvings in wood, we select for award the clever representation, in limewood, of a "Dead Bird," by Mr. R. J. Tudsbury; the oak panel, by Mr. J. Osmond, and the mirror-frame, in oak and ebony, by Mr. W. H. Holmes; the forms in the latter are ingeniously flattened and made appropriate. Cameo-cutting is represented by two examples from Mr. Ronca, who also sends a carving in ivory. The neglect of these arts amongst us is the more surprising and regretable as they offer a field for artistic industry to female as well as male art-workers.

The progress in artistic glass-blowing, which we are slowly making, is shown by some good specimens exhibited by Mr. T. C. Barnes and Mr. Elijah Barnes, to the former of whom we have found reasons for awarding the larger premium.

Looking to the group of articles submitted by the firm alluded to, Messrs. Cox and Son, we would mention that it includes a number of specimens of silversmiths' work, in the shape of church plate, a polished brass eagle lectern (worked by J. Skelley), a large wrought iron gas standard (well forged by W. Prendergast); a font-cover of oak and brass, and a panel for a reredos, in hand-painted encaustic tiles. To the manufacturers we have awarded the Society's silver medal, accompanied with strong commendation of the well-directed and intelligent spirit of enterprise that has led to the mounting of a large establishment for the production of works of an artistic character. We have awarded a silver medal severally to Mr. John Keith, under whose superintendence certain pieces of the silver work examined by us were produced, and to Mr. B. J. Talbert, as designer of the chief works exhibited. We have further given money premiums to the two principal silversmiths employed.

In conclusion: for the works that we have specially rewarded, the Council may fairly seek to obtain the distinction of being included in the coming International Exhibition at South Kensington; they will assist in showing that skill in the application of the arts to objects of utility is making progress amongst us. Designers and workmen, it may be anticipated, will at this great gathering be able to measure their advances and their shortcomings against the works of other countries, and in either case will find incitement to further efforts. In such contests there are no losses; even the vanquished are gainers.

H. A. Bowler.
George Godwin.
Richard Redgrave.
M. Digby Wyatt.

The following articles have been sent in competition for the Prizes offered by the Council:—

Carving in Wood.

1. A Pulpit; designed, and the joiner's and tracery work executed by J. F. Wilson, 38, Newman-street, Oxford-street, W. The figures, and five panels, carved by W. C. Anderson. The spandrels and other carving by J. Wilcocks. Price 100 guineas.
2. A Lectern; by the above. Price 20 guineas.
3. Oak panel; design adapted from an old panel; by J. Osmond, 5, Featherstone-street, Bunhill-row, E.C. Price £18. **PRIZE** of £5.
4. Oak frame, suitable for a painting or mirror; designed, carved, and executed by George S. Thorpe, 10, Robertson-street, Hastings.
5. Mirror-frame, carved in oak and ebony; by W. H. Holmes, 107, Dean-street, Soho, W. The mirror by W. Evans. Price £7 10s. **PRIZE** of £3, to W. H. Holmes.
6. Figure of "St. Peter," carved in oak; by J. E. Knox, 10, Canterbury-place, Lambeth-road, S.E.
7. Group, carved in lime-tree wood; by W. H. Jenkins, 6, Mead's-row, Westminster-bridge-road, S.E. (unfinished).
8. Medallion in box-wood, "The late Charles Dickens" (copied from the *Graphic*); by E. Dujardin, 46, Camberwell-grove, S.E. Price £5.
9. Medallion head in boxwood, "Maidenhood;" mounted in rosewood, with emblematical flowers in boxwood; by W. Matthews, 79, Manor-street, Cheyne-walk, Chelsea, S.W. Price for copy, £10.
10. Carving from nature, lime-wood; by R. J. Tudsbury, Edwinstowe, Notts. **PRIZE** of £10.
11. Clock-case in oak, designed and carved by G. H. Bull, 16, Millman-mews, Millman-street, Foundling Hospital, W.C.

Inlay in Wood.

12. Amboyna inlaid loo-table, the lower part enclosed by four marqueterie panels (fixed); designed and executed by Thomas Jacob, 4, Upper Charlton-street, Fitzroy-square, W. [The Society's **SILVER MEDAL** and **PRIZE** of **£25**; also the **NORTH LONDON EXHIBITION PRIZE***], assisted by Cornelius Riech (marqueterie cutter) [**PRIZE** of £12], Charles Helfer (engraver) [**PRIZE** of £5], George Brown (turner) [**PRIZE** of £1], Joseph Platt (carver) [**PRIZE** of £1], and George Tappin (polisher) [**PRIZE** of £1]. Price 100 guineas.
13. Inlay in various woods, "Our Saviour;" designed by Bassett Keeling; executed by William Clayton, 125, Wardour-street, St. James's, S.W. Price £15.
14. Cabinet in mahogany and ebony woods, with metal gilt mouldings, (plaques painted on ivory); exhibited by W. Bertram and Son, 100, Dean-street, Soho, W.; designed by W. M. Holmes; carving by W. M. Holmes and W. Maskell; cabinet work by C. Peterson and J. Hickman. **PRIZE** of £5 each to W. H. Holmes and W. Maskell.

Inlay in Marble.

15. Table Top; by J. Taylor, 6, Mead's-row, Westminster-bridge-road, Lambeth, S.E. Price £16. **PRIZE** of £3 for this and No. 16.
16. Group of Flowers; by the above. £25.
17. Cribbage Board; by John Edward Daly, 14, Langford-row, Cork, Ireland.

Carving in Stone.

18. Group of Flowers; by James Goudge, 117, Page-street, Westminster, S.W. **PRIZE** of £2 for this and No. 19.
19. Bird and Foliage; by the above.

Modelling in Plaster.

20. Figure of a Child; by J. W. Gould, 85, Castle-road, Kentish-town, N.W. The Society's **SILVER MEDAL** and a **PRIZE** of **£10**.
21. Clock Case; by Carlo Lina, 4, Egbert-street, N.W.
22. Portion of a Frieze for a Drawing-room, Thoresby-hall; designed and modelled by J. Daymond, jun. (under Mr. A. Salvin, architect), 4, Edward-street, Vincent-square, S.W. The Society's **SILVER MEDAL** and a **PRIZE** of **£10** for this and Nos. 23 and 24.
23. Alternate Centres for Frieze of Dining-room, as above.
24. Portion of Frieze for ditto, as above.
25. Bracket, Gilt; executed by A. Aspinwall, Lea-row, Bradford-moor, Bradford, Yorkshire.

Metal Work.

Church Plate, *Exhibited by Messrs. Cox and Son,* 28 *and* 29, *Southampton-street, Strand. Executed under the superintendence of Mr. John Keith.*

Messrs. Cox and Son, Mr. John Keith, and Mr. B. J. Talbert have each been awarded the Society's **SILVER MEDAL.** A **PRIZE** of £5 is awarded to H. Tickell, in respect of Sets Nos. 2 and 4, and a **PRIZE** of £3 to J. Keith, jun., in respect of Set No. 3.

Set No. 1.

26. Chased and jewelled silver set of communion plate (offertory basin, metal electro-gilt); designed by S. J. Nicholl. Price, flagon, 85 guineas;

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* This prize consists of £4 18s., the interest of £167 7s. 3d. Consols, invested in the name of the Society of Arts, to be awarded by the Council "for the best specimen of skilful workmanship" at the Society's Exhibition of Art-Workmanship.

chalice, 48 guineas; paten, 9 guineas; basin, 40 guineas.

SET NO. 2.

27. Chased, jewelled, and enamelled silver set of communion plate, parcel gilt; designed by Messrs. Goldie and Child. Price, flagon, 75 guineas; chalice, 55 guineas; paten, 8 guineas.

SET NO. 3.

28. Engraved and enamelled silver gilt set of communion plate, jewelled with rubies; chased silver centre for an offertory basin; subject, "The Last Supper" (from one of the Ecclesiological Society's patterns, altered and enriched). Price, flagon, 130 guineas; chalice, 60 guineas; paten, 7 guineas; silver gilt offertory basin, if made 22 inches in diameter, 86 guineas.

SET NO. 4.

29. Engraved, jewelled, and enamelled silver set of communion plate, parcel gilt; subject on flagon, "The Last Supper" and "The Crucifixion;" designed by B. J. Talbert. Price, flagon, 40 guineas; chalice, 25 guineas; paten, 8 guineas.

SET NO. 5.

30. Engraved silver set of communion plate (offertory basin metal electro-gilt); from one of the Ecclesiological Society's patterns, slightly altered. Price, flagon, 15 guineas; chalice, £11; paten, £4 10s.

SET NO. 6.

31. Engraved silver set of communion plate; designed by G. Goldie. Price, flagon, 13 guineas; chalice, £10; paten, £3 14s.

SET NO. 7.

32. Engraved and jewelled silver-gilt set of communion plate; designed by B. J. Talbert. Price, flagon, 25 guineas; chalice, 16 guineas; paten, 6 guineas.

SET NO. 8.

33. Chased, jewelled, and enamelled silver set of communion plate (offertory basin metal electro-gilt); designed by Isaac Jones. Price, flagon, 50 guineas; chalice, 28 guineas; paten, 16 guineas; basin, 30 guineas. The second of the prizes offered by Messrs. Cox and Son to members of the Architectural Association was awarded to the design for this set.

SET NO. 9.

34. Engraved silver set of communion-plate, parcel gilt; designed by G. Goldie. Price, flagon, 20½ guineas; chalice, 15 guineas; paten, £5 16s.

SET NO. 10.

35. Engraved and chased silver set of communion-plate; designed by G. Goldie. Price, flagon, 28 guineas; chalice, £17 10s.; paten, £5 15s.

SET NO. 11.

36. Engraved and enamelled silver set of communion-plate; designed by B. J. Talbert. Price, flagon, 27½ guineas; chalice, 17½ guineas; paten 5 guineas.

SET NO. 12.

37. Portable set of silver communion-plate and other articles of ceremonial; various designers.

SILVERSMITHS

Employed in the production of the above Specimens of Church Plate.

H. Tickell, sets Nos. 2, 4, 7, 9, 10, and 11.
T. Cleghorn, set No. 1.
J. Keith, Jun., chalice and paten, No. 3, and patens for other sets.
J. Bingham, flagon, No. 3.
J. Sharpe, set No. 6; offertory basin and paten, No. 8.
D. Leighton, flagon and chalice, No. 8.

CHASERS.

A. Barrett, set No. 10; flagon and paten, No. 1.
Frederick Brown, set No. 2.
Thomas Brown, flagon, No. 8, "Pelican and her Piety"
G. R. Meek, chalice and paten, No. 8.
R. Orpwood, foot of chalice, No. 1; sets Nos. 4 and 7; flagon, No. 8.
E. Richards, offertory basin, No. 1; paten, No. 2.
G. Tapley, chalice, No. 1, except foot.
G. B. Tapley, offertory basin, No. 8.

ENGRAVERS.

R. Evans, set No. 11; offertory basin to set No. 4
W. Keith, principal part of other sets.

ENAMELLERS.

J. Low, set No. 11.
T. Ladd, the other enamelled sets.

JEWEL SETTER.

S. Plato.

38. Pair of plates in silver, after subjects by *Rubens*; by Alfred Page, 4, Derby-place, Old Ford-road, Victoria-road, E.
39. Watch case and dial in silver; by T. J. Bowman, 2, Rheidol-terrace, St. Peter's, Islington, N. Price £5. **PRIZE** of £1.
40. Chalice, silver gilt; by J. W. Frith, 71, Herbert-street, Hoxton, E.
41. Card tray; designed by W. U., chased by P. A. Price £2 2s. **PRIZE** of £1 each to designer and chaser.
42. Silver gilt smelling-bottle; chased by P. A. Price £2 10s.
43. Chasing in bronze, piece of ornament; by Y. Z. Price £2 2s.
44. Do. "Black Boy and Girl;" by W. U. Price £3.
45. Do. "Sleeping Child;" by W. U. Price £1 10s.
46. Do. "Sleeping Nymph;" by Y. Z. Price £2.
47. Bust of *Canning* in bronze; by W. U. Price £1 15s.
48. Damascened steel-bladed trowel; designed by Sebastian G. Rice, executed (with the exception of the ivory handle) by T. R. Rice, Messrs. Hart, Son, and Co., Wych-street, W.C. **PRIZE** of £5 to T. R. Rice.
49. Hammered work in bronze, "Stem of Tree;" By W. U. Price £1 10s.
50. One of a pair of wrought-iron gates; executed for the Union Bank of London, by T. Winstanley, 25, New Compton-street, W.C., assisted by G. Winstanley and F. Lancester, apprentices; designed by Mr. Porter, architect. Messrs. Porter and T. Winstanley have each been awarded the Society's **SILVER MEDAL. PRIZE** of £10 each to G. Winstanley and F. Lancester.
51. Hammered bracket in iron; designed and produced by W. Morris, 14, Goding-street, Vauxhall, S.E. Price £5. **PRIZE** of £3.
52. Hammered bracket in iron; designed and executed by William Robson, 11, Parkside-street, Battersea-road, S.W. Price £3. **PRIZE** of £2.

53. Gas Standard in brass; designed and executed by Joseph Taylor, 12, Wynford-street, Islington, N. Price £12. **PRIZE** of £5 for this and No. 54.
54. Inkstand in brass; designed and executed by the above. Price £6.
55. Table ornament, comprising inkstand, pincushion, scent-box, bell, cotton reels, and pair of brackets for candles; by E. Millard, sen., 7, Northern-buildings, Somers-town, N.W.
56. Portrait in repoussé, from a carving by *Jean Goujon;* by Robert Tow, 36, Aldenham-street, St. Pancras-road, N.W. **PRIZE** of £7 10s.
57. Head of Satyr, repoussé in copper; blocked by W. Theuerkauff, and chased by G. Deere, 11, Hermes-street, Pentonville, N. **PRIZE** of £4 to W. Theuerkauff and £3 to G. Deere.
58. Head of Garibaldi; by James Gwillim, 20, Sydney-square, Mile-end, E. Price £5.
59. Tobacco jar and cover (Elizabethan period); designed and executed by F. B., 31, Cantelows-road, Camden-square, N.W. **PRIZE** of £1.
60. Specimens of mathematical engraving and dividing, on metal, ivory, &c.; by H. E. D. Davies, 20, Durham-street, Kennington-lane, S.E.

Die-sinking.

61. "Prospero and Miranda;" exhibited by Messrs. Waterlow and Sons, London-wall, E.C.; designed by W. H. Boorn; executed by Thomas Brittain.

Bookbinding.

62. Book, "Foxe's Book of Martyrs;" designed and executed by W. Chiddenton, 4, Melbourne-place, Parker's-piece, Cambridge; put in boards by G. Lister.

Cameo Cutting.

63. "Psyche;" designed and cut by J. Ronca, 42, Blantyre-street, Chelsea, S.W. **PRIZE** of £2 for this and Nos. 64 and 65.
64. "Clytie; by the above.

Carving in Ivory.

65. "The Rainbow;" by J. Ronca, 42, Blantyre-street, Chelsea, S.W.

Painting on Porcelain.

66. Plate; designed and painted by G. W. Rhead, Messrs. Minton's studio, near the Albert Hall, South Kensington, W.
67. "Group of Cockatoos;" by J. Randall, Madeley, Salop.
68. Panel, for insertion in frieze of a chimney-piece, subject—"The Hawthorn;" by William Slater, Field-place, Stoke-on-Trent.

Glass-blowing.

69. Two plain Toilettes; by Elijah Barnes, 13, Hingeston-street, Birmingham. **PRIZE** of £5 for this and Nos. 70-72.
70. One ditto, with twisted stand; by the above.
71. Champagne glass, with filigree; by the above.
72. Flower-glass; by the above.
73. Two toilettes, with filigree; by T. C. Barnes, 135, Camden-street, Birmingham. **PRIZE** of £7 10s. for this and Nos. 74, 75.
74. Flower-glass in green and splashed with gold; by the above.
75. Loving cup; by the above.

The following are Exhibited by Messrs. Cox and Son, 28 *and* 29, *Southampton-street, Strand, W.C.*

6. Polished brass eagle lectern (jewelled); designed by B. J. Talbert; brass worker, J. Skelley; chaser and modeller, A. Barrett; engraver, James Keith. Price 120 guineas. **PRIZE** of £3 to J. Skelley, for this and other specimens.
77. Polished brass corona (jewelled); designed by B. J. Talbert; brass worker, W. Marsden. Price 50 guineas.
78. Wrought-iron gas standard, relieved with brass and jewelled; designed by B. J. Talbert; forger, W. Prendergast; fitters, R. Emms (lower half of standard), and J. Morgan (upper half of standard, including bumping leaves). Price 36 guineas. **PRIZE** of £3 to W. Prendergast.
79. Board with specimens of chasing and modelling; two fire-iron heads, figure of "Hamlet," A. Barrett; three studies from natural foliage, G. B. Tapley; two classic dishes, E. Richards; hinge for side and front of sideboard, R. Emms. **PRIZE** of £1 to G. B. Tapley, and of £2 to E. Richards.
80. Two panels of tomb rail for a child's grave; designed by J. Moyr Smith; made by J. Morgan.
81. Caen-stone font, with marble columns and bosses, and oak cover with wrought-brass mountings and chain; designed by B. J. Talbert; mason, T. Woodcock; stone carvers, C. Abbey and R. Davis; joiner, E. Hooper; wood carver, T. Burdett; brass workers, J. Skelley and W. Marsden; beaten cross chased by A. Barrett; engravers, W. Lucas (two upper bands and leaves) and J. Taylor (lower band and leaves). Price, font 60 guineas, cover 100 guineas. **PRIZE** of £2 to W. Marsden.
82. Reredos and altar table, with frontal, the panels in hand-painted encaustic tiles; subject, "The Last Supper;" designed by B. J. Talbert: cartoon of subject, M. Casolani; masons, T. Woodcock, T. Brock, and R. Sutton; stone-carvers, C. Abbey and R. Davis; tile-painter, W. W. Robinson; joiner, W. Layfield; wood-carver, W. E. Matthews; embroideresses, Fanny Thurling and Susannah Grice. Price 100 guineas. **PRIZE** of £2 10s. to M. Casolani, £2 10s. to W. W. Robinson, and £1 10s. each to Fanny Thurling and Susannah Grice.

The articles sent in competition for these prizes are now arranged for exhibition at the Society's Rooms, and are on view for members and their friends between the hours of ten and four, till the 11th instant (to-morrow).

THE LIBRARY.

The following works have been presented to the Library:—

Four Pamphlets. By the Rev. H. Moule, M.A.:—
  The Warming of Churches.
  The National Educational Expenses.
  The Dry-Earth System.
  Manure for the Million.

The Inaugural Lecture at the Opening of the Industrial Technological Museum of Victoria.

The Address delivered by Sir Redmond Barry, at the Opening of the School of Mines at Ballarat, Victoria.

A Handy Book on Health. By C. A. Cameron, M.D. Presented by the Author.

Ten Sets of Cassell's Drawing Copies, containing series A, B, C, D, and E.

A volume of Vere Foster's Copy Books for Drawing. Presented by Vere Foster.

Elementary or National Education. By J. Parkin, M.D., F.R.C.S. Presented by the Author.

The Annual of the Royal School of Naval Architecture.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

General Purposes Committee.—His Royal Highness the Prince Christian of Schleswig Holstein, K.G., presided over a meeting of the General Purposes Committee on Tuesday. There were also present Mr. Bowring, C.B., M.P., Mr. Cole, C.B., Mr. Gibson, Mr. Thring, and Lieut.-Colonel Scott, R.E., secretary.

Class X. (Educational Works and Appliances.)—Committees of Selection.—Additions to and corrections of the Committees of Selection in Sections C, D, and E, have been made, and which now stand as follows:—

Section C.—Appliances for Physical Training, including Toys and Games.

G. C. T. Bartley (Science and Art Department).
Dr. Archibald Campbell.
Rt. Hon. Wm. Cowper Temple, M.P.
Rev. J. H. Edgar (Science and Art Department).
C. W. Franks (Endowed Schools Commission).
Sir Duncan Gibb, Bart.
Wm. Hawes, F.G.S. (Vice-President of the Society of Arts).
Rev. Muirhead Mitchell (one of H.M. Inspectors of Schools).
E. G. Ravenstein (President of the German Gymnastic Society).
Rev. T. W. Sharpe (one of H.M. Inspectors of Schools).
Henry Vaughan (Member of Council of Society of Arts).
R. G. Wylde (Science and Art Department).
Major Waddington.

Section D.—Specimens and Illustrations of Modes of Teaching Fine Art, Natural History, and Physical Science.

Sub-Section Physical Science.

F. A. Abel, F.R.S. (Laboratory, Royal Arsenal, Woolwich).
W. F. Barrett, F.C.S. (one of the Society's Examiners).
Charles Brooke, M.A., F.R.S.
Major-Gen. F. Eardley-Wilmot, R.A. (Member of Council of the Society of Arts).
Professor Fuller, C.E. (University College).
J. F. Iselin, M.A. (Science and Art Department).
C. W. Merrifield, F.R.S. (Royal School of Naval Architecture).
Rev. Arthur Rigg, M.A.
W. W. Smyth, F.R.S. (Royal School of Mines).
Rev. J. Twisden (Royal Military College, Sandhurst).
Professor A. Williamson, F.R.S. (University College).
Professor Willis, F.R.S.

Section E.—Specimens of School Work Serving as Examples of the Results of Teaching.

Professor D. T. Ansted, F.R.S.
Rev. G. C. Bell (Head Master of Christ's Hospital).
Alfred Bourne (Secretary to the British and Foreign School Society).
Rev. J. S. Brewer (one of the Society's Examiners).
H. A. Bowler (Science and Art Department).
Lieut.-Col. Ewart, R.E.
J. G. Fitch (one of H.M. Inspectors of Schools).
W. G. Larkins (Editor of the *Journal of the Society of Arts*).
F. Pitman.
E. Carleton Tufnell (one of H.M. Inspectors of Schools).
L. Schmitz, LL.D. (Principal of the London International College).
Mrs. Le Neve Foster, Miss Mason, Miss J. Mason } (Specially for Needlework).

The Blind.

All matters connected with the Education and Training of the Blind.

Dr. T. Armitage.
Rev. R. H. Blair (Worcester Proprietary College for Blind Sons of Gentlemen).
Rev. J. Evans (Chairman of House Committee, School For Indigent Blind).
Rev. J. B. Johns (School for Indigent Blind, Southwark).
Edmund C. Johnson (*Chairman*)
T. G. Sambrook.

The Deaf and Dumb.

All matters connected with the Education and Training of the Deaf and Dumb.

A. H. Bather (Hon. Sec., Association in Aid of the Deaf and Dumb).
Rev. Samuel Smith (Chaplain and Secretary, Association in Aid of the Deaf and Dumb).

Albert Hall.—Considerable progress has been made during the last few days towards the completion of the internal arrangements of the hall. The ugly but necessary scaffolding has all been removed, and the whole of the glass roof has been uncovered, so that the fair and beautiful proportions of the building are now displayed to the view of the spectator. These proportions will possibly never be seen to greater advantage than now; in a day or so, hangings, curtains, and chairs will break the graceful curves. The curtains of the private boxes will be of crimson, and the carpeting of them green; the general draperies throughout the hall will consist of crimson satin, for which contracts have been taken, and are in course of execution in France. In every other respect the fittings will be according to the tastes of the holders, who will be allowed full license, so long as the general effect is not interfered with. The bright, massive pipes of the organ are being rapidly reared in their places, and in all the departments the utmost activity is being displayed, under the superintendence of Lieutenant-Colonel Scott and Mr. Wentworth Cole, to perfect the arrangements by the day of the opening ceremonial by the Queen.

Delivery of Exhibits.—Since the 1st instant, the quietude that has reigned in the buildings erected for the exhibition since their completion has been broken by the rapid arrival of articles sent for the inspection of the Committees of Selection. Every day throughout this month is appointed for the reception of certain articles. One day it is machinery, another fine art, another educational articles, and so on. The first consignment of the handsome collection promised by Belgium has arrived, as well, also, as a consignment from Leipsic. Outside the gallery, in the Prince Albert's-road, are being placed the engines that will supply the motive power necessary for showing the machinery in motion.

All objects in the following list must be delivered at the Exhibition Building, at the entrances specified, on the days named below:—

		Entrances.
Feb. 10 ,, 11	Pottery and raw materials	Exhibition-road.
,, 13 ,, 14	Woollen and worsted fabrics and raw materials	Royal Albert Hall.
,, 15 ,, 16	Sculpture not applied to works of utility	Prince Albert's-road.
,, 17	Painting applied to works of utility	Prince Albert's-road.

		Entrances.
Feb. 18 „ 20	Sculpture applied to works of utility	Prince Albert's-road.
„ 21	Engraving, lithography, photography, &c.	Royal Albert Hall.
„ 22	Architectural designs, drawings, and models	Royal Albert Hall.
„ 23	Tapestries, carpets, embroideries, &c.	Prince Albert's-road.
„ 24	Designs for all kinds of decorative manufactures	Royal Albert Hall.
„ 25	Copies of pictures, mosaics, enamels, &c.	Prince Albert's-road.
„ 27 „ 28	Painting not applied to works of utility	Prince Albert's-road.

New South Wales.—The commissioners appointed by the New South Wales Government to see to the selection of articles that shall properly represent the colony in the London International Exhibition just about to open, are doing their best to afford the people of England an opportunity of judging of many of the features of colonial life. Advantage has been taken of the opening offered by a display of photographic skill to send views of most objects of public interest. The public buildings have all been taken; the heads of departments have been directed to prepare views of all the public works under their superintendence; the banks send their offices; the religious bodies their churches; the Council of Education their chief school-houses; the principal shopkeepers their establishments, accompanied with information concerning the salaries and wages paid to attendants and workmen; manufacturers their works, and so on. Similar views will be furnished from the chief towns, and occasionally a view from the bush will be collected to present that phase of life. Specimens of raw materials will be sent, and, in most cases, where these materials are made up, the manufactured product will accompany it, in order that the English workman may see whether he could use his skill upon our material to better purpose. He will also be able to compare his wages with those obtained there, and ascertain the cost of house-rent and living from the information that will be sent, and thus satisfy himself whether emigration will prove favourable or not. The first consignment proceeds by the ship *La Hogue*, under the care of Mr. S. Sedgwick Cowper, secretary to the commission. The Council of the Agricultural Society are appointed commissioners of this body. Mr. Howard Reed, Mr. W. Wallis, Mr. J. Thompson, and Captain Mann, form the Executive Committee, with Mr. John Alger as treasurer. A suggestion has been made that, after the Exhibition is over, the articles should be collected and displayed in the provincial towns, Mr. Cowper acting as exponent.

Spain.—Senor Juan Fecundo Riano has been appointed Spanish Executive Commissioner for the International Exhibitions. The Spanish government announced recently that the administration connected with the representation of Spain at the International Exhibitions would be placed under the Directors-General of Public Instruction, Public Works, Agriculture, Industry, and Commerce and Statistics. From the order published in the *Gaceta de Madrid*, it appears a preliminary exhibition of objects will be held each year in Madrid. This exhibition will be inspected by a special jury, who will select therefrom objects considered worthy to be sent to London. The details and cost of the transport of these goods will be undertaken by the Spanish Commission. The exhibitors will have only to bear the cost of sending their goods to Madrid. The Commission has issued an exhaustive set of rules for the guidance of exhibitors. The special jury of selection is composed of three sections, the first one for the fine arts, the second for manufactures and modes of education, and the third for scientific and other inventions. The duties are honorary and gratuitous, and commence on the 20th of this month; and all goods for the London Exhibition will, in accordance with the rule laid down, be in the hands of the British Commission on or before the 15th of April.

Music. — Her Majesty's Commissioners have sent letters of invitation to the following musical composers of European celebrity, requesting them each to compose a suitable piece of music for the opening of the Exhibition, on the 1st day of May next, namely, M. Gounod, Herr Wagner, Signor Verdi, and Mr. Arthur Sullivan.

Sir,—Some short time since, I ventured to address a letter to the *Journal of the Society of Arts*, upon the results I thought likely to be realised in connection with the Albert Hall, and the buildings in progress for the forthcoming Exhibition of industry, to be opened in May next, adjoining the Horticultural Society's gardens, at South Kensington. I then ventured to say that I believed that a surprise as great as that created by the Exhibition and building of 1851 was being prepared for the public. Since I wrote, much has been done and published relative to the buildings then in progress and the objects to which they are to be applied.

Having read in the *Journal of the Society of Arts* the advertisement announcing the ceremonial opening of the Albert Hall, on the 29th of March next, I was induced to seek another opportunity of viewing the building, now that the scaffolding has been removed. All I had previously anticipated in reference to the effect of the interior of the building as a whole have been more than realised. The breadth, simplicity, and beauty, combined with vastness, at once struck me as unlike and beyond anything combined in any other existing building in Europe. Then, as to the internal arrangements for auditors seated in the building, it appears to me that there is no such thing as a bad position throughout the building, and those most distantly removed from the platform command a full view of whatever is being done upon it.

The balcony seats, every one of them, command nearly the whole building, from base to roof. Then again, as to the roof, it is an unseen marvel of engineering in iron, at the same time it is so glazed as to form an elegantly ornamented glass screen, tempering the light of day as it passes into the vast space below it.

The building seems to be equally adapted for either day or night uses. Its day capabilities are to be tested on the 29th March, when Her Majesty the Queen is to open the building; but I am informed that the privilege is reserved to the public, through the Society of Arts' concerts on behalf of a National Musical Training College, to see the building by gaslight. I anticipate on the part of the first audience, if others feel as I do, nothing short of amazement. To look up to the roof, and see the spider-webs pendant from the roof, with star jets for gas hanging at their ends, like so many spiders, is to look through space and wonder how such gas jets are to be lit, as they appear quite beyond the reach of man. Upon inquiry, I found that those having the conduct of this vast enterprise are quite equal to the occasion, for they have fallen back upon that wonderful agent, electricity, to reach these far-removed lights.

I fear you will set me down as an enthusiast, or think of me as a child pleased with a new toy, and doubt the propriety of giving space to this rambling scrawl. Nevertheless, I venture again to predict that all those who have been working so quietly for the gratification of the public, and the advancement of industrial interests in the future, will reap a rich reward, in the thorough appreciation of their work by the public.—I am, &c.,

S. H. W.

MILITARY DRILL IN SWITZERLAND.

The following letter was published in the *Times*:—

Sir,—A few days back you called attention to the importance of a study of the military organisation of the

Swiss Confederation, in case it should become necessary to introduce a system of universal military service into England; and you threw out a valuable hint as to the training undergone by young boys in this country. On the latter point, if you will allow me, I will say a few words.

I am aware that at some of our public schools, at very great expense to the parents, volunteer corps have been got up. But in Switzerland economy is a science, and thoroughly appreciated, treating of the greatest amount of result to be attained by a small expenditure.

In this town there is a college of some 200 or 300 boys of all ranks, and ages varying from 10 to 16 or 17. They are dressed in tunic and trousers of coarse dark blue cloth, with cap and belt—not a gala uniform for strutting about in at stated times, and costing a considerable sum, but cheap and durable, and worn throughout the year, at home or at school. Thus, there is no invidious distinction between boys rich or poor, nor have parents to provide both uniforms and plain clothes. The municipality, as I am told, provide these boys with bayonet rifles, large and small, according to their age, and with a light battery of field artillery. Every Wednesday afternoon, during the summer, the boys are marched out, in charge of a capable instructor, and headed by an excellent band, to a neighbouring meadow, where they go through their drill—the artillery corps dragging their guns and working them in admirable style. Every now and then ammunition is served out, and sometimes the regular soldiers join in the evolutions.

The boys are officered by themselves, the officers wearing a somewhat superior uniform, with sword and epaulets according to rank. The instructor rarely gives his own orders, but communicates them to the commanding boy officer, who gives the word and directs the movements. Last summer, when passing through several little Swiss villages, I was startled by drum and fife and measured tramp—it was merely the thirty or forty members of the village school going to their afternoon drill.

Now a boy accustomed to march, fall into his place, or dress up, who is familiar with all the bugle notes, and who can fire a rifle with fair precision, forms, I submit, excellent material from which to form a soldier—just as a boy used to a gun generally makes a good shot in after life. For him a year's training, somewhere between 17, 18, and 20 or 21, will probably be found quite sufficient; his efficiency being kept up by an annual three days' camp life, and by so many afternoons spent at the butts, more or less, according to the score against his name.

One other remark. The military service here is not dreaded and hated like the French conscription. Why? Because it bears equally upon all and hardly upon none. Arrangements are soon made to meet the duty each male owes to his country, and, as but a few hours of his day are occupied, even during his term of service, he can generally manage to carry on his education. And this general enrolment has another advantage; it brings the lawless classes and low populations of large towns under more control. Of all countries of Europe, a universal liability to military service would press least hardly in England, seeing that there is no necessity to send 60,000 or 100,000 men to the frontier from time to time, as Switzerland and Belgium have been doing, drawing young men (except railway *employés*) away from their occupations. Then the shoe does pinch. The pressure is hardly felt when each man can discharge his duties in his own village.

Trusting that you will pardon the length of these remarks, and that Great Britain will find herself prepared in the day of trial, I am,

An Eye Witness.

Lausanne, Jan. 27.

P.S.—I hear it is under discussion to substitute breech-loading ordnance for the muzzle-loaders hitherto used by the college boys.

EDUCATIONAL NOTES.

National Education League.—A meeting of the Executive Committee of the League was held on the 2nd inst., to consider the action to be taken during the next session of Parliament. It was decided to concentrate the efforts of the League on resisting the proposed increase of government grants to schools, which forms a part of the scheme of last session. The Publishing Committee was authorised to prepare a circular to the branches, expressing the views stated at the meeting, and urging them to hold public meetings, and to use every means for inducing their representatives in Parliament to give their most strenuous opposition to the proposal of the government. The Rev. Charles Vince called attention to the large grants of public money which are made to sectarian normal schools, and a resolution was passed requesting the officers to consider and report upon the subject at the next meeting of the Executive Committee.

The London School Board and Compulsion.—At the meeting of the Board on Wednesday last, a motion by the Rev. John Rodgers, that the 74th clause of the Education Act (that referring to the attendance of children at school, and giving to the Boards the power of compulsion) be referred to a special committee for consideration, gave rise to an interesting discussion, and although some members dwelt upon the importance of handling the question with the utmost care and tenderness, and one went so far as to express a fear that "the adoption of compulsory education would exasperate a certain portion of the lower classes," not one member actually objected to the principle, and the motion was carried unanimously. Mr. Lucraft, upon the same subject, moved the following resolution:—"That it be a bye-law of this Board that the parents of children between the ages of five and thirteen be compelled to cause such children to attend school, unless a reasonable excuse be given for not doing so, as provided by the Act," but this was afterwards withdrawn in favour of an amendment proposed by the Rev. Dr. Barry, to the effect that the Board desired to affirm the necessity of enforcing attendance at school in accordance with the provision of the Act, such enforcement to be carried out under such limitations and regulations as shall hereafter be approved by the Board. This was carried unanimously, and a special committee was nominated in accordance with Mr. Rodgers' motion.—With reference to the statistics now being obtained by the Board, Lord Sandon explained that at present the inquiries instituted comprised the numbers of children between the ages of 3 and 5, and 5 and 13, for whom elementary education was provided; the real number of children requiring to be provided for; the state of existing schools; the erection of new schools, with the precise localities and nature; and generally the social condition of each district.

The Nonconformists and School Fees.—At a meeting of Nonconformists held in Birmingham on Tuesday, to consider the question now before the Birmingham School Board as to the payment of fees for children attending denominational schools, resolutions to the following effect were agreed to:—1. That the passing of the Education Act, and the formation in Birmingham of a School Board, relieves the religious congregations of the town from the responsibility which has hitherto rested upon them with regard to the elementary education of the people. 2. That in the event of a religious congregation surrendering its school, the managers be advised to offer the use of their school buildings, at a nominal rent, and for a limited period, to the School Board, on condition that the religious teaching therein shall be confined to the reading of the Bible without note or comment. 3. That the central Nonconformist Committee be instructed to correspond with the managers of Nonconformist schools, with the view of securing the united offer of their schools to the

Board, under the above conditions. 4. That a memorial to the School Board be prepared, protesting against the proposal for the payment out of the rates of school fees for children attending denominational schools, and expressing the conviction that the managers of the Nonconformist schools will decline to receive the fees from the Board.

Denominational Inspection.—A letter has appeared from the Bishop of London, expressing his opinion that the tendency of the Education Act will be "to deteriorate both the quantity and quality of the religious teaching in Church of England and denominational schools, unless counteracted by watchfulness and effort;" and urging "that it is essential to the maintenance of the present standard of Scriptural instruction, and to the placing the teaching of the doctrines and duties of religion on the same level with the other lessons of the school, in the eyes of the taught at least, if not of the teachers, to supplement and strengthen the efforts of the clergy, and of the masters and mistresses, by systematic, skilful, and authorised inspection." Moreover, the Bishop considers that those who subscribe to the schools "have the right to ask some guarantee and evidence that the religious education, to provide which they are making a sacrifice, is faithfully and efficiently given." In the diocese of London it is proposed that the provision for inspection in religious subjects shall be made by the Diocesan Board of Education, which undertakes to raise the funds, to make the necessary arrangements, and to recommend to the Bishop, for appointment by him, an efficient inspector. His Lordship concludes by appealing for funds to enable the board to provide the required inspection. In reference to the Bishop's letter, "A Churchman," drawing attention to the fact that schools of other denominations have had no regular inspection in religious subjects, says that "it is hard to conceive a severer reflection on the clergy of the Church of England, and on the influence they exert in national schools, than this episcopal apprehension of a 'deterioration in the quantity and quality of religious teaching' immediately on the withdrawal of that special aid in enforcing religious teaching which has hitherto been given by the government to the schools of the Church of England, and to no others." He quotes from a report of Mr. J. G. Fitch, with reference to British and other Protestant schools not connected with the Church of England, who says:—"It is too commonly assumed by public speakers and writers who know little of the interior of a school, that every place of primary instruction must either be distinctly sectarian, and teach a special creed, or be absolutely secular and non-religious; but I take leave to testify that the schools which fall under my inspection are neither the one nor the other. They are almost without exception essentially Christian schools, in which the Scriptures are read and accepted as the rule of life, but in which no attempt is made to dogmatise or to fix the convictions of young children on those points on which Christian people differ from each other."

CORRESPONDENCE.

MUSIC AND DRILL IN PRIMARY SCHOOLS.—THE DEPUTATION TO MR. FORSTER.

SIR,—There is much force in the reply of Mr. Forster to the influential deputation that waited on him respecting the introduction of music and drill into the primary school course. Mr. Forster's words, as reported, are these:—"In the primary schools there was scarcely any surplus of time, after devoting an adequate portion to reading, writing, and ciphering." The importance of music and drill, and also of the elements of science being taught in primary schools, was fully admitted by Mr. Forster, but "how are we to get the time for it?"

Reading, writing (including spelling), and arithmetic are the prime necessities of education, and yet the reports of the Education Department show how lamentably deficient the children who pass through inspected schools are in these subjects.

In England and Wales there are, in round numbers, 400,000 children of the labouring population between 12 and 13 years of age. Half of these, or 200,000, are probably in inspected schools, and unless they acquire the ability to read, write, and cipher before the age of 13, the chances are that they will never learn to any purpose. The sixth standard of the Education Department requires a child to read a few lines from a newspaper, and to spell the same correctly. The number presented, to say nothing of passing, in this standard annually in government schools is about 25,000; and in the fourth standard, which requires a child to read a short passage from a school book, and spell the same, is about 80,000 annually.

Assuming even that an equal number attained to these two standards in uninspected schools, which is by far too favourable an estimate, we have 80 per cent. of the youths who grow up year by year, and are absorbed into the labour market, unable to read a newspaper with understanding, and 20 per cent. unable to read an easy school book.

How is time to be gained to teach this vast army who pass year by year from the school age to the work age? Much doubtless may be done by compulsory attendance, a great deal may be done by improved methods and arrangements in teaching, but these efforts will not overtake the whole of the work required; we must improve our instruments of education.

The importance attached to mere spelling in the inspectors' examination, and, therefore, the time devoted to the teaching of it in inspected schools, is absurdly out of proportion to the value of this subject. The Education Department and the inspectors are not altogether responsible for this, but custom has has given a fictitious value to mere orthography. A child would be plucked in a primary school for spelling plough, *plow*, as it is in our Bibles, or enough, *enuf*, as King Charles I. wrote it, or programme, *program*, as Carlyle writes it now; and I have known a boy plucked for omitting the *u* in honour; And, after all, how very few, even in the higher ranks of life, spell correctly, as it is called. Half the time now devoted to teaching spelling would suffice to give the children in our schools a good knowledge of drill, of music, of the elements of science, and especially of the science of health, for lack of which so many of our people are perishing. By permitting and accepting as good spelling simpler forms of spelling used by standard authors, present and past, all this might be done without injury to any principle or interest. Why should we not spell believe, *beleve*, and deceive, *deceve*, as the older authors did, and friend, *frend*, debt, *det*, &c., to the great relief (*relefe?*) of learners, and saving of time for more useful purposes.

I have ventured to call the attention of the readers of the *Journal of the Society of Arts* to this subject, and to state that a memorial to the above effect is now being signed, Professor Max Muller, Sir Walter Trevelyan, several Members of Parliament, principals of training colleges, and a large number of teachers in different parts of the country, having already signed it. The memorial will be presented to Mr. Forster shortly, and I shall feel pleasure in forwarding a copy to any one addressing as below.—I am, &c., E. JONES.

Hibernian Schools, Liverpool.

SIR,—I am glad to see, by reports and letters in the *Journal*, that the above-named subjects are receiving the consideration they deserve.

As I introduced such instruction into our national schools here, it may be interesting to some of your readers to know that they may be taught without in any way interfering with the usual routine of the day-school.

The plan I adopted, nearly 30 years ago, was to have all the scholars of suitable age assembled in one of the schoolrooms, once a week; the boys on one evening, and the girls on another, from 7 till 9 o'clock; and all who had an ear for music were taught upon Hullah's system. When they were sufficiently advanced, we assembled both sexes on one evening, and the result was most satisfactory. On these occasions, we frequently had 400 scholars present, and we experienced no difficulty in obtaining the services of honorary teachers to assist in the instruction, and in leading the separate parts.

It is only about ten years since I was induced, in consequence of the stooping postures in which the young men who attended our evening schools stood and sat at their lessons, as well as their awkward gait, &c., to arrange a drill-class, which was also held in the evening as early in the spring as the length of daylight would permit. At first, I had to engage a serjeant-major who was drill-instructor to the rifle volunteer corps, but in less than twelve months I had offers of voluntary help from several competent retired serjeants, and the instruction led to the best possible results, and was only discontinued when we could no longer obtain premises to drill in. I may add that this led to the formation of a drum and flute band, which has attained considerable efficiency, and continues its practice regularly to the present time.

From all my experience, I believe that if school-managers will allow their schoolrooms to be used in the evenings for singing classes, there are few parishes in which any difficulty will be found in obtaining gratuitous help for giving instruction, and, under proper superintendence, the best results may be anticipated.
—I am, &c.,

Herbert M. Holmes,
Hon. Local Secretary to the Society of Arts.
Derby, February 1st, 1871.

THE PRESERVATION OF VEGETABLES.

Sir,—In the report of the remarks made by me during the discussion upon the paper read by Mr. Buchanan last Wednesday, there occurs an important omission.

It had been stated that there were naturally present in vegetables certain noxious matters that required heat or pressure, or both, for their removal, and the manufacture of tapioca from the root of the poisonous *Jafripha manihot* was cited as an instance.

My observations were to the following effect:—"That so far from there being a necessity to remove anything from edible vegetables, for years the value of the whole constituents had been so fully recognised that they are now recommended to be cooked by gaseous (dry) steam, so that nothing should be lost, and that the instance brought forward of the preparation of tapioca had nothing to do with the preservation of vegetables, but with the manufacture of a special article."

By the insertion of this correction you will greatly oblige Yours, &c.,

J. E. D. Rodgers,
Professor of Toxicology.
London Hospital Medical College,
February 6, 1871.

Sir,—There is no doubt that the patent process for preserving both meat and vegetables proposed by Mr. Buchanan, and laid before the Society on Wednesday evening last, will meet with success, as a similar process was carried out in the early days of the first French empire, under the superintendence of the elder Carnot, who published a description of it in his great work on fortification and the defences of strong places, the original proposer of the plan not being alluded to. The process was very simple and inexpensive, for it consisted merely in hanging up cane baskets filled with quicklime in the stores, and changing occasionally when the lime became effete. The spent lime can still be used for building.

I mention cane baskets, because they are much cheaper in the end than when made of willow or osier, as cane never decays, but only wears out by long and rough usage. The animal and vegetable matters, when removed, are similar to horn, have no seeds of corruption left in them, and can be kept anyhow. They only require sufficient soaking in order to return to their fresh state.

Unfortunately, I was a prisoner of war under the first Napoleon for more than eight years, and thus gained early knowledge of this process; and I feel sure that I have long since placed it before the public in print.—I am, &c., Henry W. Reveley.
Reading, February 2nd, 1871.

COTTON SUPPLY.

Sir,—The leaders of the Manchester Cotton Supply Association justly consider that they are entitled to rest from their labours, after so many years' exertion in the cause. The work has not been accomplished simply by money subscriptions, but mainly by the personal and gratuitous exertions of Mr. Cheetham, Mr. Edward Ashworth, Mr. J. B. Smith, Sir T. Bazley, and other friends of the cause, ably assisted by the secretaries, and many voluntary co-operators throughout the world.

The posts of president and vice-president of the Cotton Association, held for so many years by their present occupants, are necessarily attended with responsibility, and we cannot expect perpetual servitude from gentlemen whose labours meet with less sympathy and support than they deserve. The large supplies now attainable from the United States will render the task of cotton raising in other countries more difficult, and the governments of India and Turkey will have bitter reason to regret that they did not discharge their duties in time, while the exhortations of the Cotton Supply Association to the East were still new, and while the competition of America was less discouraging.

Manchester has accomplished a task of honourable labour, but for the sake of India, of many of our colonies, and of other countries, it is not desirable all organisation shall cease. The Society of Arts can hardly render a service more congenial to the purposes of its foundation than the constitution of a Cotton Committee, to watch over the interests of India, and to co-operate in the great work Manchester has so admirably inaugurated. A Cotton Committee there, and one in Liverpool, will afford the means of joint action.—I am, &c., Hyde Clarke.

THEORIES OF COLOUR.

Sir,—Would you allow me a brief space in reply to your correspondents on the above subject. I have always been under the impression that "theories," in any department of science, should be based on first principles, that all else are but corollaries, deductions, or analysations. I contend that the first introduction of colour on earth is caused by light refracted into darkness, which causes blue; that the varying density of the medium through which light first reaches vision produces all other colours. It is nature's first effort in this important principle. If light introduces the first effect of colour in nature, it is the cause of it. If light first introduces every colour nature can produce, in their utmost brilliance and intensity, by the medium through which it passes increasing in density, then that light and density are the first great causes of colour; and as that density would be darkness without light, then light and darkness originate the first principles or "theory of colour."

Scientific men may modify these truths into more complicated theories, but the artistic mind, which in no way deserves the slight put upon it by your correspondent, and which is quite capable of forming a sound judgment on colour principles, will be content with the simple truths nature offers, as theories founded on first principles.

Now, in the primitive colour—creation of light and atmosphere, green is never produced, except by admixture of blue and yellow; therefore it is not a primitive colour, it is a compound.

I confess to the charges of "Nemo," that careful observation of nature, not books, has been my chief study; and a confiding, reliant mind is always safe in the contemplation of her instructions. The different bias of men's minds, through their varied qualifications and readings, may lead to a variety of theories, but they are all referable to first causes, and I do not see anything in the answers to my letter which in the least affects its contents.

The discovery of Newton, that light was formed of rays of varying refrangibility, supports my theory. They are all light in its broadest term, in which sense I used it. Light is not a chemical substance, it is an effect. It must be placed in the category of those wonderful instances of the proliferous powers of nature, which in its benevolence it gives us for our purposes of existence, sound, speed, elasticity, and other properties, which are effects; matter remains the same.

If the admixture of "light and darkness" be not the great first cause of colour, your correspondents are bound to show what is, which I have not yet seen. Colour is made for the eye; and the artist studies only its effect on transparent or opaque substances, which in the absence of light are colourless, dark. We have nothing to do with chemical analysations; what we have to do with are appearances, and having traced these to their first cause, our theory is soundly based thereon.—I am, &c.,

W. G. HERDMAN.

West-villa, St. Domingo-vale, Liverpool.

PENMANSHIP.

SIR,—A friend having called my attention to the announcement of prizes and the observations on penmanship in the *Journal of the Society of Arts*, dated December 30th and January 13th, I write to say that, though I had never before seen a report of those observations, I have, in common with numerous other persons, held the same opinions as Mr. Grant, and have, moreover, put them in practice on a very extensive scale for some years past.

Believing the promotion of free, legible penmanship to be a means of extensively increasing the power of earning wages, and equally disapproving of the stiff, copperplate, unnatural style of the different copy-books generally in use in our public schools, and of the illegible, sprawling, angular style affected in numerous private schools for young ladies, a style which was happily characterised by the late Lord Palmerston as the "area-railing style," I formed some years ago a collection of the most popular copy-books in use in many countries. I adopted what I considered to be the characteristic excellencies of each, and published in the year 1865, with the special approval of Lord Palmerston, a set of copy-books, which were at first entitled the "Palmerston" series, by permission of his Lordship, under whom I had served as a subordinate in the diplomatic profession, attached to the special missions of Sir Henry Ellis and Sir William Ouseley to Brazil and Monte Video. The books were immediately adopted by the Commissioners of National Education in Ireland, and became so rapidly popular that their sale has already reached many millions in Ireland, where they are universally used in the national boys' schools, and in the majority of the national girls' schools, angular writing being still preferred in numerous cases for girls, especially in Irish private schools, because it is believed to be fashionable.

The distinguishing characteristics of my series are as follows:—

Combination in the greatest possible degree of legibility with rapidity. The formation of all the letters, and notably of the letters *a*, *d*, *g*, *q*, is adapted to this end.

The tailed letters are of moderate length. The up and down strokes are of nearly equal thickness, as in the ordinary writing of both sexes, and as contradistinguished from the engraver's style.

The writing of each word is continuous from end to end.

The exclusion of large hand, on the Continental and American principle, as unfit for small fingers.

The systematically progressive arrangement and variety of head-lines—two lines on each page.

Traced lines, under each copy, to be written over (in Book 1).

Guide lines to regulate the length of tailed letters (in books 2 to 6).

Careful and abundant selection of proverbs and aphorisms (in books 4 to 9).

Collection of over 200 of the Christian names in most common use, affording scope for a great variety of elegant capitals (in book 7).

The most perfect collection yet published of plain and ornamental lettering (in book 10).

I have much pleasure in forwarding, for the inspection of the Society of Arts, a complete collection of both the penny and twopenny editions of my copybooks, bound in one volume. Those published for the Commissioners of National Education in Ireland contain half as much more paper, with a corresponding increase in variety of head-lines.

I myself, two months ago, offered prizes to the amount of £70 to pupils, and £30 to teachers, of public or private schools in Ireland, for specimens of penmanship in imitation of the style of writing in my own copybook No. 7, to be delivered to me on or before March 31, and the prizes to be awarded by myself.—I am, &c.,

VERE FOSTER.

43, University-road, Belfast, January, 19, 1871.

GENERAL NOTES.

New Hill Town.—The Indian government has chosen the Pachmaree Hills for an experimental sanitarium.

Gold.—Gold has been discovered in Madagascar, but search for it is prohibited by the government, on the ground that it will lead to a large importation of foreigners.

Rock Salt.—A seam of rock salt, 4 ft. thick, has been discovered near Scone, New South Wales, and is about to be worked. A lease of the land has been bought by Dr. Creed. This is the first instance of salt being found in the colony. It is said to be the first in Australia.

New Metal Market for South Wales.—Efforts are now being made to establish metal markets in the leading towns in South Wales, so that the iron, coal, tin-plate, and other proprietors may meet on stated days, as is the case at Wolverhampton, Birmingham, and Middlesborough. A meeting of the committee appointed to promote the proposal has been held at Cardiff, when it was announced that numerous promises of support had been received, and it was resolved that markets should be held at Newport and Swansea every alternate Wednesday and Thursday. A market will also be held at Cardiff, provided the co-operation of the coal interests of that port can be obtained.

Military Road Steamers.—Several traction engines of the kind known as Thomson's road steamers have been ordered for use in the Royal Arsenal at Woolwich, and it is expected on their arrival experiments will be made to ascertain their adaptability for the purpose of moving heavy guns into action. The men of the Army Service Corps are being trained in the use of these engines, and it has been found that they can be made of great service in the ordinary work of a campaign, not only in the transit of carriages loaded with heavy material, but also in extricating guns and other *impedimenta* of war from difficult positions. By the use of steam for such purposes, the drivers and horses of the artillery will be left to their more legitimate work of manning the batteries.

Gas, Cannel, and Coals.—The annual circular of Messrs. J. P. Higginson and Co. contains some analyses of the comparative value of gas made from coals and cannel. The first is by Dr. Andrew Fife, Professor of Chemistry, King's College, Aberdeen, to the effect that "a ton of English caking coal yields, on an average, at gas-works, 8,000 feet of gas; and though a larger quantity was given with my apparatus, yet we must take 8,000 as the quantity on a large scale. The value of coal is taken as 1. The Wigan cannel yielded 9,500 and 11,500, the value of the gas, bulk for bulk, being the same, viz., 1·85 to the former as 1. Now, taking into account the quantity of gas afforded, the value of the coals for yielding light, by the consumption of their gases, is as 2·23 for the one quantity, and ·25 for the other. Taking the average, we state the value of English cannel coal as 2·35, or say 2⅓ to Newcastle coal as 1." The following analysis of the cannel raised by the Ince Hall Coal and Cannel Company, by John Leigh, M.R.C.I., Consulting Chemist to the Manchester Corporation Gas Works:—

Carbonic oxide and aqueous vapour ..	1·53	
Olefiant gas and divers hydro-carbons..	8·50	
Atmospheric air	4·32	
Nitrogen	0·19	
Hydrogen	40·30	
Light carburetted hydrogen	33·83	
Carbonic acid	11·35	
		100·02

Quantity of gas produced ...... 11·673 cubic feet.
Specific gravity of gas .... 3·20 ,, ,,
Coke produced from 1 ton of cannel, 13 cwt. 0 qrs. 13 lbs.

This cannel is used by the chief gas-works of this country, including London, Liverpool, Manchester, and Birmingham, and by the principal foreign gas-works, both on the Continent and in North and South America. An analysis of Wigan gas-coal, made by J. E. Clift, Engineer of the Pagoda Gas-works, Birmingham, gives the following results:—

Carbon, from 100 parts	84·5	
Hydrogen ,, ...	5·14	
Oxygen ,, ...	2·10	
Nitrogen ,, ...	5·20	
Sulphur ,, ...	·33	
Ash ,, ...	4·12	
		98·30
Less		1·61
		100·00

The products obtained from one ton of gas-coal, being the average results obtained from using 300 tons in making gas were:—Gas produced, 10,200 cubic feet; illuminating power—one Argand burner, consuming five feet per hour—thirteen spermaceti candles of six to the pound; specific gravity, 462; atmospheric air being 1·00. Coke produced, 13 cwt. 3 qrs., or 44 imperial bushels; suitable for ironfounders, brassfounders, and maltsters. Ammoniacal liquor produced, 20 gallons, 1 gallon requiring 10 oz. of the sulphuric acid of commerce to saturate it. Tar produced, 10 gallons. 1,000 cubic feet of gas requires 12½ lbs. of lime for its purification, which shows it to be comparatively free from sulphur. The other impurities of coal-gas are not more abundant than in that made from other coals. Further analysis of same gas coal, made by Professor Thompson, of London:—

Specific gravity	1·270
Coke, per cent.	65·2
Volatile matter, per cent.	34·8
Cubic feet of gas per ton, gross	11·400
,, ,, ,, purified	11·200
Impurity per cent. in gas	1·8
Specific gravity of purified gas	406·
Illuminating matter condensible by bromine, per cent.	4·25
Carbonic oxide in purified gas, per cent.	4·

Illuminating power of the gas, burnt at 5 feet per hour, equal to 13·8 spermaceti candles, each consuming 120 grains per hour. The heating power of the coal is such that 1lb. will convert 15½ lbs. of boiling water into steam.

Wool Product of California.—The production of wool in California, in 1870, exceeded 20,000,000 lb. The average price was about 20 cents, the whole clipping being worth 4,000,000 dols. It is estimated that 1871 will see an increase of 25 per cent. in the quantity produced.

Sorghum Sugar.—In New South Wales the Imphee, a variety of *Sorghum*, is the sugar-bearing cane of hardier habits. It stands frost better than the sugar-cane proper, and is little affected by floods. It comes to maturity in five months, and therefore may be employed as an interval crop, alternating with sugar-cane, and keeping the sugar-mills going. There are sixty acres planted with imphee in various districts. Present experiments lead the growers to expect from 1¾ to 2 tons of sugar to the acre. When not grown for sugar, the plant yields abundance of valuable food for cattle, at the rate of 30 to 40 tons of cane per acre.

Breweries in Victoria.—From the return of the Registrar-General of Victoria, for the year 1869, it appears there were in that colony 119 breweries, employing 955 hands, at which 14,000,000 gallons of beer were made in the year. The materials employed were about 11,500,000 pounds of sugar, 1,000,000 bushels of malt, and 900,000 lbs. of hops. The value of the machinery and plant was £211,269; of the buildings, £224,000; and of the land, £58,365. 390 drays and waggons, and 670 horses, were employed for these breweries.

Orange Trade of New South Wales.—A considerable portion of land is devoted to the orange, particularly in Cumberland, where a fine market and an accommodating railway are to be found. Thousands of cases come down to Sydney annually from the Paramatta orangeries, and are shipped to Melbourne, South Australia, Tasmania, New Zealand, &c. The profits of orange-growing are, when the practical management of the tree is understood, very considerable; but in many cases the trees have been exhausted by being allowed to bear heavily, year after year, without any attempt being made to recruit their jaded powers by the administration of manure. Most of the orangeries are new; but in some of the older ones the trees have attained a height of 35 feet, the diameter from the extremities of the branches being 33 feet. From trees of this size, of which there are few in the colony, 12,000 oranges are occasionally picked in the year, which, at 6d. a dozen wholesale, would give £25 as the value of the yield of the single tree. The plantations are generally young, and the trade in oranges and lemons is likely to assume large proportions; but the growers will have to master the principles of drainage and manuring, and apply them before they will be able to preserve their trees in a healthy state.

Manufactories in Victoria.—There are 171 factories, &c., in Victoria working on raw material, the production of the pastoral interest. Of these, 27 are boiling-down establishments, of which 19 are worked by steam; 37 fell-mongeries and wool-washing establishments, 9 being worked by steam; 6 bedding and curled-hair works; 1 flock manufactory; 4 glue and oil works; 11 meat-curing establishments; 31 soap, candle, and tallow-rendering works; and 54 tanneries.

Tin-plate Manufacture.—Last year, an inquiry was instituted into the tin-plate manufacture of the United Kingdom, and twenty-six firms, with ninety-nine mills, rendered very complete returns for the year 1869 to Mr. Robert Hunt, the keeper of the Mining records. The total number of mills, fully or partially at work, was stated at 164. The returns received from the ninety-nine mills, for 1869, show the number of boxes of tin-plate 866,985, and of black plates 298,892, making the total number of boxes 1,165,877. The actual weight of the whole returned was 54,314 tons. Estimating that the sixty-five mills not returned produced at the same rate as the ninety-nine returned, they must have made 746,460 boxes, showing the total number of boxes of tin-plate made in the year to be 1,912,337. According to this, the mills will have worked only three-quarters of full time. But this estimate is thought to be too low, and the following is offered by an experienced manufacturer as being nearer the truth:—Mills going, or ready to work, in 1869, 164; deduct 14 for mills known to be stopping, and mills calculated to be making block plate, leaving the number of mills 150. These, making on an average 300 boxes for forty-eight weeks, would produce 2,160,000 boxes. But it is thought that 350 boxes per week must be nearer the average per mill. This would increase the estimate by 360,000 boxes, showing the total estimated make of tin-plates in the United Kingdom to be 2,520,000 boxes. The Board of Trade returns show that 1,934,034 cwt. cf tin-plates, the manufacture of the United Kingdom, of the value of £2,304,820, were exported in 1869, two-thirds of which went to the United States. There has been a steady annual increase in the exports, and they have risen half a million cwt. in the last five years.

Education in Domestic Economy.—A meeting of the Victoria Discussion Society was held on Monday night at the Cavendish-rooms, Mortimer-street, at which Lord Lyttelton presided, and where a paper was read by Mr. Phillips Bevan, "On the Necessity of Education in Domestic Economy." A discussion ensued, in which several ladies as well as gentlemen took part. The main interest of the proceedings centred in an announcement by Miss Faithful, that under the distinguished patronage of the Earl of Shaftesbury, the Countess of Warwick, and others interested in the undertaking, a proposition is about to be made to remedy the lamentable ignorance which prevails in this country with reference to domestic economy and household management, and to supply several requirements which have long been felt by ladies resident in or temporary visitors to London. With this view, it is hoped to form a self-supporting training school, to include the thorough teaching of a certain number of resident servants in the several duties of cooks, kitchen, house, chamber, and parlour maids; whilst instruction would be given to daily learners in the culinary and confectionary departments. Among other advantages, it is proposed that a course of 24 lessons in the art of cooking and general household management should be given to ladies who are subscribers of £2 2s. Lord Lyttelton, in summing up at the close of the discussion, took occasion to observe that he hoped that in future girls would participate to a greater extent in the advantages of the old foundations of the country, and by way of instancing the injustice done to girls through their non-participation in these endowments, he remarked that in Christ's Hospital, with an annual income of more than £40,000, the benefits of the institution were extended to more than 1,000 boys, but only to 18 girls. He expressed his confidence that in future educational arrangements disparities of this kind would undergo alteration.

Machine for Writing Music.—An ingenious French invention is a machine for writing music. The inventor passes over a metal cylinder, turning regularly by means of a clock movement and communicating with a battery, a band of paper impregnated with a solution that will decompose under the influence of an electric current, as in telegraphic apparatus according to Caselli's and other systems. The clock movement may be put in motion or stopped at will by an electric or mechanical stop or detent. The band of paper being placed on the cylinder, the inventor places above it a series of metal wires or plates, isolated from each other in such a way that as they rest at one point on the paper, in a parallel direction to the axis of the cylinder, they each communicate, by means of a separate metallic wire, with a contact apparatus placed under each of the keys of the keyboard of the instrument. These contact apparatuses are worked by the motion of the key, either by bringing together two wires or metallic plates, or by plunging one point in a jar of mercury communicating with the battery. The circuit is thus closed for each of the wires only when the key corresponding to it is lowered.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

February 15.—On "The Commerce of India." By Dadabhai Naoroji, Esq. On this evening Sir Bartle Frere, K.C.B., G.C.S.I., will preside.

February 22.—On "Water Meters." By Frederick E. Bodkin, Esq. On this evening John Hick, Esq., M.P., will preside.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Social Science Association, 8. Mr. Thos. Hare, "On the Suggestions afforded by the Application of the Cumulative Vote, and by the other incidents of the School Board Elections, for Improvements in the Constitution of Municipal and Local Governing Bodies."
Institute of Surveyors, 8. Mr. W. Matthews, Jun., "The Valuation of Annuities and Reversions Dependent upon Terms of Certain Duration."
London Institution, 4. Prof. Huxley, LL.D., F.R.S., "On the First Principles of Biology." (Educational Course.)
Royal Geographical, 8½. 1. Letter from Mr. Churchill (Consul at Zanzibar) concerning Dr. Livingstone. 2. Mr. Charles B. Brown, "Discovery of the Kaieteur Waterfall, British Guiana."
Medical, 8.

Tues. ...**SOCIETY OF ARTS, 8.** Cantor Lectures. Dr. Crace Calvert, F.R.S., "On Dyes and Dye-stuffs other than Aniline."
Royal Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Mr. Wilfred Airy, "On the Archimedean Screw for Lifting Water." 2. Mr. David Thomson, "Centrifugal Pumps."
Royal Institution, 3. Dr. Foster, "Nutrition of Animals."
Photographic, 8. Annual Meeting.
Anthropological, 8.

Wed. ...**SOCIETY OF ARTS, 8.** Mr. Dadabhai Naoroji, "On the Commerce of India."
Meteorological, 8.
Royal Society of Literature, 8½.
London Institution, 7. Conversazione. Mr. W. H. Perkin, F.R.S., "On Alizarine and other Colouring Matters."

Thurs...Royal, 8½
Antiquaries, 8½.
Linnæan, 8. 1. Tulasne on Tremellineous Fungi and their Analogues. 2. Lindberg. Bryological Remarks.
Chemical, 8.
Numismatic, 7.
Royal Society Club, 6.
Royal Institution, 3. Dr. Odling, "Davy's Discoveries."

Fri.......Geological, 1. Annual Meeting.
Philological, 8¼.
Royal Institution, 9. Mr. J. N. Douglass, "On the Wolf Rock Lighthouse."
Royal United Service Institute, 3. Capt. R. A. E. Scott, "On Naval Armaments."

Sat ......Royal Institution, 3. Prof. Jowett, "On Socrates."
Associated Arts Institute, 8¼. Mr. R. P. Spiers, "That Painting and Sculpture should be Subordinate to Architecture."

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FRIDAY, FEBRUARY 17, 1871.

PROCEEDINGS OF THE SOCIETY.

ELEVENTH ORDINARY MEETING.

Wednesday, 15th February, 1871; Sir Bartle Frere, K.C.B., G.C.S.I., in the chair.

The following candidates were proposed for election as members of the Society:—

Barnett, Samson, jun., Lansdowne-cottage, 316, Essex-road, N.
Burn, Major-General Henry Pelham, 94, Inverness-terrace, Hyde-park, W.
McNiven, C., Perrysfield, Godstone.
Owen, Lieut.-Colonel Charles H., R.A., 27, Common, Woolwich, S.E.
Rooks, George Arthur, 16, King-street, Cheapside, E.C.
Rosenthal, Sigismund, 2, Red Lion-square, W.C.
Smartt, Walter, 11, Poultry, E.C.
Smith, Robert, 52, Downshire-hill, Hampstead, N.W.
Wragge, Lieut.-Colonel Romaine, India-office, S.W.

The following candidates were balloted for and duly elected members of the Society:—

Armitage, Thomas R., M.D., 33, Cambridge-square, W.
Besant, Walter, M.A., 9, Pall-mall East, S.W.
Brinton, Thomas H., 5, Newcastle-place, Clerkenwell, E.C.

The Paper read was—

THE COMMERCE OF INDIA.

By Dadabhai Naoroji, Esq.

The commerce of India is one of the most important subjects that can engage the attention of the public of England. I do not think the audience before me needs to be told the reason why. They know well enough how the prosperity of this country, as of any other, depends chiefly upon its commerce, and how important it is to them that the vast continent of India, with its teeming population, should be opened up for their commercial enterprise. It is a calamity to India, and a great loss to this country, that the subject of the commerce of India is not fully considered by the public or press of England, and that even the merchants and manufacturers do not give to it the attention it demands. I am constrained to say, after my residence in this country for fifteen years, that the knowledge of the public here about India is not only imperfect, but in some matters mischievously incorrect. But why should I blame the English public or others, when those who ought to know best, and upon the information furnished by whom the public must depend, the past India-house itself has made statements entirely at variance with facts. I do not wish to blame anybody, but set it down with grief to the misfortune of India. The Parliamentary return, No. 75, of 1858, gives "A Memorandum (prepared at the India-house) of the Improvements in the Administration of India during the last thirty years." This return, at page 11, gives a paragraph entitled, "General Prosperity." In the part referring to the commerce of India, after giving figures for exports and imports of India, at the interval of 21 years (from 1834 to 1855) the paragraph ends, in relation to the commerce of India for these 21 years, with the strange words, "The great excess of exports above imports (of merchandise) being regularly liquidated in silver." It also states that the exports of merchandise increased 188 per cent., and imports 227 per cent., during the same 21 years.

I cannot trouble you at present with several other fallacious statements in this paragraph. I confine myself at present to those I have mentioned about the trade of India. It is a wonder to me how this statement about the liquidation in silver of the excess of exports over imports could have issued from the India-house. A return (No. 369) made by the India-house itself, on Mr. Bright's motion, in the year 1853, gives the total imports and exports of India. The total exports, according to this return, *including* all treasure for the first 15 years (1834 to 1850) out of the 21 to which the return of 1858 refers, are given as a little above £231,000,000, and the total imports of India, *including* all treasure, a little above £163,500,000, leaving a difference of £67,500,000 of excess of exports above imports, for which, neither in the shape of silver nor of any other goods, has there been any import whatsoever into India. So far, therefore, for the first 15 years' "regular liquidation in silver" for £67,500,000, of excess of exports was simply a creation of imagination.

Now, let us see about the remaining six years. The return (No. 3,891 of 1867) gives the total of exports, including treasure, about £125,500,000, and the total of imports, including treasure, about £105,500,000. These imports include the loan for railways remitted up to the year 1856. I take this remittance to be only £10,000,000, as a low figure, as I cannot get from official returns the exact amount. Deducting this, and not making any allowance for any remittances on account of public debt made during the same period, the total amount of imports is about £95,500,000, or the "excess of exports above imports" of about £30,000,000 which was *not* liquidated, either in silver or in any other goods. Thus we have a total of about £97,000,000; and allowing, to some extent, for the amount of public loans raised in England and remitted to India during the 21 years under consideration, an "excess of exports above imports" of above £100,000,000 which was never liquidated in silver or in other goods. To this must be added about £30,000,000 of profit on exports, thus making about £130,000,000 for which India has received no return in imports. And yet the India-house coolly told the English public, in the year 1858, that during the 21 years previous to 1856, "the great excess of exports above imports was regularly liquidated in silver." I appeal to you, gentlemen, to say whether there ever was a more misleading statement made; and is it a wonder that the English public are indifferent to the complaints of India? The India-house would have been correct if it had said that the great excess of exports above imports of India, during the 21 years, amounting to above £130,000,000, was retained for the benefit of England. Now, I would not have alluded to a statement made 12 years ago, were it not that I have seen its mischievous effects to the present day. So far as my reading goes, I have not come across a single statement in the subsequent Parliamentary returns which distinctly and directly corrects it, and in my conversation generally, except in very few instances, I have found that this misleading statement has led to the almost universal belief that India is rich and prosperous, when it is not so. No more have the imports, with all silver included, been equal to exports after 1856. Notwithstanding the so much talked of wealth poured in during the American war, the total figures are, for 1856 to 1869,* exports (including treasure), about £588,000,000; imports (including treasure), about £545,000,000. Out of these imports, about £72,000,000 (the total expended till end of 1869 being £82,000,000, of which I have taken £10,000,000, the total to 1856) are railway loans, about £27,000,000 are public loans raised in England, and about £15,000,000[*] of registered debt of India, transferred to this country, leaving the actual imports in exchange for exports about £431,000,000 This gives an excess of exports above imports of about £157,000,000 during the last 13 years, which is not liquidated either in silver or in any other goods. Add to this the profits of the export, say about £60,000,000, making a total of above £210,000,000, for which there is no commercial imports into India.

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* (Parliamentary Return, 3891 of 1867, and c. 184 of 1870.)

Now, instead of a misleading statement, that the great "excess of exports over imports was liquidated in silver," if the English public were told that during the past 34 years, exports for about £260,000,000 have had no corresponding material return in imports, nor the ordinary commercial profits of these 34 years, to the extent of some £90,000,000, had been returned to India, its attention would be naturally directed to the strange phenomenon; for everyone knows that in the ordinary course of commerce every country gets a full return with some profit for its exports, and that it is simply impossible for any country to carry on such a commerce as that of India without being impoverished, unless special means are adopted to counteract the evil.

I propose to consider, 1st., the real extent of the commerce of India; 2nd., the reason why it is extremely limited, notwithstanding the progress it has to some extent made; and 3rd., what suitable remedies should be adopted for such an unsatisfactory state of affairs. First, we may see what the extent of the real commerce of India is. I take the latest year for which I can get returns. The table for exports from India, as given in Return c. 184 of 1870, including treasure, gives the amount for the year 1868-9 about £53,700,000, and imports, including treasure, about £51,000,000. Now, we must examine whether these figures represent the commerce of India. I have no doubt every gentleman here reads the little paragraph in the money articles of the daily newspapers about the bills drawn by the Secretary of State for India. I would not undertake to say how many readers of that little paragraph understand its full significance, or care to do so. I am afraid the number is not large. The total of these bills for the last official year was estimated at about £7,000,000. What are these bills drawn for? Certainly not for any commercial purpose. What is the operation of these bills? It is simply this, that out of the proceeds of the exports from India, the Indian Secretary keeps £7,000,000 here, and India receives no corresponding commercial import for the amount. In this manner, what are called "the charges in England on the revenues of India" are paid, that is, India exports about £7,000,000 worth of produce to pay for these charges.[†] You will therefore see that out of the so-called exports of India, about £7,000,000 are not commercial exports at all. Next, in India there are about 2,500 English civilians, covenanted and uncovenanted, about 5,000 English military officers and some 60,000 soldiers. All these naturally remit to this country, for the education of their children, and for the support of their families and dependent friends, and bring with them their savings. The total of their pay is about £9,000,000, and I put down what an English friend, who ought to know well, tells me is a low estimate, about half for the remittances I have alluded to. There are, besides, certain English goods especially wanted for the consumption of Europeans in India. If I therefore take £5,000,000 as the exports of India for all these purposes, to say nothing of remittances by non-official Englishmen, such as barristers, solicitors, doctors, merchants, planters, &c., making up a large sum, I shall be found much under the mark. Thus, then, we have a total of about £12,000,000, out of the so-called exports, which do not form a part of the commerce of India at all, whatever else they may be. I cannot discuss what they really are, or what their significance is, before this Society. I may just tell you that Sir George Wingate calls this item the "tribute" India pays to England; or that another intelligent Englishman calls it the "salary of England" for ruling over India. Be that as it may, one thing is clear, that these £12,000,000 are not a part of the commerce of the country, and for which there is no liquidation either in silver or any other goods. India must send out annually at least £12,000,000 worth of produce, whether it will or no, without any corresponding commercial return. Besides the above two items, there is another which strictly is not commercial. I mean the remittance of interest from India on railways, irrigation, and other such loans. I must not be misunderstood, however. I consider these loans as one of those things for which India is under special obligations to this country. I do not allude to this item in any spirit of complaint. Far from it. On the contrary, I always think of it with great thankfulness. It is a blessing both to the receiver and the giver. I only mean that the interest, even supposing it to be all earned by the railways, though forming a part of the exports of India, is not a part of the commerce of India. This item is about £4,000,000, making altogether about £16,000,000 of exports from India which are not commercial. The balance of the exports representing the real commerce of the country is therefore about £37,000,000 for 1868-9.

Let us now analyse the imports. The total is about £51,000,000. We must deduct the following items as not commercial:—Railway loan for the year, about £5,000,000; irrigation, State railways, and other loans which I have not been able to ascertain, say about £2,000,000; government stores, about £1,500,000; payment on account of the Abyssinian expedition, about £1,250,000; leaving about £41,250,000 as commercial imports. So we have roughly considered about £37,000,000 exports and £41,000,000 imports. This shows something like a national commercial profit of about £4,000,000. But as, on the other hand, India has had to pay to this country £12,000,000 for its administration, the real balance of India's profit and loss account is some £8,000,000 on the wrong side for the year.

Leaving the question of the nature and consequences of this balance alone for the present, we have this remarkable fact that, while the exports of the produce of the United Kingdom are nearly £6 10s. a head of population, of British North America about £3 a head, and of Australia about £19 a head, for 1868, those of India are scarcely 4s. a head, or altogether, including political and non-commercial remittances to this country, about 5s. a head. Even deducting the gold exports, the other exports of Australia are about £11 per head.

I may just remark here, that just as the India-house liquidation in silver of excess of exports, is incorrect, so does its assertion of the increase of 188 per cent. in exports, and 227 per cent. in imports, require explanation. From what I have already said, you may have seen that a good portion of this increase is owing to causes other than commercial, viz., increase of political charges in England, of national debt, and the increasing remittances of official and non-official Europeans.

The question is often asked, why India does not take largely of British manufactures? Why is it that, with a population of 200,000,000, there are only about £17,500,000 worth of British manufactures, or less even than 2s. a head, exported to India, while Australia, with a population of less than 2,000,000, takes about £13,000,000, or more than £6 a head, and British North America, with its population of about 4,500,000, about £5,000,000, or about 25s. a head? Before I proceed to a discussion of this scantiness of the export of British manufactures into India, I must clear away two misapprehensions. On account of such misleading statements as those of the India-house, and a quantity of silver being actually imported into India, it is a general impression here that India is a great sink for silver, that there is great hoarding, and that it is rich. The fact is, first, that India has not imported as much silver as the India-house statement leads one to believe; and secondly, that under the British administration, silver has naturally become a necessary commodity. The revenue having to be paid in cash, a great demand arose for coins, and silver, not being produced in the country, its importation became a necessity. Besides coins, it must also be remembered that, as in all countries, certain social customs require the use of a certain quantity of the precious metals. I am not at all here taking into consideration the withdrawal of the treasure from India that had taken place in the earlier times of the East India Company. And yet see what the gross total amount of bullion is which India has retained during the whole period of the last seventy years, from the commencement of the present century. I think you would hardly believe me when I say it is only about 34s.[*] a head. Conceive, gentlemen, 34s. a head, not per annum, but in the whole course of seventy years, for all purposes, commercial, social, and political, for circulation, wear and tear, for remittances, for railway and other *loans*, and to fill up the drain of former periods—in short, for every possible purpose.

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[*] Parliamentary Return, 258 of 1869.

[†] The "charges on the revenues of India," disbursed in England, are, for 1869-70, above £7,700,000; and those for 1868-69 about £7,350,000. I put down, say £7,000,000. Return 234 of 1870.

Why, in the United Kingdom, for the last 12 years only, from 1858 to 1869 (there are no earlier returns for imports), you have retained for your national uses nearly 30s. a-head, besides leaving about £18,000,000 in the Bank of England intact at the ends of 1857 and 1869. There may be some little hoarding by some men, as the means of investment and circulation in India are not yet developed; but may I ask whether there is any gentleman now present here who has not some hoarding about him of several pounds in his watches, pins, &c? However, here is the *whole* quantity of bullion imported into India during 70 years, 34s. per head. Now, in discussing the question why India takes less than 2s., or about 1s. 9d., a-head of British manufactures, you will see that the general cry of large imports of silver being the cause is not correct. The wonder is that 34s. a-head, received in the whole period of 70 years, could be sufficient for all necessary wants and wear.

The second misapprehension which requires explanation is the notion that wages and prices have risen enormously, and that, therefore, India is very prosperous. This notion is not only an exaggeration, but is also incorrect to a great extent. It would be impossible for me to discuss it to-night, as it would require a long time to do so clearly. I need simply say, what I think I am able to prove from actual facts and official documents, that though there is some general rise in prices (not, however, to the extent usually supposed), it is not an addition to former sufficiency, but a return from a low ebb, to which it had gone down before, and that it only indicates some progress towards, but not actual, sufficiency, much less prosperity. There is much confusion of ideas on this subject. For instance, while some writers point to rise in prices as a proof of prosperity, the India-house return, in the same paragraph to which I have already referred, speaks of "the cheapening of agricultural produce" as a matter to boast about. Now, the "enormous" or "unexampled" rise in prices or wages, about which much noise is made by some writers, is no more true than that because there may be a few millionaires in London, therefore all Londoners are millionaires. The phenomenon is simply this, that in special localities, where railway and other public works are being constructed, money congests, and prices and wages for a time go very high, because, on account of imperfect communication, neither labour nor food is drawn there in sufficient quantity to equalise or moderate wages or prices. And because at some of these special localities prices and wages rise very high, a general conclusion is hastily drawn, as if prices and wages had gone up enormously all over India. I shall give hereafter a few instances of prices, which will show that the notion of enormous general rise in prices is incorrect.

I must now return to the question of the causes of the miserable extent to which the natives of India take of British manufucture. Do not, gentlemen, for a moment suppose that a native does not wish to put on a better coat —or rather a coat at all—if he can get it. You should seriously ask the question why India does not afford to English industry and enterprise a field comensurate with its vast extent, population, and natural resources, though it is under your own control and administration. If this country could export of its produce only £1 a head of India's population, it will be as much as you now export to all parts of the world.

There is no question of the vastness and variety of India's resources. The number of principal articles it exports to this country is above fifty, many of them in great varieties, and some two or three dozens of minor importance. Much more can this number be increased. Why should not India alone supply to this country cotton, coffee, sugar, tea, silk, seeds, fibre, or anything else, in any quantity wanted. The causes of this unsatisfactory state of affairs are various, both moral and material. The moral causes I am sorry I cannot discuss before this Society; I shall only mention them. As long as a people have no reasonable voice, or have only a farce of a voice, in the legislation and taxation, municipal or imperial, of their own country, it is simply impossible there can be that watchful care and attention to its wants which those most interested alone can give. So, also, as long as the people of a country have no fair share in its administration, the powerful stimulus of patriotism and self-interest cannot come into action. Moreover, this want of a proper share for the native in the administration of the country produces one deplorable moral evil, As long as the English are officials, their mouths are shut. All the wisdom acquired by their experience is or no use in guiding the natives. The moment they are non-official they leave the country, and thus drain poor India of wisdom also. After coming to this country, the majority of these retired English officials forget India. Here, for instance, is Lord Lawrence. I congratulate the London School Board on such an acquisition, but there is also another side of the picture. What does this mean to India? Here is wisdom of above 30 years, I suppose, acquired in India, and it is all now lost to it. When and how will India have its own Lawrences, its Freres, Trevelyans, &c., to guide the nation towards progress, enlightenment, and prosperity. This is most deplorable for India that natives are not allowed a due share in the administration, to acquire the necessary wisdom of experience to become the guiding spirits of the country.

One more moral cause I would just touch upon, is the want of adequate education. Most sincerely thankful as I am for even the small extent to which education has progressed, I need simply say just now that education, both high English and professional for the higher classes, and vernacular and industrial for the mass, is far from being adequate, and yet government are committing the political suicide of discouraging English education in Bengal.

Having thus simply stated the three moral causes, I now come to the material. What, I wonder, would you say to the following facts? I have been studying for the past six months the administration reports of the different presidences of India. From these and other sources (thanks to Mr. Grant Duff and other gentlemen in the India Office for lending me any books I wanted), I have myself worked out, as a rough outside estimate, the total gross produce of all cultivated land in the average good season of 1867-8:—Central Provinces, North-West Provinces, Madras Presidency, Bengal Presidency, and Oudh, less than 40s. a head of their respective population; Punjaub produced less than 50s. a head; and the Bombay Presidency, with all the advantages of the late American war, railway loans, and three lines of railway converging into it, produced 100s. a head. But even Bombay, I am afraid, on account of disastrous losses during the last five years, is gradually lowering its level. The average of all British India will be a good deal under 50s. a head per annum, or say 1s. a head a week. If I put 80s. a head per annum, or 1s. 6d. per week per head as the total production of all kinds (agricultural, manufacturing, mineral, &c.,) of the country, I shall be, I cannot help thinking, guilty of exaggeration of over-estimate.

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[*] Return 133 of 1864 and [c. 184] of 1870.

With this low production we must bear in mind that a larger proportion goes for the consumption of the Europeans in India, of the higher and middle-classes of natives, £12,000,000 a-year are to be exported to this country, and a portion is to be reserved for seed, and then we may ask how much of this 1s. 6d. a week a head could go to the share of the poor mass, from whose labour, after all, must all production be raised. Is not this one cause alone quite enough to explain the whole problem why India is such a poor and wretched customer of England? Is it any wonder, then, that Lord Lawrence deliberately stated, in 1864, that "India is, on the whole, a very poor country; the mass of the population enjoy only a scanty subsistence;" and that Mr. George Campbell, in his paper on "Tenures of Land in India," published by the Cobden Club, quotes from an official authority a report made so late as 1869, about the Madras Presidency, as follows:—"The bulk of the people are paupers. They can just pay their cesses in a good year, and fail altogether when the season is bad. Remissions have to be made perhaps every third year in most districts. There is a bad year in some one district, or group of districts every year." Lastly, I would refer to an incidental remark made in the Calcutta correspondence of the *Times*, published as late as 12th December last. It says:—"But an ordinary native can live comfortably on about 2d. a day. He only needs a few rags for clothing, a little rice, and pulse or bean, and 'curry stuff.'"

Now, I ask you, gentlemen, whether it is from such men, who are obliged to be satisfied with 2d. a day, a few rags, and wretched hovels, that you can expect to raise £50,000,000 of annual revenue (nearly one-fourth of which has to be remitted to this country); or even £1 a head, or £200,000,000 of commercial exports, receiving large imports of your British manufactures in return. Pray do not suppose the native would not like to be better fed, clothed, and lodged. Such a supposition will be simply contrary to human nature and to fact. Let us examine a little more closely. Insufficient as the whole production is, and scanty as must be the share of it for the great bulk of the population, perhaps hardly 1s. a head a week, the mischief is further aggravated by imperfect distribution, so that the plenty of any one part is not available for the scarcity or famine of another. The best test of this is the difference in the price of food in different parts. If wheat sold at 50s. in one part of this country, and 70s. or 80s. in another part, I wonder how long this Society, or the English public would allow such a state of things to endure? In Punjaub, in 1869, the average price in Delhi was 52lbs. of wheat per rupee, while at Mooltan, 34 lbs.; and at Peshawar, 30 lbs.

In the Madras Presidency, in the year 1867-68, a good season year, at Cuddapa, the price of rice is 492 rupees per garce (9,256¼ lbs.), at Vezagapatam it is 203 rupees, and Godavery, 222 rupees. In the North-West Provinces, for the month of June, 1868, as the month of average plenty, at Meerut, wheat is 54 lbs. for one rupee, but at Allahabad and Mirzapore only 34 lbs. In the Central Provinces, in 1867-8, an average good-season year, rice, at Hoosingabad is five rupees for one maund (80 lbs.), while at Ryepore and Balaspore it is only one rupee; at Sumbulpore, one rupee two annas. In the Bombay Presidency, for Feb., 1868, as a month of average plenty, at Dharwar, the price of jowaraee is 84 lbs. for one rupee, while at Thanna it is 27 lbs. per one rupee. Again, bajree at Dharwar is 80 lbs. per one rupee, while at Dhoolia only 26 lbs., and at Broach and Thanna only 24 lbs. (These prices are taken from administration reports and the *Bombay Government Gazette.*)

In Bengal, the *Calcutta Gazette* gives, for June, 1868, average good time, what are described for rice of cheapest sort, the "ordinary prices at this season," and what do we see? At Maunbhoom 50 seers or 100 lbs. for one rupee, and at Bancorah, 47 seers or 94 lbs. per rupee; while close by, at Singbhoom, it is only 20 seers or 40 lbs. for one rupee; at Patna, 18 seers or 36 lbs.; at 24 Parrugnas, 16 seers or 32 lbs.

But there is another deplorable test.

Now, what better proof can you have than that when, in the year 1861, while British India exported to the United Kingdom alone, at the distance of thousands of miles, more than 3,000,000 cwt. of rice, at about 12s. a cwt. here, after paying all charges of freight, profits, &c., or at about 6s. to 8s. a cwt. at the ports of shipment; and to all parts of the world, grain worth £3,500,000, or say about 6,600,000 cwts, the North-West Provinces lost a quarter of a million of lives and immense property by famine.

In the year 1866, the United Kingdom imported above 2,000,000 cwt. of rice from British India, at about 6s. to 8s. a cwt. at the ports of shipment; and all parts of the world imported grain from British India worth about £5,250,000, or say, above 10,000,000 cwt., while Orissa and Madras lost nearly a million of lives and millions worth of property.

Again, the last two years, Rajpootana lost a million of lives, says the Calcutta correspondent, on the authority of Rev. Mr. Robson, in the *Times* of 27th December last, while the exports of rice to the United Kingdom has been 4,000,000 cwt. in 1868, and I think as much in 1869; and of grain to all parts of the world worth £2,600,000, or above 5,000,000 cwt each year. Thus, in India, for want of proper communication, and therefore of easy distribution, famine destroys millions of lives and property. Good God, when will this end!

The question may be put by you, what it is I want to suggest. I ask, gentlemen, only for some good English common sense, both political and economical, that common sense which destroyed monopolies and corn laws, upset the mercantile theory, and established free trade; and I trust the desire of Englishmen, which is no less mine, and I believe of all educated and thinking natives, that British rule should endure long, would be fairly accomplished—a blessing to India and a benefit to England. Like the causes, the remedies I wish to be applied are also moral and material. About the moral remedies, the statement I have already made of the causes suggests also the remedies. There are, Sir John Shore said 80 years ago, certain "evils inseparable from the system of a remote foreign dominion;" and I say that these evils must be counteracted if that foreign dominion is to endure, and be based on the contentment and loyalty of the people. These evils can be stated in four words, "material and moral drain." The first I have already shown to be at present £12,000,000 a-year. The moral one is that of the wisdom of administration brought over to this country on the retirement of every English official, to whom alone both practical legislation and higher administration are chiefly confined. These two drawbacks political common sense requires should be remedied, or the people cannot be satisfied. It is no use thwarting nature, however strong your arm may be. Nature will avenge every departure from truth and justice. Thus simply touching on the moral remedies, I come at once to the material ones. The very first question suggests itself, why should India have to remit £12,000,000 a-year to this country? This, to a certain extent, is inevitable. If India is to be regenerated by England, India must make up its mind to pay the price. The only thing I have to say is, that England, on its part also, should act justly towards India; the financial relations between the two countries should be equitably adjusted. No unreasonable burdens should be imposed on India because it is at your mercy; and the revenues of India should be administered with economy, wisdom, and the sense of responsibility of a great trust. I appeal to the conscience of English statesmen and thinkers to give a careful consideration to this subject. Here, however, I must leave this point, hoping that England will do justice to India in this matter.

The other, and still more important material remedies I must discuss at some length, as falling within the province of this Society. It is again a little economical common sense that is required. The most obvious remedy for the very poor production of the country, and its extra-political wants, is to increase production and facilitate distribution. It is no discovery of mine. Irrigation to increase production, and cheap communication are the crying wants of a country like India. These react upon each other. Irrigation will supply traffic for communication. Cheap communication will react by stimulating production, opening up new markets, and equalising distribution. This certainly sounds very common-place, and an oft-told tale, but it is this common-place remedy upon which the material salvation of India depends, and it cannot be told too often till it is accomplished. Well, you may say the Indian government don't deny this. I grant they are as loud in their acknowledgment of this necessity as anyone else. Then where is the hitch? That is just the question.

In order to avoid confusion, and save time, I give you at once my own views, without entering into a discussion of the present policy of government. The expenditure on public works may be divided into two sorts—on repairs and on original works. For repairs, by all means pay from the revenue, for it would be unjust to saddle posterity with any debt for them. The "original works" are divided by government into "ordinary" and "extraordinary." Ordinary are those which do not pay directly, such as barracks, buildings for civil administrations, and common roads. These do not bring direct returns certainly, like railways, but repay indirectly, in the saving in rent, and in many other ways.

Now, nobody will contend that these works are only useful for the day, and that posterity, or even one or or two generations after the present, can have no interest in them. Is it just, then, not to say anything of the want of economical common sense, that the present generation, so little able to bear the burden, should be pressed to furnish the whole means, without any distribution of the burden with the next one or two generations. I maintain that government should adopt the just as well as the economical policy of distributing the burden of these ordinary works over say fifty years or two generations by means of terminable loans. By adopting this policy, the other most injurious effects of stopping works from time to time, according to the condition of the revenue, will be avoided. What is of the utmost importance is, that these works once decided upon should be carried out vigorously, and completed as soon as possible. I repeat, then, that I ask for only common sense in this matter. When a large load is to be raised, a common, unintelligent labourer tries to raise it directly by his hands, an intelligent labourer tries a lever, and a man of knowledge uses a system of pulleys or some machinery. What is the whole secret or aim of all mechanical science? Simply to distribute weight. Use, I say, the same common sense in financial matters. Use suitable financial machinery, and distribute the weight. Don't waste time, energy, and means in trying to raise the heavy load directly.

It looks almost ridiculous before an English audience to insist on this, but the Indian government somehow or other does not do this. The mischief of this policy of making revenue pay at once for the ordinary original works is threefold—uncertainty, delay, and the consequent waste in the works themselves; the intolerable pressure of taxation upon the people, and their dissatisfaction; and, lastly, what is still worse, the withdrawal of so much capital, which at present is very dear, and insufficient for the ordinary wants of the production and commerce of the country, government using capital worth nine per cent. and upwards, when it can easily get the same for four or five per cent., causing thereby to a poor country like India a serious loss, and shutting out England from safe investments in a country which is under its own control. Paying for these ordinary works from revenue, or from terminable loans, makes the whole difference to the people between being crushed by a load or carrying it with the greatest ease. It must be also borne in mind that any increase in the communications of the country, and the better attention to the wants of the country, will make the future generation better able to bear greater burdens than the present.

I next come to extraordinary public works, such as railroads, irrigation works, canals, &c. In the case of these works, government has fortunately adopted the policy of borrowing; but, somehow or other, there is some hesitation in going vigorously and boldly into the matter.

The hesitation for borrowing is grounded mainly, as far as I can make out, on one reason. It is said England's tenure in India is uncertain, and that if, after England lent a large sum, she should have to leave India, she may lose her loans. This is a very fair question, and must be fairly discussed. Now, what is the best guarantee the English can have? As a native of India, I may answer, the loyalty and affection of the people. But, as Englishmen, you may say, "Well, we fully appreciate loyalty and gratitude; but after all, it will not be prudent to depend upon that guarantee alone." Well, then, I ask, what is the best thing you can have? Can you have anything surer than a sufficiently strong English army? And if by the same policy which may enable you to have a strong army, you can also secure the loyalty and gratitude of the people, how much more will your security be increased. How can you have a sufficiently large English army without a sufficiently large revenue, and how can you have a large revenue unless the people are able to pay it, and pay it without feeling crushed by it? If, on the one hand, the present political drain continues, and the country is not helped to develop its resources, the result is evident. The people must get poor, and revenue must diminish. If revenue must diminish, you cannot provide for a sufficient military expenditure, the guarantee for your rule is impaired, and still more so by the discontent of the people. On the other hand, if the government went boldly and vigorously into the prosecution of all necessary public works by sufficient cheap loans, the production and commerce of the country, and the ability of the people to pay taxes will increase, government will be able to raise with ease larger revenue, and will be able to keep up the necessary strength of the army, the security by which will be further enhanced a hundred-fold by the contentment and loyalty of the people.

The most absolute wants of any country, in the undeveloped condition of India, are irrigation and railroads, canals, and other cheap communications. Even now, the only or chief bright spot in the administration of the past fifteen years, for which government claims, and justly receives, the greatest credit, for which India is most thankful to the English public, and which has opened a hopeful day for it, is, even with all the waste and jobbery, the railways, canal, and irrigation works already built by English loans, I beseech, therefore, that government should pursue with vigour this hopeful path, for on this alone do the material salvation of India, and the strength and benefit of English rule depend. There is one more question in connection with loans which requires a fair discussion. It is the opinion of many that the loans should be raised in India. The reasons assigned are, either the fear of uncertain tenure of English rule, or that India may not have to remit interest to this country. The first, I have already answered, is suicidal. With regard to the second reason, I say, if India is able, by all means raise the loans there. I am very glad that government have succeeded in inducing some of the native princes to lend money to build railways. But I have shown you already that India does not at present produce enough for its ordinary wants, much less can it save or spare capital for these loans. The very fact that capital is worth 9 per cent. ordinary interest in India shows its insufficiency, even for its very limited commerce.

The idea of making India raise loans is like ordering water to run up a hill. Raise loans in India, the result will be still the same. Water will gravitate to the lowest level. Beyond a certain amount needed in India for investments of trusts, retired persons, banks, unenterprising zemindars, &c., the rest will be bought up by this country. Be this as it may, the test is a very easy one. Let government open loans at 4 per cent., both in India and England, at the best prices capitalists would give for this interest, and in such a way that the notes be easily negotiable both in India and England, and that the interest may be also obtainable in both countries without unnecessary trouble; and the natural laws of capital will settle the rest. If the English public have confidence enough, and if the 4 per cent. sterling loan is now at a premium, why should the Indian government not allow India the benefit of these loans, and the capitalists of England an investment under the control of the British themselves. It is said that if government resorted to loans, the future debt of India would be very large. But why such should be the case I cannot understand. As to the ordinary works, the very fact of terminable loans means contributions from the revenue, and limit to the duration of the loan, the great advantages being "distribution of weight," With regard to extraordinary works, they are paying works, and even if they fail in paying the whole interest, the prosperity of the country will easily yield increased resource to make up for any deficit of interest. All progressing countries are building their public works by loans, and come to this country for borrowing, while poor India, with all her material and moral drawbacks, and struggling for her very existence, is tortured by all sorts of vexatious, local and imperial cesses and taxes.

When I ask government to build the works vigorously themselves, I should not be misunderstood as being in any way against true private enterprise; in fact, the principal articles of present export, except cotton and rice, owe their production mostly to English private enterprise. Who are the producers of the greater part of tea, coffee, indigo, silk, &c., and even in the case of cotton, how much is owing to Manchester constantly knocking at the door of the India-house to build roads, canals, &c.? If English capital is encouraged in a reasonable manner, to open up new sources of production, what great benefit may be the consequence, both to England and India. England's benefit would be double; the profits of the investors will ultimately come over here, and consumption of British manufactures will be extended, with the greater ability of the natives to purchase them. The administration reports of the different governments give us figures of many millions of acres of culturable waste land. If government only did the ordinary duty of opening up these lands by providing necessary communication, and wherever practicable necessary irrigation, what a vast store of treasure would be brought out, and what prosperity bestowed upon poor India.

Natives also would do a great deal, if properly guided and encouraged. I am afraid encouraging natives to look out does not seem to be much in the line of officials. I know of an instance, in which one Mr. Rustonjee Bomanjee, a Parsee of Bombay, has been running about for two years from collector to commissioner, and from one official to another, to be allowed to undertake, on his own account, an irrigation project near his property in Bassein, without, I fear, any result. I do not know whether anything has been lately decided. I don't wish to blame anybody. I cannot say what government's ideas in the matter may be, but such dancing as this persevering gentleman has had is, I think, sufficient to discourage anybody. Moreover, scanty, if any, encouragement is given to natives to enter the engineering service.

I would just sum up the remedies I have been discussing in a few words of Lord Lawrence, as Commissioner of Punjaub, and which are quite as applicable now for all India:—"Let means of export, the grand desideratum, be once supplied, everything will follow. . . Then money will be abundant, prices will recover their standard, and the land revenue will flourish." *

Before finishing the discussion of these remedies, I must urge one on the English public, which I sincerely believe to be an important one. The great misfortune of India, and consequently a great loss to England also, is that its real condition is not known here, and very little cared for. Every institution in this country has its independent body or society to watch its interest; for India, also, some such machinery is absolutely necessary. The India Reform Society, under the leadership of Mr. Bright, aided by the exertions of Mr. J. Dickinson and others, did at one time good service. Latterly, the East India Association has been formed for this purpose. I think it very essential, if England is to derive the full benefit of its Indian Empire, and be at the same time a blessing to it, that this East India Association, or some such body, whose object is to make India better known here, and to watch all Indian and English interests, must be well supported by the English public. The result of my 15 years' observation in this country is, that some such institution is absolutely necessary, or England cannot do its duty to India, and poor India must continue to suffer from the want of an independent watchfulness of the administration over it. I can only appeal to the existence of this very Society, and of many others, without which I do not know how much good would have remained undone, and how much mischief would have continued unchecked. At present, the want of unity among the different interests produces its usual consequences of weakness and failure. As each interest, such as tea, or coffee, or cotton, or manufacturers, planters, commercial, civil or military, or any other, English or native, attacks the India-office in its small detachment, it is easily repulsed. But should all these interests combine together, and with the strength of the union of a powerful body, propose well-considered measures calculated to be beneficial to all interests, the India-office, less able to resist such action, will most probably welcome it to aid in its administration; and Parliament will be better guided in any efforts it may make, from time to time, to do its duty to India.

Now, gentlemen, whatever attention you may think my address worth, I am sure that on one point we would all agree, that the subject of the commerce of India is one of those most important ones for the attention of the English public, whether for duty to India or for their own interest. You are aware that the East India Association has resolved to petition for a select committee of parliament, and that Mr. Fawcett, having last session moved for a committee, the Right Hon. the Prime Minister has shown a disposition to be favourable to the motion when made this session. I sincerely trust the Council of this Society, in the way that may seem most suitable to them, will help in asking for the committee, and in getting it to institute a searching inquiry into the great questions why India's commerce is so miserably small, and not commensurate with its vast resources, extent, and population. Is it correct or not that the total production of the country is, with all

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* Select Government of India, No. xviii., page 30.

the progress said to be made, yet so wretched as 1s. 6d., or say even 2s., per week per head; and, if so, is such a state of affairs creditable to British administration? Are the British rulers practically adopting a policy which would justify their declarations in the report of the material and moral progress for 1868-69, that "the State has now publicly announced its responsibility for the life of the least of its subjects," or the noble sentiment expressed by Lord Mayo, "The coils that she (England) seeks to entwine are no iron fetters, but the golden chains of affection and of peace?" Will the next ten years be free from the heartrending, destructive famines of the past decade; and cannot the people of India be rendered so contented and loyal as to make Russia's ambition for the conquest of India a mere dream to be laughed at?

In submitting my views at present, and asking the help of this powerful Society in obtaining and utilising the select committee, nothing is further from my mind than any hostile feeling to the Indian government both at home and in India. I only desire to see the right administration of the country, and I wish to point out that, just like all the interests of this country itself, those of India also require intelligent, independent investigation by select committees of Parliament at reasonable intervals, and the watchfulness of some independent, well-organised body. The Prime Minister himself has given the strongest reason last session:—"And the fact, which we must all deplore, that it is not easy to secure adequate attention within these walls to Indian affairs, is an additional reason for having a committee to inquire into the matter."

It is, gentlemen, my deep conviction that the future elevation of the 200,000,000 of the people of India cannot be in better hands than those of the British nation. I only beseech you to do the good which is in your power, both to yourselves and to India, crowned with the blessings of a sixth of the human race.

DISCUSSION.

Mr. Andrew Cassels said the very earnest speech which had just been delivered by so intelligent a native of India, who, to the well-known sagacity of his race in all matters connected with trade, unites the experience gained during 15 years' residence in this country, deserved the greatest attention; and he very cordially agreed with him upon many points, deploring, with him, the ignorance that was still so prevalent in England respecting India, and the little interest taken in Indian subjects by those who ought to lead public opinion, as might be seen by the way in which the benches of the House of Commons were deserted when any subject affecting our Eastern Empire was brought before Parliament. Some fallacies had been pointed out in certain returns laid before Parliament, some years ago, by Mr. Melville. It was, of course, impossible, speaking without book, to check the figures given; but that there were periods when the exports from India largely exceeded the imports, was proved, he thought, by the fact which was very strongly impressed upon his mind, that during the ten years ending in April, 1866, the imports of bullion into India amounted, in round numbers, to 180 millions sterling. He presumed, however, that Mr. Dadabhai Naoroji's object in drawing attention to these figures was to establish the fact that England drew a large sum annually from India without making any tangible return, and that India was thereby impoverished, and this was no doubt a fact upon which a great deal of misapprehension existed. But what had England and Englishmen done in return? They had given India security of life and property, civilisation, and the blessings of what, with all its defects, must be called a good government. Even in Mr. Dadabhai Naoroji's own time how much had been done! Remember the lawlessness and misrule that prevailed in Oude, the Punjaub, and Scinde 25 years ago. Even if the amount drawn by England from India could correctly be called a tribute, then he would say never before had a conqueror made so great a return to a land gained by conquest. He quite agreed with what had been said about the expenditure on public works, and had lost no opportunity, public or private, of stating his opinion, that the policy of paying for even what were called ordinary works out of revenue was a mistake. It was not fair and just that barracks, buildings for civil administration, and common roads, which would benefit coming generations, should be entirely paid for by the tax-payers of to-day. It would be much more equitable that the cost of these works should be spread over a certain number of years, and be paid by terminable loans. During the last few years, there had been deficits on the Indian budgets amounting to upwards of six millions sterling, but of these, three-and-a-half millions could be accounted for by the expenditure on barracks alone. In order to cover these deficits of our own creation the people of India were exasperated by the imposition of unnecessary taxes, especially an income-tax (the most odious of all taxes in their sight), equivalent to 7d. in the pound sterling. At the same time the army was cut down to such a low state, that in any time of danger uneasinesss was created. Many useful works could not be undertaken. At the same time, while everyone must see the policy of encouraging the cultivation of agricultural products in India, export duties were still retained, which in principle were altogether indefensible. Again, it had been truly said that loans should be raised in England as well as in India, and it certainly seemed very strange that semi-bankrupt States, like Turkey and Egypt, should get money from this country, that we should lend to states whose chronic condition was one of revolution, like Peru, and yet we should virtually shut out our own great eastern empire from the market. If the reason were, as had been stated, the fear that India would one day be lost, and that when that evil day came the less we had to lose the better, all he had to say was, that the present system was best calculated to bring about the very consummation which was dreaded. He could not refrain from expressing his regret that the Secretary of State did so little for Indian trade; for instance, for the last two or three years Lancashire had been urging upon government the expediency of appointing a Board of Agriculture in India, and it was believed the thing would have been done—but it had not been done. Half-a-dozen under-gardeners had been sent out from Kew, and that effort seemed to have exhausted the energies of the Indian Board for the time. Yet it was very necessary to encourage production in India in every possible way, even considering only the pounds, shillings, and pence side of the question. At present, the imports of India about equalled the exports, and the consequence was that the rate of exchange had fallen between the two countries to what might be called a bullion rate; and, bearing in mind that the Secretary of State for India had to draw largely on India, the drawings in 1870 amounting to no less a sum than nine millions sterling, and that many persons in the services and in trade in India had to make large remittances to this country, and that every fall of a farthing in the rate of exchange represented a loss of one per cent. to the State, on the one hand, and to private remitters, on the other, it would be seen at once how very desirable it was that everything possible should be done to keep the exports of India in excess of her imports. Attention had also been drawn to the very distressing fact that, while one part of India was exporting rice to Europe, in another portion of the empire hundreds of thousands were starving. This was, no doubt, most distressing, but he did not quite understand whether Mr. Dadabhai Naoroji desired that government should prohibit the exportation of rice. If so, he had been studying political economy in a very old-world school. Of course, what was required was to open up communication thoroughly by means of roads and railways, and a good deal had been done lately in that way. When all obstacles to trade were removed, demand would bring forward supplies of food before the point of actual want was reached. It must not be forgotten that the revenue at present drawn from the duty on opium, amounting to between £6,000,000 and £7,000,000 sterling, was a most precarious one, and might one day fail us altogether, and he could not help thinking that England had treated this question unwisely. It seemed to him the high duties levied on the drug represented an unworthy compromise between our sense of what was morally wrong and a care for material interests. England ought to wash her hands of the opium trade altogether, if she came to the conclusion that it was morally wrong to touch it; but, on the other hand, if she did not come to that conclusion, the duties ought to be lowered, and the cultivation of it encouraged, so as to discourage the growth of the poppy in China. He did not see why it should be treated in a different way to any other agricultural produce, especially as it appeared to him, speaking generally, that the baneful influence of opium lay in the abuse and not in the use of the drug. However that might be, this question would some day press itself very seriously on the public attention. Again, he could not help thinking, from statements which reached him from India, that the day was not far distant when it would be found necessary, in the interests both of the State and of the people, to inquire into the present position of the so-called "perpetual settlement" in Bengal, with a view either to repurchasing the rights of the zemindars or to devise means of making them contribute much more largely than they did at present to the necessities of the State. It was a great mistake that, made by Lord Cornwallis 80 years ago. There were now very often three or four middle-men between the zemindars and the wretched cultivator of the soil, each one screwing a profit out of the land, which produced a rent of four or five millions sterling only to the government, whereas it ought to produce fifteen or sixteen millions. He would not do more than allude to this subject on such an occasion, but it seemed to him that the only thing to be looked to in India in future to support the revenue was that which could be obtained most equitably and fairly from the land. An Indian association had been suggested, which would, no doubt, do a deal of good, but it was in Parliament that the cause of India had to be defended; and he had often wished that the electors in Lancashire, a county which was so largely interested in India, would make it a *sine quâ non* with their representatives that they should attend to Indian affairs.

Mr. Hyde Clarke said it must have been with great pleasure that the meeting had witnessed that evening, almost for the first time, a native of India pleading the cause of that country, not in one of its own languages, but in a foreign language, although with such ability that he had already touched the hearts of his audience. Still, that was only the greater reason why more caution should be exercised in discussing the subject. They had heard that India wanted advocates, but how could this be said when she had an advocate so eloquent as Mr. Dadabhai Naoroji himself, exercising an advocacy which his ancestors could never have done, even in India itself, an advocacy which would not be without its impression on the people of England nor on those of India. What he had said, however, must be carefully and calmly weighed, in order that it might exercise a good and not an evil influence on the interests of India. It might be so weighed in England, but what influence would such a discourse exercise when it reached India? The paper was professedly on the commerce of India, but it was really a discussion on the government of India, and the benefit which the natives of India received from it. On such a subject public attention ought not to be drawn away by the eloquence of the speaker who had, amongst other things, remarked that when the people of this country were roaming about as naked savages, India was in a state of civilisation. That was a mere rhetorical phrase. It might or might not be in the pages of history, for anything he or anybody knew, but at a time in long past ages, when England was in a high state of civilisation, the population of India was in a state of savagedom; but without revelling in the realms of imagination, the two countries must be looked at as they were at present. In England the savages were few, but the hills and plains of India teemed with savages, kept in a state of barbarism by the oppression of the natives of India themselves, but they were being liberated from that barbarism and raised in the scale of civilisation by the exertions of Englishmen. He would ask the chairman, as one of the administrators of that great country, to bear testimony to what had taken place under his own eyes, where the people, whose ancestors were in a savage state, were being raised up to take up a position side by side with their friend who had just addressed them, to exercise the same noble advocacy. Under these circumstances the public mind must not be led astray, but must look to the known facts upon the subject. He would not then quarrel with the figures which had been laid before them, although unfortunately the tables from which they were taken had not been given, but simply the broad results, which were very liable to mislead. A great deal had been heard about dates and figures during 70 years, and what the quantity of silver imported into India during 70 years amounted to, namely, 34s. per head. That was spoken of as a very appalling figure, and it was intimated that through some defect in the Indian government the natives were in that condition. But what was the population on which that average had been taken; and how had the silver and other bullion been distributed in that time? In a short period, ending in 1866, no less than 180 millions, as had been stated by Mr. Cassels, were imported into India, showing therefore that this mass of figures ought to be separated from that long beadroll which had been referred to, in order to ascertain its actual bearing upon this subject. Such figures could not be followed in an oral discussion, hardly even when they were in print before one, and when these figures come to be thoroughly examined, it would, he believed, be found not to bear out the inferences which had been drawn from them; for, after all, there were certain broad tests on questions of this kind which must be conclusive. For instance, he would call attention to the state of affairs nearer home, which illustrated the case. The inequalities had been spoken of, and the very depressed state of the population, and it had been intimated that India was going to ruin. They had heard the same thing with regard to Ireland, and he (Mr. Clarke) had been forcibly struck with the resemblance between India and Ireland in some respects. It had been stated that the average wages in India was about 3d. per day, but, even within his own time, the rate of wages in Ireland was only 4d. or 5d. per day; but, notwithstanding that, Ireland had been advancing within the last few years, and India itself was also advancing. No doubt there were the inequalities that had been spoken of, but they arose from the very reason assigned, namely, that in some parts, where communication had been carried out, and large operations had been conducted, the rate of wages had risen, while in other parts they were stationary. Of course, it must be so in the nature of things; and the broad question to be considered was, what was the condition of India, and on this broad question of political economy it appeared to him that Mr. Dadabhai Naoroji's skill had, to some extent, failed him, through having omitted some elements of the question. In truth, for the purpose of his paper, he had treated this as a simple commercial matter—a question of imports and exports of India, stating that the exports were larger than the imports, and intimating that India expended at least 10 millions a-year, with no benefit to itself; but he had here mixed up the question of commerce with that of political results, and in political arithmetic 2 and 2 did not always make 4. He had intimated that this 10 or 12 millions went in utter waste. On the one side he had put down so much cotton spun by English hands, so much manufactures produced by England and English intelligence, but he did not give credit to this country for that very portion of the expenditure which had been spent on military purposes of which he spoke. That was as pure a result of the hand-labour of this country for the benefit of India as any number of million yards of cotton goods that could be supplied. Nay, it was more, for India might supply itself with these textile fabrics, but it was England alone, as he had himself confessed, that could maintain the balance between the different races of India, and enable them to persevere in the course of advancement and civilisation in which they were maintained by this country. We were bound, therefore, to put down this blood and bone, contributed for the service of India, as a most important item in the account; but there was another item, and that was the brain furnished to India, in the persons of those great statesmen to whom so high a tribute had been paid. After all, therefore, the result was one of the progress of India, If, for instance, we went back to any former period, say 100 years ago, it would be found that the exports and imports at that time bore a very small proportion to their present amounts; and although many of the natives of India were in a state of great degradation and bitter poverty, their general condition must have been advancing during that period. The natives of India were spoken of as if they were suffering from some common cause, and attention being called to these woful instances of famine, a picture had been drawn at which he was surprised. Had any Englishman used the words which Mr. Dadabhai Naoroji had used, he should not have been astonished; but that one of the most intelligent teachers of India should put before a meeting such a picture, stating that rice was exported largely from Burmah, while at the same time other portions of India were suffering from famine, implying a great charge against this country, was something like a mistake which a very slight acquaintance with geography would be enough to correct. India, like Europe, contained countries widely separated from each other, and what had been referred to was no more than had taken place in Europe, and was actually taking place at this moment, for there were portions of France now suffering from the direst famine, whilst other portions of Europe were exporting grain. Means of distribution might be wanted, and they would have to be provided, but England was not to be taxed with the death of these natives as altogether arising from the method of its government. An appeal had been made to the common sense of Englishmen, and that no doubt must be exercised, but not in the manner which had been suggested, viz., a transfer of the government of India to the natives, for that was what it amounted to. Before this was done, it must be proved, not that there were such defects in India as had been pointed out, but that 100 or 200 years ago the whole of India was in a state of great prosperity, that the condition of each native was much better than at present, and that India was one great model republic, like the United States, with the citizens exercising all the functions of government, and fully competent to carry them out. That was one of the cardinal mistakes which had been made. India was not England, and although there were some native gentlemen, like Mr. Dadabhai Naoroji, the condition of the great mass of the people must not be forgotten. It really only did mischief to the advancement of India to suggest topics to them which they were incapable of considering as a body; and although they might be very well discussed by men of intelligence and enlightenment, they were calculated to create disaffection and disappointment amongst the natives of India. This therefore answered the remark of Mr. Cassels that Europeans were more generally disposed to lend their money to countries even in a chronic state of revolution than to India. The question lay entirely with the natives of India. The more they proved the permanence of the system of government under English leadership, but which was really being carried out by native intelligence, the greater would be the amount of capital, which it was said could not be obtained in India, but must come from Europe. He would therefore call the attention of the author of the paper to the political remedy, not such as he supposed, of handing over the government direct to the natives of India, but the improving of the municipal organisation, and so to gradually do what the government of India was doing, educating the natives, and bringing them forward step by step; but for that purpose it was necessary that the intellectual gifts of a man like Mr. Dadabhai Naoroji should be employed, not in promoting political agitation, which, though a great instrument in England, would be a very dangerous one in India, but in promoting the moral and social improvement of the people.

Mr. Vesey Fitzgerald said that, whatever might be the comparative advances made in civilisation by England and India in years gone by, in those ancient times both countries were destitute of the resources and appliances of modern civilisation, regard being had either to physical and material agencies, or to financial administration. With regard to material progress in India, there was no doubt that much had been already done, and that more would be accomplished, although the amount and extent of the improvement would depend upon various eventualities, which he would not then speculate upon. He might say, however, that the East Indian Irrigation Company stopped the progress of the Orissa famine wherever its works were carried out, and human life had thus been saved to a considerable extent, a fact to which he looked back with the most unmixed satisfaction, for he believed there was no moral or religious duty more incumbent on all connected with India than to put a stop to these horrible famines. Government had now purchased the works of the company, since which time, he believed, not much had been done in extending them, but still they existed, and that was something, though a mere trifle compared with what might be done by an extension of these irrigation works throughout the country.

Mr. Eastwick, M.P., said he did not intend to throw any light on the controversy which had sprung up, in the first place, because he was unable to settle it, and next, because he would not if he could, since it might serve to accomplish the great object in view, that of calling the attention of Parliament to the affairs of India. He was not at all sanguine that Parliament would succeed in solving the problem, but, at any rate, they would awaken public interest in the matter. He would, however, throw out one or two words of consolation to the author of the paper, who, naturally enough, was inclined to look upon the dark side of the picture. Even supposing it to be true that England was drawing £12,000,000 annually from India, and returning very little to it, he was quite sure, from the examples to be found in history, that India would soon recover herself. Without going back to the old times, when gold, ivory, and peacocks were brought from India, he would only refer first to Mahmoud, who carried off countless sums of money—hundreds of millions—if the accounts given were correct; but nevertheless, not many years afterwards, India was again flourishing and full of wealth. The enormous wealth taken away in the time of Shah Jahom was a wonder to every one, but that period passed, and after a time Nadir Shah was seen going away with innumerable possessions. He had seen the magnificent jewels in Persia, worth from £15,000,000 to £20,000,000, the greater part of which were taken from Delhi. In spite, however, of the tremendous spoliation, India very soon recovered herself, and was now in a most flourishing condition. This was proved by the fact that prices had risen, that public works were being spread over the country, and that the people were contented, notwithstanding the little trouble about the income tax, which would soon pass away. With regard to lending out money in India for public works in a much more profuse way than had hitherto been adopted, he thought it a very questionable proceeding. If the works were remunerative, capital would naturally be attracted to that country; but on the contrary, if it were not attracted, and if the returns were not very great, it showed that much caution ough to be used.

Mr. Krishnarao Deshmukh said, whilst he agreed that the growth of the raw products in India should be encouraged and stimulated, he was of opinion that something more in the shape of manufactures was needed, in order to give employment to the people and value to the natural productions of the country. Now, government in India was of a patriarchal character, being looked up to for everything that was required, and, therefore, he would suggest that something in the way of national schools of art and science should be established. It was also highly necessary that there should be better means of distributing the wealth of India, and for that purpose further means of communication were required. Now, public works of all kinds, as at present conducted, were very expensive, and consequently limited in amount, one reason of which was, that all the engineering superintendence had to be imported from Europe, at a great expense; and as the gentlemen who went there for this purpose had to run the risk of ruining their health by the climate, they, of course, required very high remuneration for their services. There was no reason, however, why natives should not be educated and trained as civil engineers; and he believed the Chairman would agree with him that they might find a legitimate field for their energies in that direction. Mr. Hyde Clarke and others seemed to think that the paper contained reflections on the Indian government rather than on the commerce of the country, and that it was proposed that government should prohibit the exportation of grain. He apprehended, however, that the object of the paper was merely to show the evils arising from want of communication between the different provinces, so that the produce of the country was diverted to different parts of the world rather than to the relief of its suffering and starving inhabitants.

Mr. Briggs proposed that the discussion should be adjourned, the subject being one of great importance.

Mr. Taylor seconded the motion, especially as he believed the purpose and scope of the paper had been misunderstood by some gentlemen.

Mr. J. A. Franklin supported the proposition, in order that the heavy indictment brought against the India government might be answered.

The Chairman said that, in accordance with the wishes of the meeting, the discussion would be adjourned to March 3rd, that being the earliest available day. For himself he could hardly look upon the paper as a bill of indictment, but rather considered it as bringing forward important facts bearing on a commercial question which it was peculiarly the province of such a Society to discuss. Mr. Dabdahai Naoroji produced figures in which he conceived he had shown very clearly that, during a certain period of years there had been a very large money balance paid by India to England, and which might be considered either as the cost of good government to India, or as a tribute, but undoubtedly it was an annual payment by India to England. He did not imagine that Mr. Dabdahai Naoroji intended in the least to complain of this burden, but rather to look upon it as a burden which India willingly bore for the great benefit which she received from England. Still, it was a matter of great importance, when dealing with a person on whom a benefit was conferred, and who had to pay an annual sum for that benefit, to know how that burden could be most easily borne, and that seemed to him a point which was peculiarly the province of the Society of Arts to discuss. As far as he knew, that point had never been brought prominently before the English public. It was brought forward originally by Sir George Wingate in one of his reports, but it had never been adequately discussed by Englishmen. In other countries, when facts of this sort, containing imputations of any kind on the government, were brought forward, parties met in some dark hole and conspired together, and got up a revolution or rebellion; but it was one of the peculiar blessings of England that, instead of doing so, Englishmen met in a well-lighted room like this, and a number of practical men took the matter in hand, set to work to discuss it, and did not rest until they had settled the question whether the facts before them bore out the inferences which had been drawn. That, as he understood, was the course which the author of the paper wished to be pursued. That was how the Corn-law question was dealt with. There were very few in that room probably who did not recollect the time when it was considered that some great benefit to somebody was derived from the Corn-law, and it was not until after long discussion, and a great deal of argument and calculation, that people began to see that there were two sides to that question, and ultimately it had been settled, as most people believed now, in the right way. It was by means of associations in different parts of the country doing the same kind of work which that Society did in London, which converted the English mind and brought the country peaceably through that great revolution, and that was the sort of thing which was wanting in the present instance, so that it might really be seen whether India did pay a large tax to England for a great benefit, and whether this tax could in any way be levied in a more favourable manner. This was a question in which the Society could render most essential service to both countries. He was glad to be able to say that only that morning, he had seen a sketch of a very large department of agriculture and commerce, which Lord Mayo had devised, and which he considered should do in India very much the kind of work which was done by the Board of Trade here; and he had no doubt that in a mail or two very full details would be seen of what that department was intended to do. He had also seen a letter within the last day or two from Colonel Rundell, in which he mentioned that 100,000 acres had this year been irrigated from the works in Orissa, commenced during the famine. And, in addition, it was stated that the port of False Point, which, at that time, was almost inaccessible, had now become of considerable importance. All this was due to the work done by Englishmen acting on intelligence derived from the intelligent natives of India, and these were the sort of agencies which he believed Mr. Dadabhai Naoroji wished to see multiplied. In considering these questions, a map of India should always be at hand, when it would be seen that what appeared an immense amount of work, if applied to a country like England, was very little when applied to such an area as that of India. In conclusion, he moved a cordial vote of thanks to Mr. Dadabhai Naoroji for his valuable paper.

Mr. Kazi Shahabudin seconded the resolution, which was carried unanimously.

Mr. Taylor said he believed one point in the paper which required discussion was the question whether the natives of India should not be more adequately represented in the government. He hoped that would be considered by gentlemen intending to take part in the adjourned discussion.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

As already announced, the Council in aid of this object will give six concerts in the Albert Hall, and a guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed is £2,503. The number of tickets taken is 435.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

A subscription of one guinea entitles a member of the Society of Arts to a transferable numbered and reserved seat at each of the six concerts.

The prices to be charged to the public for admission to reserved seats at the concerts will be as follows:—

Arena for one concert	£0	7	0
Or subscription for the six concerts..	2	2	0
Balcony for one concert............	0	7	0
Or subscription for the six concerts..	2	2	0
Amphitheatre for one concert	0	10	6
Or subscription for the six concerts..	3	3	0
A box holding five persons for one concert........................	3	3	0
Or for the six concerts	15	15	0

In letting, preference will be given to a subscription for the six concerts.

Members of the Society of Arts will have the privilege of subscribing for a set of six tickets (transferable), admitting the bearer to a reserved seat, at each of the six concerts, as follows:—

The Arena	£1	1	0
The Balcony	1	1	0
Amphitheatre	2	2	0
Box holding five..................	10	10	0
Ditto „ for one concert (if vacant)........................	1	15	0

Special Notice to Members of the Society of Arts.

The price to members subscribing for sets of tickets for the six concerts at the Royal Albert Hall is 1*l*. 1*s*. up to the **15th MARCH**, after which date the price will be 2*l*. 2*s*.; and the above privilege to members can on no account whatever be extended.

OPENING OF THE ALBERT HALL.

Tickets to admit to the ceremonial at the opening of the Royal Albert Hall by the Queen, on the 29th March, can be obtained of Mr. Samuel Thomas Davenport, the financial officer:— Arena, 3*l*. 3*s*.; Balcony, 2*l*. 2*s*.; Picture Gallery, 1*l*. 1*s*. each.

CANTOR LECTURES.

The second lecture of the course on "Dyes and Dye-stuffs other than Aniline," by Dr. Crace Calvert, F.R.S., was delivered on Tuesday evening, the 14th inst. These lectures will be continued as follows:—

Lecture III.—Tuesday, February 21st.

Blue Colouring Substances.—Indigo; how prepared, and how to determine its commercial value; its applications in dyeing and calico printing—Prussian blue; its properties; how produced on wool and silk, and how used in calico printing—Ultramarine blue.

Lecture IV.—Tuesday, February 28th.

Yellow Colouring Substances.—Quercitron-bark—Flavine—Fustic—Persian berries—Annatto.

Black Colouring Substances.—Gall-nuts—Shumac—Divi-divi—Mirabolam—Catechu.

These lectures are open to members, who have the privilege of admitting two friends to each lecture, and will be published in future *Journals*.

POSTAL REFORM.

With this number of the *Journal* is issued a specimen envelope, proposed by the Society of Arts to take the place of the post-card. It weighs less than the card, and will enable the sender to transmit his message closed and free from the pryings of impertinent curiosity. All particulars with regard to it will be found printed upon it.

ESSAY ON TEA.

The Judges appointed to consider the merits of the essays sent in in response to the offer by the Council of the Silver Medal of the Society for the best treatise on the profitable production of tea, have sent in their report, upon which the India Committee passed the following resolution, which has been adopted by the Council:—"The India Committee, under the recommendation of the judges appointed, is not in a position to recommend the Council to award the medal, but it gives commendation to the essay of Mr. James Macpherson, of 49, Hereford-road, Westbourne-grove, as containing much information as to the growth and manufacture of tea in India." The Judges were Major-General Henry Pelham Burn, Dr. Archibald Campbell, and Robert Fortune, Esq.

MEMORIAL TABLETS.

Since the last announcement* the following tablets have been fixed on houses formerly occupied by:—

John Dryden, 43, Gerrard-street, Soho, W.
John Flaxman, 7, Buckingham-street, Fitzroy-square, W.
George Handel, 25, late 57, Brook-street, W.

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* Vol. xviii., p. 137.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

Fan Competition.—The date on which fans sent in competition must be delivered at the Exhibition Building has been altered from Friday, Feb. 17th, to Wednesday, March 1st.

The Bearing of the Exhibition on Industrial Instruction.—Mr. J. C. Buckmaster has been appointed by her Majesty's Commissioners to deliver an address on "The Value of the Exhibition, and its Bearing on Industrial Instruction," designed particularly for the working classes, in all the large towns of the country which express a desire to have it.

The Lighting of the Albert Hall. — The greater portion of the light by night will be obtained from star pendants. These are, however, at so great a height as to render their ignition by the ordinary method almost, if not wholly, impracticable. Arrangements have, therefore, been made to light the gas by means of the electric current. The apparatus will be lodged in the roof, wires proceeding thence to the several burners. The ignition of all the burners will be simultaneous, and all perceptible escape of gas will be avoided.

At the Ceremony of Opening the Hall by the Queen on the 29th March, an officially-reserved free seat will be offered to the mayor, provost, or bailiff of every place in the United Kingdom which paid £100 and upwards to the subscription fund of the Exhibition of 1851.

Delivery of Exhibits.—During the week the objects consisting of machinery, scientific inventions, objects of earthenware, porcelain, terra cotta, woollen and worsted fabrics, sculpture and painting, were delivered in great quantities on the respective days appointed. Another large consignment has also arrived from Belgium.

All objects in the following list must be delivered at the Exhibition Building, at the entrances specified, on the days named below:—

		Entrances.
Feb. 17	Painting applied to works of utility	Prince Albert's-road.
,, 18 ,, 20	Sculpture applied to works of utility	Prince Albert's-road.
,, 21	Engraving, lithography, photography, &c.	Royal Albert Hall.
,, 22	Architectural designs, drawings, and models	Royal Albert Hall.
,, 23	Tapestries, carpets, embroideries, &c.	Prince Albert's-road.
,, 24	Designs for all kinds of decorative manufactures	Royal Albert Hall.
,, 25	Copies of pictures, mosaics, enamels, &c.	Prince Albert's-road.
,, 27 ,, 28	Painting not applied to works of utility	Prince Albert's-road.

ON MILITARY ORGANISATION AS AFFECTING ARTS, MANUFACTURES, AND COMMERCE.

By Edwin Chadwick, C.B.

I apprehend that few will deny the great extent to which the progress of arts, manufactures, and commerce will be affected by a determination to spend several millions more of money, in augmentation by twenty thousand of the pot-house recruited force of the standing army—bringing it up to one hundred thousand—as proposed by the advocates of the existing system, or by spending seven millions less upon a superior national force of at least half a million of men, in quality equal to the rank and file of the German army, raised upon a voluntary instead of a general compulsory system, as in Switzerland.

I submit that it is due to point out how far the conclusions, advanced in the Society before the present war, as to the difference between educated and uneducated force, and as to what art and science gives to defence against attack, and as to what may be done to avoid the large detrimental effects of standing armies upon arts, manufactures, and commerce, have been affected by the experience of the war.

I must submit that the difference in efficiency between educated and uneducated force is fully established, as stated. Military writers in newspapers and reviews of the old school, really knowing no other than the one pot-house recruited force, continue to ascribe every result exclusively to organisation, strategy, and tactique; whilst it is quite clear that if Moltke had had no better educated rank and file than most of that of France, he could not have produced results like those he has attained. General Trochu, of whose writings I was until recently unaware, has put forth, as a primary measure for the reform of the French army, a sound general system of education. He also points out the disadvantages of the system which separates the soldier from the home and the feelings of the citizen. He speaks of the deleterious influence of the barrack upon soldiers and military force. Now, I know as a fact, that German generals ascribe a large part of their success in overmarching the French to the excessive proportion of the *trainards* from disease of the barrack-kept men of the standing army of France, excessive proportions of whom were found amongst the prisoners.

Our older military authorities generally insist upon one year's continuous service in the barrack as essential to the formation of a soldier. General Trochu declares, in respect to the forced service men, that a year is lost before they can reconcile themselves to it. Then, again, as to the instruction they do get there, in the town barracks, for example, it has always appeared to me that the conditions they must have to deal with in the field in actual warfare must be as new to them as to any volunteer force. I might illustrate this by the experience of our army in the Crimea. And now I find that Prince Frederick Charles, "the Red" Prince of Prussia, one of the foremost of the German warriors, in his military memorial, states, as a first principle of action, "to set absolutely aside, as soon as the army is in the field, the regulations of the barrack, and the very recollection of the parade-ground." He also states, that "a sound principle, which soon becomes as familiar to the soldier as to the general, rests in the axiom that "moral force is superior to physical force." "Napoleon," he observes, "struck out this idea when he said 'that moral force contributed three-fourths part to success, whilst physical force only contributed one-fourth.'" The sense in which Napoleon used the term moral force is not precisely the one which would be accepted by most moral philosophers; but in the sense of intelligent force for war, in corroboration of the independent conclusions I stated from observations in England. The following testimony may be cited in corroboration from a Prussian military work of authority, translated by Colonel Ouvry:—

"With our present experiences of 1866, we think it very wonderful that up to that time no foreign power would believe in the superiority of the breech-loader, or even in the possibility of employing it on service, and yet it is very natural that it should have been so; no one contested the fact that the breech-loader in itself was a very superior weapon, but the cardinal point was, whether the common soldier would be able to attain to that degree of military education, or whether his intelligence could ever become sufficiently developed, to enable him properly to make use of that delicate and dangerous arm. If this could be attained, then certainly the weapon would be irresistible; but if the soldier should fail, and not be found sufficiently ripe to appreciate it, then it would become ruinous to its bearer. Let any one only picture to himself the continual care, attachment, and intelligence which is required in the common soldier for the mere preservation of the arm, particularly under unfavourable circumstances in the field. Should a most careful instruction in details, and an unremitting attention to interior economy, not be one of the fundamental principles in an army, it is much to be feared that on the day of battle it will find itself in in possession of an excellent arm indeed, but one that is quite ruined and unfit for use.

"Should the general of the hostile army be acquainted with this weak point, he has merely to refuse battle for some eight days, and then he may hope, particularly if aided by unfavourable weather, to find an army of men who, though very good shots, have only damaged weapons which will not go off. Here we see attention to interior economy in troops coming into relation with strategical conditions. No nation, however, dared put this questionable matter to the test in a great war; but we who knew our men were ripe to use the arm with effect, had sufficient confidence to employ it, and by that means, or rather by the soldier who used it, we gained an overwhelming advantage, though it was only the intrinsic worth of our army which permitted us to reap the benefit of its use. Whether another army, having had occasion from accidental circumstances to use the breech-loader for the first time in a great war, would have been equally successful, is a very questionable matter. The finer and more complicated the weapon, the greater the difficulty of using it, and thus it depends entirely on the bearer of it whether all its great advantages are turned to account.

"The superiority of the breech-loader does not so much consist in rapidity of fire and the number of missiles discharged, as upon the training and selection of intelligent and independent soldiers who are capable of using it, and thus reaping the advantages of its intrinsic qualities.

"Mere drilling will never make such soldiers; they must not merely act at word of command, but according to their own judgment, and of their own accord, which will then operate so that the humblest soldier will become able to take an active part in the battle."

The entire campaign has been replete with illustration of the principle of the wastefulness of ignorance in the unit of force of "unthinking bayonets."

On the point of the gains of defence over attack, from the progress of science, it might appear, from the great success of the German army, that the conclusion had been entirely reversed.

I have already mentioned that, a few days after the declaration of the war, an officer who had served in the Confederate forces went to the Emperor of the French, and strongly represented the cheap and efficient power gained by extempore earthworks, a proved power of four to one of defence, by intelligent and sound force, against attack. Commencement was made with the system by the French generals. Before Orleans earthworks were thrown up, which competent authorities declare might have been held by one of intelligent force against four. But the ignorant and impassioned rank and file—even the long-service, barrack-trained rank and file—could not be got to retain those advantages, and they were dislodged frequently by inferior numbers of more intelligent force. On the other hand, the more intelligent rank and file have enabled the attacking force to avail themselves of the defensive power, and demonstrate its importance, as they did before Metz, before Paris, and before Belfort; they repelled the best *elan* of the French, and threw back two, three, and four to one of superior force. A French officer who led out some attacking forces from Paris described his astonishment at seeing nowhere any German force. He only saw the head of one man, who raised his head out of the ground as it were, and put his fingers to his nose, taking a sight at him derisively. Yet when the attacking forces advanced within the range of the needle-guns, there arose from the ground a withering, deadly fire, against which there was no effective replying or advance to be got.

Officers from America have joined the French army, and tried to get action taken upon the principle which I cited from the declarations of French officers at Chalons, that there was an end of the *combat avec l'arme blanche*, and throw away swords, and bayonets, and lances, and to rely on the six-shooting revolver and the repeating rifle. General Trochu defines cavalry as *instrument de vitesse*—the means of changing positions in half the time of infantry. The equipment of General Sheridan's cavalry was a repeating long-range carbine or rifle and a six-shooting revolver. On arriving at a position, the men dismounted, and one man stayed at a convenient position, holding the horses of three others, as well as his own, whilst they were in action. But the change could not be made with effect with the French force. The firing with the best of the very superior repeating small arms, put into their hands by the Americans, has been so ineffective as to render practicable and effective the continuance of cavalry charges and of bayonet charges in the open by the Germans, which, in the American army, have practically been abandoned.

Such being the confirmation of the leading Continental doctrine, and confirmation of it by manifest experience on the largest scale, it is greatly to be regretted that public writers should be unaware o the wastefulness of ignorance in war, and as to the comparative waste from the common pot-house recruited force, or should not have been struck with the great difference displayed between well educated and intelligent, as compared with uneducated rank and file in the present war. Thus, we find the *Pall Mall Gazette* declaring, and Mr. W. P. Greg, in an article in the *Contemporary Review*, approving the declaration "that a more foolish measure than the abolition of this punishment (flogging), one more weakly advocated, a more symptomatic of popular silliness, which threatens to be fatal to British military efficiency, was never ventured upon in the existing condition of our forces. The lash, we were told, degrades the British soldier. Who, then, is the British soldier as we have him now? He belongs to a class which is certainly not without good qualities of the rougher sort, but of which it is flat absurdity to say that it is degraded by physical pain. The looser sort of agricultural labour, and the rough of the towns pretty much make up the material of which the British rank and file is composed."

I concur in the objections which Mr. Greg makes to the ballot for the militia, but what is to be said of the conceptions of those who, by the ballot, would augment that force, which for the greater part is notoriously composed of a lower material than the rank and file of the line. The sons of the highest nobility of Germany serve their time in the ranks; but I have heard respectable persons of middle-class life declare that they would send their sons abroad to avoid service in such ranks as those of our institution. Yet one great plan of military organisation is compulsory service in this low, and I must contend, comparatively wasteful and inefficient force, with the alternative of serving in another force, the volunteers, which is less repulsive, but of confessedly loose organisation and discipline. It is, I apprehend, a serious mistake to suppose that either force would be more competent to meet the German national force than the best of the French barrack-trained force, under commands not inferior to our own have proved to be.

But so little does the teaching of the great example before us serve, that difference of educated and intelligent national force, the difference of which I had stated as two to three—but which has beaten two to one, and even three to one—is overlooked, and every success is referred by military writers of the old school to tactique, when it is evident to those who examine the subject, that Moltke himself would have been worsted if he had only such material as our pothouse-recruited force to wield against the newly-educated generation of Germans.

On a recent discussion of a paper on our military organisation, by Colonel Leahy, at the United Service Institution, General Lindsey, who presided, actually ruled that the question of a change in the quality of the unit of force, whether educated or uneducated previous to admission, and the difference it involved between two, and three, or more, whether they might be kept a month or six weeks under colours, under the Swiss system, was irrelevant to the present general question of military organisation. Military officers of all ranks go on assuming that force of the quality of the pothouse-recruited force of the line, trained under what General Trochu designates as the deleterious influence of the barrack, is an unquestionable necessity; and in this view military governors of military prisons are re-claiming the restoration of the lash.

The steady increase of the crime of insubordination since the abolition of corporal punishment (this year amounting to 100 per cent.) says Major Bacon, Governor of the Military Prison at Dublin, in the last report, for 1869, on Military Prisons, "is a subject for serious consideration; and it is evidence to my mind that a more severe punishment than simple imprisonment is necessary to check the spread of a crime which cuts at the root of all authority and discipline in the army." "Insubordination in the army is increasing," says Colonel Wellesley, the Governor of the Military prison at Gosport, and "in spite of all the benefits that have been accorded to the soldiers in later years, desertion maintains a very high rate; and so long as a bounty is given on enlistment, and the public-house is the medium of recruiting, there is little hope of its diminution." He calls for the restoration of the lash. "For such violent men the lash is an imperative necessity, and the soldier committing an act of brutality is no more deserving of exemption than the garotter in civil life. Of the many cases that have come within my observation only one failed to produce entire reformation; in all the others prompt punishment was followed by undeviating, exemplary conduct." So that, according to the logic of facts stated, since increased pay has failed, there is nothing for it but a return to the lash to maintain discipline in our army, and the safety of the country depends upon the lash. And thus general society of every degree is to be requisitioned for additions to this floggable force. The lowest demand is for at least one year of continuous barrack life in the midst of it. The whole forecast of our future is, according to these military and other writers, beclouded by it.

Mr. Greg speaks of the "rough" as teachable in the army, and therefore as being eligible for it. There has been a foundation in this respect for long service and severe discipline in the habit and traditions of the Prussian army. In the time of Frederick the Great, all sorts of semi-barbarians were forced into the ranks; and in the uneducated and ill-educated Polish peasantry the material is so heavy, stupid, and brutish, that considerable time and labour may be requisite to mould it into any available shape. For the loutish clods of our rural districts, and for the roughs of our towns, the regiment, and even the barrack may be the only school he has ever had. But, after all, it is ignorance of psychology to suppose that as a rule any teaching in the adult stage will bring them up to the capacity and value of those who have been trained and educated in the infantile or juvenile stage. And have the gentlemen who contend, on this account, for continuous service, estimated the cost of the one, two, or three years keep and education of such unwrought, unintelligent force, as compared with forces of ready-made intelligence and proved aptitude in learning, in days instead of in weeks, in months instead of in years, as in such instances as that of the police service, the rank and file of which is far from being the best possible? or have they regarded the advance of science in war, and the continuous changes requisite for wielding the new army, rendering higher intelligence for the rank and file of increasing necessity.

At the price of one year's continuous service, and one year's keep of a soldier in barrack, for his education and discipline, a dozen boys may be educated and trained for four years in school, and finished in elementary education, military drill, better than is got in after stages—better training in obedience and discipline included—than the barrack-trained soldier ever attains, even with the stimulus of imprisonments and other punishments applied by his teachers, the officers. The military schools of discipline are scenes of indiscipline never witnessed in the civil schools; and the common military notion of the barrack as an educational institution is as fallacious as it is wasteful. The forces enlisted and already educated in the infantile and juvenile school stages, to the extent even of the constabulary forces, experienced officers who know both sorts, which few general officers do, declare would "walk over the best of those who are only barrack-trained in the adult stages."

But Captain Du Cane, the Superintendent of the Military Prisons, does open a gleam of hope. "Many objections," he says in his last report, "have from time to time been made to the practice of marking men with the letters B C, to denote bad character, or D, to denote desertion. It is very doubtful whether this is a perfect protection against re-enlistment, and it is well worthy of consideration whether the object would not be better attained by the means ordinarily in use to ensure a sufficiently respectable character in a man whose services are engaged for any ordinary employment, viz., to require some previous account of the candidate, and to make some inquiries from those who have a knowledge of him."[*]

Precisely so—this is what we say; but this would alter the whole character of the army of the line. The police forces are filled up in this method. What would be thought of such language as that above cited as applied to them? Has the notion of flogging a policeman, or flogging and marking a private of the Irish constabulary force, ever occurred to any one, and yet it will not be pretended that the discipline of those forces is not superior to that of the standing army or the militia. Those who enter the police force may, if they find it disagreeable or unsuitable to them, leave within a month's notice. This freedom to leave is a great inducement to volunteering, so that the force gains more than it loses by it—it gains in competitors for admission, and whilst the rank and file gain in relief from grumblers, the general force gains in morale by the substitution of willing for unwilling service.

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[*] The *Pall Mall Gazette*, which has deplored the loss of the lash, gives the following paragraph:—"No measure of army reform will be perfect unless it provides for the discharge from the ranks of notoriously bad characters. It is a well-known fact that the authorities at the Horse Guards, for some reason best known to themselves, take a positive delight in refusing to sanction the discharge of soldiers who are a disgrace to their regiments. There is, unless we are misinformed, a private in a battalion of the Grenadiers whose military career has been so glorious that it deserves record, and affords a striking example of the fatherly interest taken by the authorities in young soldiers who have succumbed to the temptations which surround them. This misguided hero has been forty-two times entered in the regimental defaulters' book, four times tried by court-martial, twice sentenced to be discharged with ignominy and marked B C, and fourteen times sentenced to imprisonment by his commanding officer. There is hardly a crime a soldier can commit short of murder that this man has not committed. The list comprises habitual drunkenness, desertion, insubordination, resisting escort, riotous conduct, &c., &c. Yet, notwithstanding that, in accordance with the order issued by command of the Secretary of Ssate for War, that men of bad character, and who are continually in trouble, should be discharged the service, even though the last offence may not be heinous, he has been twice sentenced by court-martial to be so discharged—yet the confirming authority has been withheld by those whose duty it was to give it, and this exemplary soldier still wears her Majesty's uniform. Can we wonder, under such circumstances, that men who have a character to lose, frequently prefer any other profession to that of a soldier, when they are liable to enforced companionship with such comrades as these?"

The immediate objection to this proposal is the expense of such a force, but the answer is that, efficiency considered, a force of such a quality is, on the whole, a cheap force, as I have elsewhere shown, even if its service were required to be as continuous as that of the police. But it is of the essence of our proposal that it should not be continuous. We would use neither a compulsory ballot nor a year of compulsory continuous service, if those measures were given to us. Six weeks of service are asked for by the Swiss military authorities, and about four weeks are used by them, and they, I am assured by a competent English officer who has inspected them, have a rank and file as good as the German rank and file. Do the advocates for long-continued barrack life, to impart discipline and obedience—which with us has required yearly twenty-five thousand court-martials, eight thousand imprisonments, and between one and two thousand markings annually to impress those qualities—do they assert that the Swiss rank and file are seriously deficient in them? It is objected that the Swiss army has not been tried; but they have been tried, not in any Swiss war certainly, for they dared even Prussia to war, and have had none. They have been tried in various armies in Europe in which they have enlisted, and have been held in high repute, especially for their superior discipline, solidity, and trustworthiness. Saturday half days' drill, and about a fortnight of continuous service in the vacation time of the year, under canvas to train it as a manœuvering field force would, in the opinion of officers of the highest experience, suffice for all that is required for getting and keeping a national army in efficient training. A great part of those who are engaged in industrial occupations, all those occupied at the work-bench, the forge, or the plough, in productive work, would, they admit, be deteriorated in *physique* and *morale* by continuous barrack life. Indeed, Lord Hardinge declared in evidence, before the Sebastopol Committee, that soldiers could be prepared for the campaign in sixty days. If that were so with the common, uneducated material, what might have been done with material of the quality of the police forces? What we propose, however, is repeated periods of training educated force.

Since we only want a twelfth, or tenth, or at most an eighth of the year for keeping men training, even if double pay were given for that time, it would be an enormous gain upon the inferior pay for the whole year of the present pot-house recruited force. Indeed, according to the practical testimony of large employers of labour, all that would be wanted to double the amount of the present volunteer force, and place it under better training and discipline, and to get men to enter it whose time is worth more than double the rate of pay of the police force, would be relief from the expenses to which the volunteer force is put, as by a ration to those who are obliged to leave home for the afternoon, and rations whilst under canvas.

The expense of the Swiss army is two pounds per head for everything—commands included. Allowing for the different value of money, and the higher price of skilled labour and service in this country, it is estimated that two and a half-fold the expense of the Swiss army, or five pounds per head, would suffice.

I beg that large *sanitary* economies of industrial force, with which I may pretend to be specially conversant, and have examined in relation to military as well as civic force, may not be lost sight of. Experienced physicians will testify to the excessive mortality and the premature loss of working disability occasioned by defective physical training and defective development. Sanitarians will agree that large masses of the youth and the adult population engaged in sedentary or partial and imperfect physical occupations, such as shoemakers, and tailors, and desk workers in our towns, and small shopkeepers in our rural districts, prematurely fail in health and in working ability by the neglect of due physical exercise. For all such—the great majority—I have always regarded the volunteer movement as being a valuable sanitary movement. As I urged on Mr. Forster the other day, the military drill in schools was worth while, though we were a nation of Quakers; and so it is to be maintained that the widest extension of military training on the voluntary principle is worth while, as giving motive and means to needed physical exercises, though we were really assured of perpetual peace. Great masses of middle-class people and artizans are cut off before their fiftieth year who might have attained their three-score and ten, in good working ability. Of course, I present defective bodily training and defective bodily exercise as only one contributing cause of premature disability and mortality—but it is a cause of weakness predisposing to the action of all other depressing and morbid agencies. It may be confidently averred that military drill and manual exercises may be given in the infantile classes with advantage to the mental work of the school, and further, that military training up to the rank and file of any Continental army may be given in advanced youth and in the adult stages of life with considerable monetary benefit to large classes of the population, and with advantage for civil work and the augmentation of the civil force of the country.

We may now rely on the adoption of the principle of the drill in the school stages by the government, and it is to be hoped that they will be disposed to aid measures for corresponding advances in the adult stages of life in the community.

The whole subject has been considered by a special committee appointed by the Council of the Association for the Promotion of Social Science, of which I have the honour to be one. Considerable professional experience has been consulted, and conclusions have been adopted, which I shall ask attention to in another number.

THE WATER SUPPLY OF LONDON.

At the Royal Institution, Professor Tyndall delivered a lecture upon the "Scattering of Light," which was, in fact, a discourse upon domestic water supply. He commenced by exhibiting the impurities of London air, the motes of a sunbeam, by the light of the electric lamp, and explained that what they saw was not air, but suspended particles, capable of being dissipated or removed, and that, when so removed, the track of the beam through the air itself would be invisible. He next related that he had accompanied the eclipse expedition to Oran, and that on his return, having been disappointed as regards the special object of his journey, he had sought to turn his opportunities to account by investigating the causes of the varying tints presented by sea-water. After paying a warm tribute to the zeal and kindliness with which his wishes had been furthered by the captain and officers of Her Majesty's ship *Urgent*, he described the way in which a series of nineteen bottles had been filled between Gibraltar and Spithead, and the results of an examination of them by the electric light. The bottles were themselves on the table, but were not placed in the beam before the audience, since the original differences among them had been diminished by subsidence. The general tendency of the examination was to show that the yellowish waters of coasts and harbours held in suspension a large quantity of particles; that the particles in the green water were less abundant and in finer division; and that the blue water of the deep ocean was comparatively free. Professor Tyndall explained the blue or even blue-black of the depths, by displaying the prismatic spectrum on the screen, and by quenching it, at first partially and with regard to certain colours, and afterwards absolutely, by a succession of cells of increasing thickness, containing a solution of permanganate of potash or of sulphate of copper. He said that when a beam of light entered the sea, the heat rays were absorbed by the surface, the red rays by a very superficial layer of water, the green rays next, and ultimately the blue. If, however, the light encountered particles, these would reflect the green rays to an observer; while, in the absence of particles, the green rays would continue their course till they were wholly quenched. Water of great depth and absolute purity would thus appear entirely black, like a sea of ink, and would reflect no light beyond a glimmer from its surface. The Professor exhibited a white dinner plate, to which a rope was attached, and which he was in the habit of having cast overboard and towed from the *Urgent*, and which always appeared green, and he also described the appearances seen on looking down the screw-well of the ship, so that the water was seen by turns green, with the screw blades as a background, and then dark blue, with the ocean depths for a background. The white plate, which appeared as a green object when towed under water, would, he said, if ground to powder and scattered, cause the portion in which this powder was suspended to return a general green reflection. Having in this way established that the visibility of the track of a beam through water depended upon particles by which the light was reflected, Professor Tyndall next placed before the electric lamp a succession of nine bottles, containing samples of the water supplied to their customers by the various London water companies. The turbidity revealed was in every case sufficient to make the audience regard water as a very undesirable beverage. That of the Lambeth Company displayed pre-eminence of a bad kind; that of the Kent Company was by far the clearest; the West Middlesex Company stood second in order of merit; and among the rest there was little to choose. With a reticence more eloquent than words, the lecturer avoided expressing opinions about the dirt that he exhibited; and he also expressly mentioned that pellucidity was no proof of the absence of soluble impurities. He also showed that to cleanse water from suspended dirt was a very difficult matter; and exhibited four specimens of distilled water, a specimen once filtered by Mr. Lipscombe, a specimen that had gone through a silicated carbon filter, and a specimen four times filtered through bibulous paper in the Royal Institution Laboratory. These were clear when compared with the water of the companies, but the track of the beam was plainly visible in all. A specimen of water from the Lake of Geneva was then exhibited in illustration of great natural purity, and here a faint blue line only could be seen. This brought Professor Tyndall to the practical conclusion at which he had been aiming, namely—to an account of the water supply yielded by the English chalk formations. He characterised this as being of the greatest attainable purity, inexhaustible in quantity, and easily accessible for the supply of the metropolis. He described its natural hardness as being such as to render it unfit for domestic use, but explained that, by Clark's process, this hardness could be entirely removed at the central works, and that the water might be delivered in London at a uniform temperature, free from organic impurity or suspended particles, and so soft as to be perfectly adapted for all household purposes. He described Clark's process, and illustrated it before the audience, and finally showed actual results by producing a bottle of water from Canterbury, derived from the chalk, and softened in the manner described. By the side of this was a similar bottle containing the water supplied to the Institution, and the two were illuminated together by way of contrast. The difference was like that between pea-soup and crystal. Professor Tyndall then read a portion of the report made some years ago by the late Professors Graham and Miller, and by Professor Hoffman, upon the admirable qualities of this chalk water, when artificially softened, upon its fitness for the supply of the metropolis, and upon the impolicy of allowing it to pass into private hands, and concluded by saying that every word that he had read he desired fully and cordially to endorse.

EDUCATIONAL NOTES.

The Scotch Education Bill.—In the House of Commons on Monday night, the Lord Advocate moved for leave to bring in a Bill to amend and extend the provisions of the law of Scotland on the subject of education; and in doing so pointed out that, whereas in England, until the measure of last session, the law made no provision for the elementary education of all children, the law in Scotland, where the foundations or endowments for the higher education were few and insignificant, made compulsory provision for the primary, and to a considerable extent for the secondary, education of the people. The parochial schools of Scotland were, for the most part, supported by rates levied upon all landed property, but such inequalities existed in the mode of assessment that it was necessary to abandon the present system. There were at present upon the roll of some school or other 424,360 children, of whom 88,183 attended parish schools, while on the roll of country schools there were 312,795. He proposed that the present system of rating on valued rent should be abolished, that the whole of the heritors should be rated, and that all should have a voice in the election of the School Board to whom the management of the schools would be delegated. The rating was to be extended to all lands and heritages whatever. The present grant, which was £80,000 a-year, would be multiplied several fold, and he proposed that the grant should still be in the hands of the Privy Council, but that a Scotch Education Department should be formed, to administer and exercise a supervision and control over the local boards. The idea upon which the measure was conceived was to take the existing provisions of the law of Scotland upon the subject of education in parish and in borough schools as a foundation, extending the system of rating for the support of borough schools, which at present were not supported out of the rates. He might state, that any remaining connection between public schools and the Church of Scotland would be severed by the Bill; while, as to what has been called the religious difficulty, as far as he had been able to ascertain, it was one which had no practical existence in Scotland, as there was no conscience clause in any of the public schools. Besides, there was no preference by parents of one school over another because it belonged to a particular denomination. Provision was made by the Bill whereby the school board of any district might, if desirable, take over existing schools. There was also a provision in the Bill applying the principle of compulsion, as in the English measure. Mr. Gordon criticised various points in the Bill as contrary to the unanimous recommendations of the Royal Commissioners, but a general approval was expressed by Dr. Playfair, Mr. Anderson, Sir E. Colebrooke, Mr. Carnegie, Mr. Macfie, and others.

Compulsory Education.—In the House of Commons, on Tuesday evening, Colonel Wilson Patten asked the Vice-President of the Council whether the government was prepared to give powers to enforce attendance at schools in those districts where there are no school boards; and, if so, to what authority. Mr Forster, in reply, said that this power having already been given to school boards by the Act, the government was not prepared to give additional powers for compelling attendance, nor would it be expedient to introduce a measure for a special purpose such as this. The *Athenæum* is of opinion that by referring the question of compulsion to a committee, the London School Board has virtually pledged itself to the admission of the principle; it thinks that this decision is mainly due to the exertions of Mr. Lucraft, who gave notice of a motion on the subject, which, it adds, is, indeed, the one point upon which working men feel more strongly than upon any other, knowing, as they do, the requirements of their own class. The same article points out that those who assert that compulsory education infringes upon the liberties of the subject have probably never considered that they thereby logically admit the right of a man to bring up his children in absolute ignorance, a right which, however, the English law explicitly denies, the Court of Chancery having more than once ruled that a child may be removed from the control of parents whose conduct is likely to prejudice its character or its education. And although it has only exercised this power in the case of infants possessed of property, it was expressly laid down by Lord Eldon that, where the infant has no such property, the court declines to interfere, not from want of jurisdiction, but from want of funds. It appears, then, that the most forcible arguments in favour of the principle are, first, that it has, as has just been pointed out, long been recognised by the English law, although never before embodied in any special enactment; secondly, that it has been adopted with success by every State in Europe except England, Belgium, France, and Geneva; thirdly, that working men, whom it will especially affect, fully appreciate its value, and are most anxious to see it introduced. The great difficulty, especially in large towns, appears to be to carry it out efficiently. In a country parish, or a small town, the rector knows each child by its name. In London, hundreds of children will escape compulsory regulations, because the authorities will have no cognisance of even so much as their existence. And yet these will be the very children for whose especial benefit compulsion is, or ought to be, introduced. It is very hard to see how this difficulty is to be faced. But, in conclusion, the *Athenæum* expresses its opinion that the attempt must be made, for it is not too much to say that the decision at which the London School Board will arrive will virtually determine whether the country shall or shall not adopt the principle.

The London School Board.—The principal business of the Board, on Wednesday last, was the consideration of Professor Huxley's proposal for a committee to consider the scheme of education to be adopted in the public elementary schools. He held that no educational system in this country would be worthy the name of national unless it created a great educational ladder, the bottom of which should be in the gutter, and the top in the Universities. The first thing necessary to secure was a pleasant way of teaching reading, writing, and arithmetic, and this could be done in the infant schools. He thought that both drawing and music should be taught in an elementary form, and that the elements of physical science should also form a part of the instruction. History should not be a prominent feature, but religion and morality, apart from disputed points of belief, should certainly be included. The committee was granted.

Provincial School Boards.—It may be mentioned as a curious fact, that when the parish of Berkhampstead was recently polled on the question a School Board, the decision in favour of one being carried by 291 to 196, it has been ascertained that one-third of those who voted in the opposition were unable to write, and were, therefore, obliged to make their mark. At a meeting at Newcastle-under-Lyme, a strong feeling was expressed in favour of appropriating a portion of the enormous educational endowments of the town, the surplus of which is said to amount to upwards of £60,000, to the education of poor children. But it was stated that the Endowed Schools Commissioners were preparing a scheme for dealing with that money, and that they would refuse to apply any portion of it for entirely gratuitous education. It was generally admitted that it would be necessary to put in force the compulsory powers of the Act. At a meeting of the Liverpool School Board, a suggestion as to the practicability of making the census available for obtaining educational statistics was brought under notice, and a letter addressed to the Bolton School Board by the Registrar-General (who had been applied to on the subject) was read, in which that official strongly objected to the proposal, on the ground that it would render still more onerous the duties of the already severely-taxed census-takers. The chairman remarked that the collection of reliable educational statistics, except in connection with the census, would be very costly, and that he had communicated with the local members of Parliament with a view to obtaining the statistics in the way suggested.

Grants to Denominational Schools.—A circular has been issued by the National Education League, in which strong opposition is threatened against any proposed increase of parliamentary grants to denominational schools. It is contended by the League that such a policy as that shadowed forth last summer by Mr. Gladstone and Mr. Forster will give rise to consequences threatening the gravest dangers to the cause of religious liberty and national education. It will perpetuate a system which, even by the admission of its advocates, has failed to meet the wants of the country, or to afford education really worthy of the name. It will also prevent the general formation of school boards, and the consequent management of schools by the elected representatives of the ratepayers. The various branches are urged to express their opinions upon this matter.

CORRESPONDENCE.

ETHICS AND ORNAMENTATION.

SIR,—May I beg the favour of some space in your columns to advert to the ethical point so forcibly insisted upon by Dr. Dresser, in his paper on "Ornamentation," read to the Society on the 9th inst. He denounces as "false," and as if wrong in a moral sense, (1) all imitations of wood, marble, or any such substance which might be used in decorative art; and (2) any use of shading or colour whereby figures, or any other ornaments drawn on a flat surface, are made to appear as if raised or projecting. I do not object to this teaching as "purism," for I most cordially agree in the principle that there can be no "little sins" wilfully committed. The love of truth can be satisfied with nothing short of the best and most perfect to which the mind can attain in thought, word, and deed. But I think the school of which Dr. Dresser is so eloquent a member fall into a grave error by confounding ethical and physical considerations in a manner which tends to confuse and mystify, rather than to enlighten the conscience.

I say that the moral guilt of falsehood cannot justly be imputed unless there be the intention to deceive. Heedlessly to do anything which is calculated to deceive is a neglect of truth which constitutes a grave offence; but, in either case, it is not the senses merely, but the mind which is the subject of blameworthy deception. Thus, if an inferior material is painted to look like one more costly, with the intention of conveying to the mind a false ideal of wealth, a moral wrong of a very contemptible nature is committed. If an unsuitable substance is made to pass for one suitable, a still grosser fraud is perpetrated. There can be no difference of opinion as to the moral turpitude of this kind of cheating. But apart from such cases of acknowledged and designed fraudulent deception, I deny that any means of imitation for the purposes of decorative art can in themselves be open to objection on moral grounds. Whatever objection there may be must stand on its own merits as a question of art, and not of ethics.

Let us try if a little careful consideration of the physiology of the eye and of the brain will not help us to draw a clearer distinction between the so-called illusions of the senses and moral deceit. Speaking loosely, I may say that my sight deceives me when I see the sun going round the earth; or that on the railway, my eye constantly deceives me, leading me to believe that I am moving when stationary, or the reverse. But, in fact, my eye reflects with perfect fidelity, according to the Creator's law of its construction, the images cast upon it. It is my brain that ignorantly or carelessly misinterprets signs truly given. Experience teaches me to look for some object which I know to be fixed, and then, by an act of cerebration, often unconscious, I interpret the meaning of the changes in relative position, of which alone the eye can inform me. To go a step further. Look at one of Turner's wonderful distances—how the imagination is carried away through space. Compare this effect with the "deceptive" realism of the stereoscope, and we shall be the more readily inclined to doubt whether, in the first case, the mind has ever, even for a moment, been "deceived," rather it has perceived, not an illusion, but a suggestive representation as full of truth as of beauty. Or again, many travellers have told of the wonderful skill with which the hunters of wild tribes will follow a track which they are utterly unable to discern, but show the savage a picture, and it conveys to him no idea whatever. It is not that the eye of the savage is a more perfect organ than that of the civilised man; on the contrary, the marks on the canvas will, materially speaking, be even slighter than those impressed on the soil. Each mind severally perceives that only which, by habit or association, can convey some idea to the brain. It is a mere confusion of ideas to suppose that any subtle moral evil can lurk in the so-called "deception" of the eye. There is no occasion for any restriction on moral grounds, the remedy is to be found in the purely intellectual culture of the special discriminative faculties of the brain, which will enable them to interpret more truly and intelligently the signs conveyed by the senses.

But it may be urged that common sense and conscience revolt instinctively from some of these "deceptions, and that all, therefore, are open to suspicion. The first part of the proposition is quite true, but let us examine a little further on what these feelings are based, and I think a very clear line will be perceived, which will leave art free to use any means of illusion or misrepresentation which may be applicable to its actual requirements. Let us take first the case cited in Dr. Dresser's paper, of a pillar painted on a flat surface, not referring, of course, to mere scenic decoration. It does not satisfy the mind, because a just association of ideas requires that a pillar, forming part of a structure, should satisfy the conditions of fitness and utility. So we come at once to this dilemma—either it is required materially, and its absence in substantial form is false work, or it is not required, and its (supposed) presence is false art, not because it is illicit to depict a projecting object on a flat surface, but because there is no adequate reason why the object represented should be there at all. Moreover, however perfect the illusion may be from one point of view, its unchanging appearance will betray its want of solidity, when looked at from different points of view. Doubt once awakened, the mind will instinctively perceive the slightest indications of this unreality. It is disturbed by conflicting appearances incompatible with the idea of stability, which is an essential element in the conception of architectural excellence. So that, in one sense, it may be said that the work is false, not because it is, materially speaking, illusive, but because the illusion is not sufficiently complete.

Mere illusions, moreover, make no appeal to the higher sense of imagination. A painted curve or projection, simply intruded as a surprise, or as a *tour de force*, affects the mind through the eye very much, as a quibble or a bad pun affects it through the ear; and as surprise, from its very nature, cannot afford a continuous impression, work designed to excite this emotion only, is obviously unsuited for permanent decoration. But in all these cases it is the purposes intended or things signified, not the means used for representing them, which are obnoxious to censure.

If once the notion of moral truth or falsehood be intruded, in this sense, into the question of the means which may be used in such art, there is no end to the confusion and contradictions which arise. If it is "false" to make a flat surface look round, is it not equally so to make a hard, dry, harsh surface appear soft, and rich, and warm. Indeed, as some colours appear to recede and others to stand out, sometimes giving an illusive appearance as of delicate and elaborate fret-work, there is another great source of danger that the mind may be carried away from the truth of "flatness." Are these means capable of being used to create beauty of such a delicate nature to be condemned as illicit; or, if the graining of wood or marble be "false," is the representation of gold true, or what thickness of plating of the precious metal is to be held true, and what tenuity of gilding stigmatised as false? Is it "truer" or "falser?"—the question will read either way—to represent the human figure, which is rounded and solid, as flat; or part of a wall which is flat, as standing out in relief. There was a mediæval drawing exhibited, on the 9th, of a man facing the spectator with his feet both turned the same way, and in the same plane as the body. If this be a tribute to the "moral" truth of the flatness of the surface on which it is drawn, it is equally a moral outrage on the natural truth of representation of the human form divine. I do not for one moment forget that the veriest outline drawing may be in perfect accordance with the highest requirements of truth and of art, but I do say that the flat ornamentation of a flat surface is not in any sense a moral truth, and that it is a very great evil to confuse scrupulous consciences by inventing an imaginary "sin," which can tend only to introduce an element of bigotry into discussions upon art, which fosters a timid spirit of obstructive and conventional restriction rather than a faith in the rational cultivation of our faculties to higher powers of discrimination and intelligence.

The same narrow and inadequate conception of moral truth has before now misled men into supposing moral falsehood in all works of fiction. They had better have concluded that, as all language is in a large measure metaphorical, silence is the only mode of expression left to truth. Childhood may teach us better, and the most scrupulous of poets has written that—

> "E'en the child that knows no better,
> Than to interpret by the letter,
> A story of a cock and bull,
> Must have a most uncommon skull."

Active, healthy children like stories which are really true, because they like to know something of the world which they can test by their own little experiences; but what child ever regarded the story or the pictures of a fairy tale as morally false? If they despise tinsel ornament it is because it is in reality flimsy; they cry out with a perfectly true instinct against the cheat of a toy which is not as strong or as good as it ought to be, but surely there never was a child with so uncommon a skull as to regard the "deception" of the senses in a conjuring trick as a lie, or to fail in experiencing other than a perfectly honest delight in those illusions of the senses, whether by means of form, or colour, or touch, which, in simple truth, serve to teach him the real nature and limits of those perceptive faculties which his

Maker has given to him. It is an ill service to truth, and that accuracy of thought which is so closely allied to it, to associate even the faintest suspicion of moral falsehood with those so-called illusions of the senses, which, like fiction or parable, are so prolific a means of conveying instruction and delight to many minds which most readily receive their impressions by means of representation and analogy.—I am, &c.,

R. H.

TRUE AND FALSE ORNAMENTATION.

Sir,—As a member of the Society of Arts, I try to apply to my every-day life what new principles and ideas I can get from the various papers read before the Society, and the publications in the *Journal.* I entered the great room of the Society last Wednesday, as happy a man as the cares and anxieties of a lawyer's office will let me be. I left it at the end of Dr. Dresser's paper, as a wretched, broken-down reprobate, thoroughly prostrate under the severe reproof I had received. He must have seen me go out. I felt that I looked like a wicked dog, with my tail between my legs. And why? you will say. Why? Ah, why, indeed. Was I not at that moment aiding and abetting my fellow-countrymen in bringing upon England the unhappy fate that had befallen Pompeii, or the dreadful scourge of war that has dragged poor France to the ground? Why, indeed. Was I not largely averting the blessing of the "Most High" from my household, because of my carpets and wall-paper. Was not my wife sitting, waiting for me to come home to tea in a room, the wall-paper of which pretended to be the trellis-work of a summer arbour, with tropical plants creeping round it. Was not my youngest child resting its miserable head in the inside of, and covered over by the wings of a real swan. Were not the four corners of the cornice in my drawing-room held up by cupids; did not the ceiling represent clouds and stars; and did not griffins grin from out the panels on the wall. "*Me miserum,*" I cried, as I jumped into a hansom, and directed the driver to go to Belgravia-villa, which I half expected to see burnt down to the ground for the impurity, the falsity it contained. With a feeling of relief, I seized the knocker. O, horror, I had seized hold of a lion's head to batter the door with, as if a real lion would have let me do such a thing. "Is everything right?" I asked nervously, as I sat down in my own chair; and leant my back against a rampant unicorn—my crest—and rested my heels on the nose of an animated looking skye terrier worked in worsted by my misguided eldest daughter. My wife, seeing my depression, to cheer me up led me to a new purchase she had made—O, horror of horrors!—to a bed for the servant's room, which turned up in the day-time to look like a chest of drawers. Such falsity, such impurity, was more than I could bear. "Miserable woman," I exclaimed, "how can you expect the sanction of the Most High to rest upon this house if you will buy bedsteads that are made to look like chests of drawers. Break it up, pull down the cupids, smash the griffins, let the baby sleep on the floor rather than in that abomination, and wrench the door knocker off." How long I went on in this style I know not. I was put to bed; and only after three days' hard work at some divorce cases have I come to the conclusion that there are causes for which nations are more likely to suffer than for false quantities in art. The first holiday I get, I mean to go to Sedan and read of the destruction of Pompeii. — I am, &c.,

A Member.

ORNAMENTATION AND RELIGION.

Sir.—If Dr. Dresser, in his paper on ornamentation, had brought the experience he seems to, and no doubt does, possess, to bear upon the laying down of certain canons in the matter of ornamentation and decoration, by which the general public could be guided, he might have done good service to the cause of art in this country. If he had only told us what ornamentation is and how, when, and where it may be used with effect, I for one, should have been glad. In fact, I should have infinitely preferred anything to the hysterical rubbish, in weak Ruskinese, he gave us. I am fully prepared to agree with him that ornamentation is the highest art possible, and something more if he likes; but when he talks of the "sanction of the Most High," and the sins of Pompeii and unhappy France, in the matter of ornamentation, being punished by the burial of the one under the ashes of Vesuvius, and the ravaging of the other by Bismarck, Moltke, and Co., I cry, hold! What, sir, am I to believe that the blessing of the Almighty will not rest upon my house, and the coming in and going out of the people thereof, if my carpets, or my cornices, or my wall-papers are not according to the gospel of Dr. Dresser? Away with such nonsense, say I.

Let us improve our taste, and surround ourselves with graceful forms, but do not let us surround them with a mock sanctity; or that man who can stand at the top of the biggest pile of "gimcracks," ornamented under the sanction of the Most High, will be nearest the gate of heaven. After all, sir, the truth or falsity of ornamentation is not in its form but in its purpose. If you ornament a chest of drawers with the purpose of making it look like a bookcase, that ornamentation is false. This, sir, is my canon, and, till Dr. Dresser can give me a better one, I intend to hold to it.—I am, &c.,

E. T. C.

THEORIES OF COLOUR.

Sir,—Your correspondent, W. G. Herdman, in his enthusiastic, but if he will permit me, in all courtesy, to say, somewhat blind worship of nature, casts an indiscriminate sneer at "books," unmindful that there are "books and books." The books to which I referred him contain the careful records of the questionings of nature, by some of our most gifted men, with her replies to their questioning. The writers are as truly worshippers of nature as your correspondent can be, and I venture to think that he, as a nature student, could not fail at least to be interested, if not instructed, by them. He might possibly be led to doubt how far his own assertion is correct, that green is never produced except by a mixture of blue and yellow. He would there see that under the careful interrogation of nature by Helmholz, Herschel, and others, she replies that no mixture of the prismatic blue and yellow (her own colours) can be made in any proportion to produce a green. I am not saying dogmatically that these men must be right, and that your correspondent must be wrong, but until he shows his acquaintance with what they and other nature worshippers are doing, and that their methods and results are fallacious when brought into contact with his own, he must not be offended or surprised if his views do not meet with ready acceptance; indeed, he can scarcely be deemed qualified to discuss the subject. However, be this as it may, I think I have shown that Professor Barff was fully warranted in stating generally, without going into proof, the accepted theory of colour of the present day.

Mr. Herdman quotes Newton in his favour, but he must not forget that even the marvellous genius of that great man himself was at fault, when his observations led him to believe that the laws of refraction and dispersion of light were such as to render achromatism impossible by any combination of transparent substances; but further investigation brought to view phenomena which had escaped his penetrating intellect, and achromatic lenses are now universal. So with his supposed theory of the seven prismatic colours.—I am, &c.,

Nemo.

GENERAL NOTES.

Erratum.—In the report of the speech by Mr. George Wallis, on page 221, a line was accidentally dropped. The sentence commencing in column 2, line 32, should read as follows:—"And there was in all these things an exoteric *meaning for the multitude, and an esoteric* meaning for the initiated."

Transposing Piano.—A simple invention has been perfected by Messrs. George, Carr, and Co., of Cannon-street, whereby the transposition has been obtained in a very easy manner. The method is as follows:—The key-frame is made in duplicate, and on it is screwed, by means of ordinary thumb-screws, the action, making it perfectly rigid. At each extreme end of the keys the block of wood, called the "key-block," is also attacked to the key-frame, and thus rendered moveable. These blocks are pierced with holes exactly a semi-tone apart, in which small pegs of wood are inserted. When it is required to alter the piano to a higher or lower pitch the pegs are taken out, and the key-board can then be moved with the smallest possible power up or down the scale. To meet the hammers, when used either way, there are extra strings, so as to enable the performer to have a full compass instrument always to play upon, and sufficient length is allowed to make it available for transposition into any key. The advantage of this piano to musicians, especially vocalists, can hardly be over-estimated, as it affords a mechanical means of changing the key in which a piece of music may be set, so as to accommodate the voice of the singer.

Great Gunpowder Blast.—A gunpowder blast has been fired successfully at Borraw Granite Quarries, Argyleshire. The mines for this blast have been in course of formation for eighteen months. The face of the rock that was operated upon ran in an angle of 45 degrees from the sea at Loch Etive, which at this point washes the base of the mountain Ben Durinish, in which the granite quarries are situated. At a distance of 60 feet from the end of the rock next Loch Etive, a horizontal entrance mine was driven in from the face of the rock to a distance of 50 feet. This mine was about four feet in height by two feet six inches in the centre, terminating in a narrow bottom, giving it the form of an egg-shaped sewer. It was situated about nine feet above the level of the quarry floor, and had a superincumbent mass of rock above it about 85 feet in height. At the inner end of this mine a heading was branched off to the right, thirteen feet in length, and from it the gunpowder chamber was excavated. This chamber was nine feet in length by five feet in breadth, and four feet high, and in it was deposited 2½ tons of gunpowder. A heading was also formed to the left of this mine twenty feet in length, and a gunpowder chamber excavated, seven feet long, five feet broad, and four feet high, in which there was deposited 1½ tons of gunpowder, the charge being in all 4 tons. The headings and the mine were all carefully built up with rubble, stone, and Roman cement, into which building the electric wires were placed, protected in wooden casements. On the stemming up of the mine a powerful galvanic battery was placed 100 yards distant from the mouth of the same. From this point Mr. Sim, the lessee of the quarry, crossed the loch to go to the island, 200 yards distant, with the cord for working the battery. Shortly before two o'clock the signal shot was fired, to intimate that all was ready. At two o'clock the battery was set in motion, and instantly the whole mass of rock operated upon was on the move. There was no report or noise, merely a silent bursting and pressing forward of innumerable pieces of rock as it existed in its natural formation. The quantity of rock displaced is computed by measurement to be 80,000 tons, being the largest quantity which Mr. Sim has had displaced during his 18 years' experience of this system.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

February 22.—On "Water Meters." By Frederick E. Bodkin, Esq. On this evening John Hick, Esq., M.P., will preside.

March 1.—On "The Principles of School Organisation and Instruction, as Advocated by the Society of Arts, and their Bearing on Arts, Manufactures, and Commerce." By the Rev. W. H. Brookfield, M.A.

March 8.—On "The Cultivation and Uses of Sugar Beet in England." By Dr. Augustus Voelcker, F.R.S. On this evening James Caird, Esq., C.B., will preside.

March 15.—On "The Different Methods of Extracting Sugar from Beet-root and Cane." By Ferdinand Kohn, Esq., C.E.

March 22.—On "Drill, the Complement of the Present School Teaching." By Major General Eardley-Wilmot, R.A. On this evening the Marquis of Westminster will preside.

March 29.—On "The Patent Laws and their Administration, with a View to the Adoption of Practical Amendments." By A. V. Newton, Esq.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal Institution, 2. General Monthly Meeting.
Royal United Service Institute, 8½. Mr. E. J. Reed, C.B., "On the Turret-ships now Building for H.M.'s Navy."
Society of Engineers, 7½. Discussion on the paper by Mr. E. S. Crompton, "On the Economics of Railway Maintenance."
Social Science Association, 8. Mr. T. Brendon Curgenven, "On the Laws of France relating to Illegitimate Children, Foundlings, and Orphans; and also those relating to the Registration of Births and Deaths."
London Institution, 4. Prof. Huxley, LL.D., F.R.S., "On the First Principles of Biology." (Educational Course.)
Entomological, 7.
British Architects, 8.
Medical, 8.
Victoria Institute, 8. Rev. G. Henslow, M.A., "On Philotaxis, or the Mathematical Arrangement of Leaves.'

Tues. ...**SOCIETY OF ARTS, 8.** Cantor Lectures. Dr. Crace Calvert, F.R.S., "On Dyes and Dye-stuffs other than Aniline."
Civil Engineers, 8. 1. Discussion on "Pumps for Low Lifts;" and, time permitting, 2. Mr. Hamilton E. Towle, "Account of the Balance Dock at Pola on the Adriatic."
Statistical, 7¾. Fourth Ordinary Meeting. Mr. Ernest Seyd, "On Currency and Pauperism."
Pathological, 8.
Ethnological, 8.
Royal Institution, 3. Dr. Foster, "Nutrition of Animals."

Wed. ...**SOCIETY OF ARTS, 8.** Mr. F. C. Bodkin, "On Water Meters."
Royal United Service Institution, 8½. Adjourned discussion on a paper by Lieut.-Colonel Arthur Leahy, R.E., "On the Organization of our Military Forces."
Geological, 8. 1. Sir W. C. Trevelyan, Bart., "On Supposed Borings of Lithodomous Mollusca." 2. Lieut.-Col. Drayson, "On the Probable Causes, Date, and Duration of the Glacial Epoch of Geology." Communicated by Alfred Tylor. 3. Mr. W. D. Herman, "On Allophane and an allied Mineral found at Northampton." Communicated by Mr. W. W. Smyth. 4. Mr. J. C. Hawkshaw, "Notes on the Peat and underlying Beds observed in the construction of the Albert Dock, Hull."
Archæological Association, 8.

Thurs...Royal, 8½.
Antiquaries, 8½.
Philosophical Club, 6.
Artists and Amateurs, 8.
London Institution, 7½. Mr. F. S. Barff, "On the Action, Nature, and Detection of Poisons."
Royal Institution, 3. Dr. Odling, "Davy's Discoveries."

Fri.......Royal Institution, 9. Dr. W. B. Carpenter, F.R.S., "The Latest Scientific Researches in the Mediterranean and Straits of Gibraltar."
Architectural Association, 7½. Mr. F. J. Francis, "Notes on the Recent Works at All Hallows Church, Lombard-street, with Remarks on Sir Christopher Wren's Churches."
Quekett Club, 8.

Sat ......Royal Institution, 3. Mr. O'Neil, "The Spirit of the Age."
Royal Botanic, 3¾.

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FRIDAY, FEBRUARY 24, 1871.

PROCEEDINGS OF THE SOCIETY.

TWELFTH ORDINARY MEETING.

Wednesday, 22nd February, 1871; John Hick, Esq., M.P., in the chair.

The following candidates were proposed for election as members of the Society:—

Blencowe, J. G., the Hooke, Lewes.
Cunliffe, Roger, 6, Princes-street, Mansion-house, E.C.
Davis, Samuel, 14, Strand, W.C.
Hudson, Robert, F.R.S., 29, Grand-parade, St. Leonards-on-Sea.
Mackay, J. Brant, 2, Bouverie-street, Fleet-street, E.C.
Ogle, John, St. Clere, Sevenoaks.
Pennington, Frederick, 17, Hyde-park-terrace, W.
Robinson, Thomas L., Union Bank, Croydon.
Spartali, Michael, 25, Old Broad-street, E.C.
Whiteman, John, 32, Hilldrop-road, N.

The following candidates were balloted for and duly elected members of the Society:—

Cressell, William, Thurlow-terrace, Lower Norwood, S.E.
Glynn, Edward, 68, Thistle-grove, West Brompton, S.W.
Knell, William Adolphus, 329, Kentish-town-road, N.W.

The Paper read was—

ON WATER METERS.

By Frederick E. Bodkin.

The question of measuring water supply by meter has for a great many years been occupying the attention of engineers. Ever since 1824, a yearly increasing number of inventions bearing upon this important subject, and amounting at the present time to a total of 313, have been brought before the public, in which are included patents taken out in England and communications from foreign engineers which have been registered at the Patent-office; yet, with all this great expenditure of ingenuity, it is generally allowed that there is no meter at present in really practical use which may be considered an accurate, or, in many ways, a satisfactory machine.

If we take a review of the time which has elapsed since 1824, when I stated the first patenting of a water meter is on record, we find that up to the year 1851, a period of 27 years, thirty different inventions had found their way into public notice; whilst, during the ten years succeeding, or up to 1861, no less than ninety; and again, from 1861 to 1871, or the present time, one hundred and ninety-three. I do not mean to say that all these were for separate and entirely different machines; the larger proportion were so, but a great many only specify certain improvements in previous inventions, or apply them to particular uses, a process which frequently implies the production of a practically new instrument.

There could be no better argument than the above statistics found in proof of the general demand for a good water meter, since all invention is necessarily the result of some extensive public requirement. We may also adduce the fact that, unsatisfactory as are all the meters at present supplied to the public, they have, at least those amongst them which present fewest defects in working, met with liberal customers among the water companies and private individuals, who are willing at much personal inconvenience and expense, to refer the estimate of the supply of water to the arbitration of these meters. In large factories, for instance, or in the case of machinery driven by water or steam power, and large stabling establishments, hotels, and even the better descriptions of dwelling-houses, it has been found an advantageous arrangement, and examples are enumerated by advertisers of water meters, pointing out the benefits likely to accrue to their purchasers, either on one side or other of the meters, from their use. For instance, a sum of £40 per annum paid in one case for water, rose no less than £1,000 in favour of the suppliers, after the introduction of a meter. We may view the matter in another light, by comparing our dealings with water supply with our management of gas, not that the cases are in all respects similar, for gas is a luxury hardly yet a necessity of life, whereas pure, wholesome water is, in the truest sense of the word; but gas is, viewed scientifically, a very similar material to deal with, and is supplied by volume through pipes, and is turned on and off as required, and measured and paid for by meter. Moreover, by comparison of equal volumes, we find that water is the more expensive commodity of the two, which is an additional argument favourable to the use of water-meters under certain conditions, even though there were more difficulty and expense in obtaining them.

If, instead of viewing the extreme cases I referred to above, we consider in a more extensive aspect the question whether the invention and use of a good water meter would be advantageous to householders and other consumers alike, one cannot but feel that the present system adopted for the general public, of payment according to the ratal or means of each separate consumer, is a most wise and liberal arrangement, hanging the chief burden of expense on the wealthier classes, and supplying an equal necessary of life to the lower orders at greatly reduced cost. Nor would the introduction of meters necessarily relieve any particular class, since the same expenditure would have to be defrayed as our requirements of proper purity and supply at present entail on the several water companies, whilst it would certainly act very prejudicially to the appearance and health of the "great unwashed" of our large towns, who would be only too anxious to reduce their water bills to a minimum. Perhaps, however, with the introduction of constant supply, the general use of water meters might become an advantage—almost a necessity—to prevent waste; but in London, where this would be most severely felt, constant supply is, as yet, only a very remote possibility.

There are also other uses to which water meters may be applied, such as calculating the supply of water to steam boilers, for the purpose of ascertaining their evaporative power; also the expensiveness generally of water and steam power, a means of accurately judging which would enable the engineer, with far greater facility, to arrive at their comparative excellencies. The great difficulties which surround the designing of a good water meter must excuse the ill success, so far, of inventors in meeting this demand; these may be better judged of by a short statement of some of the offices required of such a machine.

Firstly, a water meter should register with accuracy, that is, within one per cent. of the truth; and this, it must be remembered, not under a uniform rate of flow of the fluid, but under every possible variation of pressure, from a head of only a few feet, up to two or three hundred, unless indeed it be intended to act as a low-pressure meter, to some of which I shall call attention presently, and also under any ordinary variations of temperature.

Secondly, it ought to be of sufficient strength throughout to stand these high pressures, and even sudden alterations and blows under them, which form a still more trying ordeal.

Thirdly, it is very requisite it should be cheap, both in original cost and to maintain in repair subsequently. This latter consideration is very important, as under high pressures any bearing surfaces would be travelling at a great speed, and, even with the common impurities of water, would be liable to wear away very fast.

Fourthly, simplicity, both in number and shaping of parts, chiefly because all water meters are liable to get soon clogged with a muddy deposit, and require cleaning, and any complexity renders this operation difficult and expensive; it also naturally infers great costliness in repairs when the machine gets out of order, a defect to which such would be particularly liable.

It also often happens that a meter may be left unused for a time, and the working parts become dry. This should not interfere with the accurate working of the machine on its again coming into use; it is also greatly to the advantage of any meter that it should be uninjured by the entrance of heated water or steam, when supplying steam-boilers or other machinery, where such are used; that it should form a closed valve against the return of water already passed through it; also that the register and work should be out of reach of interference of people desirous to tamper with them; and a very important consideration, that there should be as little loss of head or decrease of flow as possible in the water during its passage through. There are also peculiar excellencies, if we may believe the statements of advertisers, which recommend some meters for use in private dwellings, far in preference to others; for instance, a certain Frenchman, with the ardour of competition so peculiar to our neighbours, describes his invention as not only a perfect meter, but a useful and elegant ornament for a gentleman's hall or drawing-room.

When we come to consider more carefully the leading features of all this vast mass of invention, we find that it is mainly directed to the measurement of water, under two different conditions, low and high pressure; low-pressure where the water is delivered from the meter entirely free from momentum; and high-pressure where the water arrives at, passes through, and leaves the meter at the same, or nearly the same velocity. Low-pressure meters were in use some time before the introduction of the other description, are much more simple in design, and can be made to register with perfect accuracy, but they have now fallen into disuse, except in special cases, where a careful measurement generally of some fluid more valuable than water is required, irrespective of the time occupied in the process. It will be worth while to notice briefly the various ways in which this has been accomplished.

In the most simple method, graduated glass-tubes are used in connection with a barrel, or vat, or closed chamber, and by which the amount of fluid run off can be easily read. Another, almost as simple, consists in the use of a measure-chamber in connection with an ordinary tap; the tap is at one end, and a valve at the other, or feed end of the chamber. These are so connected that one turn of the tap handle allows the water access to the chamber, and closes the outlet; the reverse action closes the inlet valve, and allows the measured quantity to escape for use; each turn of the handle is registered. This principle is applied in many ways, some constructing the measure-chamber large enough for a considerable supply.

A third makes use of a large vessel of known capacity, generally an upright cylinder, and places a valve on a properly fitted seating at the lowest part; there are also floats in the vessel, and while the valve is closed and the water rising, the float also lifts, and in doing so actuates lever arms, which by ordinary mechanism shift the valves when the vessel is full, the lower valve from its seating, and a cut-off valve attached to the inlet pipe. One means whereby this is attained is by hanging a weight from the float over a pulley, fixing a cam on to the shaft of the pulley, and causing the cam to raise a long lever arm at one point of its revolution. As the arm rises and falls, it moves the valve. The float, when out of water, being heavier than the weight, falls with the water and reverses the valves at the bottom; a register tells the number of rises and falls that have taken place.

A fourth group of inventions places two tanks side by side, or subdivides one by a central partition; in each are valves at the lower ends, and each contains a float. In one case a system of syphons is substituted, the supply-pipe is placed over the partition, and alternately made to direct its flow into one or the other subdivision; the floats rise in each alternately, and, in most cases, by a central axis, which they actuate by lever, change the direction of inlet, and raise their own outlet valves; the central axis has weighted arms attached, to ensure the instantaneousness of the action.

According to another device, a subdivided trough is centred on trunnions, and caused to tilt or tumble over from one side to the other, by the weight of water which has flowed into each division of it from a fixed inlet; the trough is generally made triangular in section, and so proportioned and centred that it shall not tilt until each division is quite full; the number of tumbles is registered in this case.

A further modification of the above arranges a number of these tumbling buckets round a centre spindle, their continual filling and tilting causing the spindle to rotate. Sometimes they are made to work in a water level, each bucket gradually sinking down to it. But when fixed, free to revolve, they are arranged so that each weight of water must overcome the resistance offered by an arm of a weighted lever, which comes in contact with a catch attached to each bucket, and will not allow it to pass until out-weighted. The revolutions are registered, and represent in amount so many buckets full each.

A very novel idea is to measure, by means of a gas meter of ordinary construction, the amount of air exhausted from any closed chamber, from which the liquid is allowed to run, the amount of water extracted being taken as equal to that of the air registered.

Endeavours have been made to convert several of the above into high-pressure meters, by making them of sufficient strength, and causing them to work without loss of head by air compressed in suitable chambers.

From this brief account it will be readily understood that water can be measured by low-pressure meters with the greatest accuracy, but they are entirely useless for supplying large quantities at any speed. They always require the intervention of a cistern of some considerable capacity placed high up; and in large establishments a separate meter would be required for every cistern. They may, in fact, be considered quite inadequate to the requirements of modern water supply.

Among high-pressure meters a greater variety exists; they may be divided into two principal classes, those which give a positive registration of actual quantities of water, and those which register by inference from the flow or pressure of the water passing through them.

Amongst positive high-pressure meters, various arrangements of piston and cylinder hold the first place. The principle of these meters is, to enclose in a hollow carefully-bored cylinder of known capacity, a piston free to move from end to end by the pressure of the incoming fluid, the piston being caused by this force to drive out the quantities of fluid already measured. This motion, and its degree of perfection, will depend mainly on the arrangement of the valves which regulate the inlet and outlet of the liquid.

In the simplest form, the piston, very carefully packed, is fitted with a long piston-rod, protruding from a packing box at one end of the cylinder, and bearing one or two catches, which, just as the piston reaches the top or bottom of its stroke, come into contact with, or strike against, the ends of levers, causing the valves to shift; or the same is effected by a roller on the piston-rod running up and down in a slot in a bar of metal, and striking each end in turn; the bar, on receiving the blow, throws over a weighted lever, which alters the valves; or, by some, a rack is used attached to the top of the piston-rod, this gears with a pinion on a fixed shaft, two catches are fixed on each side of the pinion, and these alternately throw over a weighted lever from side to side; the weight in falling turns a four-way cock. This last is a device used by Mr. Kennedy, in his patent water meter, one of the first ever brought into use. It possessed the advantages over others of the same time, that it allowed a continuous stream of water to pass without serious loss of head, and registered very correctly. But the acknowledged defects of expense and great complexity, and also the continual attention required to keep it in working order, have caused its gradual fall into disuse, for it was found, as soon as the oil in the works, which are not in these meters in contact with the water, got thick, the tumbling-weight refused to fall, and the water passed through the half-open valve without registry; and fresh oiling was found necessary every few months.

Messrs. Chadwick and Frost, in their Manchester positive meter, cut a long flat strip off one side of the upper part of the piston rod; against this flattened portion a roller is pressed at the end of a bent lever, the square ends of the strip or slot drive the other end of the lever at right angles to the piston rod, causing it to actuate in that line of direction a valve, which allows the water to flow alternately through the connecting link to the back of two small circular discs; its pressure at once forces each forward in turn, carrying the main valve with it, thus forming a fluid pressure valve. This arrangement is found superior to Kennedy's meter, and in fact has gained the ascendancy over all other cylinder meters we possess; but it is an expensive meter, and the number of wearing surfaces it contains prevent that durability which a high original expenditure ought to ensure to customers. It will not either, without great additional outlay, stand exposure to heated water.

A French patentee specifies a long cylinder, containing two pistons joined by a rod, passing through a central division with bearings, on which the cylinder rocks, by the greater weight of fluid alternately in each end, the central bearing being hollow and arranged on the four-way cock principle, and opened and closed by the tilting of the cylinder.

A large number of meters have also been devised, with two or more cylinders as measuring vessels; these are fixed side by side, fitted with pistons, and their rods working a common shaft by means of cranks. By the revolution of this shaft, two eccentrics or cams are made to open and close the valves; these are sometimes placed between the cylinders, sometimes on the outside, and in one case, in a meter designed by Mr. Duncan, placed at considerable angle to the piston-rod. When the cylinders are placed in the same line, end to end, as is the case in some meters, the rod connecting the two pistons, by means of a long catch, is made to actuate bars placed parallel to the piston-rod and outside the cylinders. These bars move secondary valves, the primary valves being placed at right angles across the further ends of the cylinders, and driven by water pressure regulated by the secondary valves, thus forming a similar, but more clumsy, fluid pressure valve to that used by Messrs. Chadwick and Frost. In some cases the cylinders are made so as to slide telescopically on one common cylinder open at each end, with a central water-tight division; but in this arrangement the valves are a great difficulty, and the accurate fitting of the cylinders is expensive.

When the cylinders are set at an angle to one another, it is generally, as in an invention of Mr. Jopling's, at right angles, and the piston-rod of one is made by direct action to open and close the valves of the other, the pair being enclosed in a water-tight casing.

An invention of Mr. Worthington's, of the United States, consists in an arrangement of two cylinders, each containing two plungers or pistons connected by a single rod, bearing a central division plate. The valves are placed between the containing cylinders, and the alternate spaces are connected, by crossway passages from one into the other of which the water flows before it leaves the meter.

The chief object aimed at by the combination of several cylinders is a continuous discharge from the meter, and the prevention of any concussion occurring in the pipes. This is so perfectly effected by Messrs. Chadwick's meter, that any additional complication and expense, such as these machines involve, is quite needless.

Another American method uses a cork piston or ram, packed with cupped leathers; and a Mr. Heppel furnishes a solid wooden cylinder, with an annular leather bag, and causes it to work loosely in a cylindrical casing. These have their advantages in cheapness and absence of friction, but their adaptability in continual contact with water is very questionable. The best form of piston for a water meter appears to be a cylinder of metal with a flange at each end, the intervening space being long enough to allow the travel of a rolling ring of india-rubber up and down during each stroke of the piston.

There is yet another combination of pistons and cylinders which has been devised for measuring water. The inventor places a number of cylinders round a central shaft free to revolve, and attaches the heads of their piston rods to the corners of an inclined plate centred on the central shaft; the pressure of the water against their pistons causes them to rotate, and their revolutions open and close their respective valves. They may also be placed along a common trough or pipe, and their piston-rods in gear with a common crank shaft. They are free to oscillate, and, in doing so, valves at their junction with the main pipe are alternately open to each side of a central partition in it, which divides outlet from inlet.

The next description of positive meters includes all which are constructed to work with flexible or elastic diaphragms. The principle of these meters is, that a perfectly water-tight partition shall be formed, capable of assimilating itself to either end of a containing chamber, its edges being firmly bedded in the sides of the chamber, so that water admitted on either side alternately will force the diaphragm tight against the other. The shape of the chambers used to enclose these diaphragms is generally that of a double sector, or a sphere, or with inclined sides and flat ends. The chambers are most usually broad and shallow, and made of two shaped plates bolted firmly together, with the diaphragm between them. This is made of leather or vulcanised india-rubber, toughened by layers of calico or prepared cloth. It is generally strengthened by a central plate of metal, to which a piston-rod is attached, which passes out of the chamber and actuates the valves.

In one patented by Mr. Ramsbottom, in 1855, there are two diaphragms in doubly conical chambers, the rods of which turn a common crank shaft. On this are two mitre wheels, which turn a rotary valve between them.

In a German meter, the rod actuates a lever with a chordal rack attached to the further end. This gears with a pinion, a crank on whose shaft moves the valves.

In another meter, four diaphragms are used at right angles, and all driving the same central shaft by means of cranks. From this shaft the registry is taken, and it is made to distribute through valves the supply of water to each pair in turn.

Meters of these descriptions will work with great accuracy, whilst the diaphragm remains entire. But it has been found impossible to discover any material which will endure active work with certainty; and, as soon as the smallest flaw occurs, water passes without registry.

Closely allied to meters of this description, are those whose measuring chambers are made of compressible bags or cylinders. One of the simpler forms of these was patented in 1850. It consists of a water-tight chamber, containing two compressible cylinders, distended with metal rings at intervals. Their upper ends rise and fall vertically as they fill and empty, raising and lowering each end of a bar with them. Chains from these ends pass over separate pulleys, and are attached to the ends of a cross handle of a four way cock. Another design fastens two such cylinders end to end on a rocking arm passing right through them. They rise and fall as they alternately increase and lose weight, and alter valves seated at their point of connection.

Compressible tubes have also been often suggested as water-meters; for use as such, they are wrapped round a centre cylindrical core, or coiled in a ring on a circular plate, and a pair or more of rollers, revolving round a shaft placed in the centre of the bag, and pressing tight against it, are caused to move by the pressure of the water entering one end of the bag, and forcing the rollers before it, in order to escape at the other extremity. By the time one roller has arrived at the end of the bag, a second comes into play; thus a series of waves of equal and known amount are continually passing through the bag, and being registered by the central shaft. An invention of Mr. Siemens makes use of a similar principle, by causing waves of liquid to pass down a tube of rectangular section, between the sides and a flexible central division. To all such meters the same objection holds as in the case of the diaphragm meter—that they are most uncertain in duration, especially if liable to stand idle, and their flexible portions to get dry and hard.

An entirely different description of meter are those which work on the principle of rotary force pumps or fans. They are usually made with cylinders or axes revolving either in the same centre or eccentrically in outer cylindrical casings with closed ends. The simplest form is that of a plate sliding in a hollow cylindrical shaft or an elliptical disc, sliding on a crank and revolving in an epicycloidal chamber, the inlet on one side, the outlet on the other. The fluid continues to flow and the ends of the plate or disc cut off equal quantities of fluid, and register the number of revolutions. Or the centre cylinder may be concentric with the outer casing, and have one or more flat vanes of metal let into slots in its periphery, which are forced into it at a certain part of its revolution, between the inlet and outlet holes, by a bulge or indent in the outer shell, causing the periphery of the inner cylinder to revolve in close contact with it, and forcing out the water included between any two of the vanes. These vanes are carefully packed and must revolve in close contact with the outer circle, and for the purpose of always keeping them tight against this, a cam is placed inside the inner hollow cylinder, which forces them out at all parts sufficiently.

A French invention proposes to shut up air in the inner cylinder, and trusts to its compression and expansion to keep them in gear.

According to another, an eccentric axle is fixed inside the inner cylinder with four short arms; on to these are hinged the travelling vanes, which at a certain part of the revolution, where required, bend at the hinges and recede, and afterwards again straighten and are forced forwards.

In these machines the accurate fitting and easy travel of the vanes is of great importance; but however carefully this may be carried out originally, from constant use these machines soon give signs of wearing and neglect to register accurately.

Some inventors make use of oscillating vanes or pistons swinging round in hollow cylinders from one side to the other of a fixed partition, the inlet and outlet being on each side and reversable by valves; and even more complicated arrangements of two or more swinging vanes, sometimes in adjoining cylinders, and other equally impracticable machines have been proposed.

A great many adopt the method of hinged vanes or floats, capable of laying close alongside their centre spindle, and of spreading out against the encasing cylinder under pressure of water. After the principle of the fan, the vanes are made concave against the pressure of the water, and are hinged on to a cylinder, so made to revolve eccentrically, that just before it reaches the inlet opening, the blades are folded closely down, but on passing it they spread, and do not again close until they have passed the outlet.

Different arrangements of two cogged wheels, rolling in contact, have also been suggested; they are made of considerable breadth, and are placed in a double cylindrical casing, the one riding loose, the other fixed on a shaft which actuates the register. The teeth of such wheels must be very carefully made, in order to continue in contact at every instant of their revolution, the water being usually supplied immediately under the point of contact. It will be easily understood that the efficiency of the machine depends entirely on the good fitting of the gearing surfaces of the wheels, and which equally applies to the preceding description of meters, to the careful packing at each end of the drums. A meter which has not come into public use, but which has been found to work satisfactorily, when applied to measure the water supplied to steam boilers, consists of a string of balls, fitting accurately in a loop formed in the supplying-pipe, and, passing over a pulley at each end, the water enters on one side of one pulley, and, carrying the string of balls before it, passes out at the other extremity. These balls cause the pulleys to revolve, and show how much water has passed.

Amongst inferential meters, which depend for their accuracy on their estimate of the velocity of the water passing through them, those which register the revolutions of an annular ring of metal, fitted with floats or paddles round its periphery, are most numerous; the water in this case being admitted through apertures as nearly as possible at right angles to the surface of the floats, impinges against them and causes revolution in a very irregular proportion to the speed and pressure of the water. An invention of Mr. Ramsbottom's has been used to some extent, and consists of a wheel with radial floats. Another machine, by Mr. Taylor, is very similar. He uses a horizontal wheel, provided round the periphery with radial floats, and riding on a vertical spindle in a closed chamber. It is to be made of any material of the same specific gravity as water, in order to reduce friction on the bearings, and is driven by the water admitted through small holes close to the wheel. This meter has been used considerably in the North of England, but is found much inferior in correctness and power of discharge to others.

To ensure an even flow, which was the only condition under which these meters would work accurately, and to prevent low pressure-water from passing at all, several different methods have been devised. By one arrangement, the water is required to raise a clack-valve, held down to its seat by a delicate spring before it can impinge against the drum; by another, the water is caused to pass through a contracted elastic orifice; and by a third means, the flow of water in its action on the drum is regulated by a specially designed governor.

The next class of inference meters include all those which register the rotations of drums with screw blades fixed round them. These drums are fitted into long cylindrical casings, and the water flows past them, having first been directed through fixed guides turning in the opposite direction, and causing it to impinge on the drum-blades at nearly right angles. An earlier invention of Mr. Siemens is of this description, who uses two drums, or two pairs of drums, turning in opposite directions, and set end to end in the same tube. The drums are made hollow, of a peculiar alloy, and have eight perfect screw threads passed round each. The registration is taken off the central ends of the drum-shaft by means of mitre wheels, and there are directing guides equal in number, but exactly opposite in direction between each.

A patentee of 1851 places a similar drum, but rather longer, on a valve seating in a vertical pipe; it is thus rendered capable of lifting before any impurity which may be carried along with the water. Some others use a great many series of drums and guides, and occasionally choose to admit the water without guides simply between two reversed drums on the same spindle. The accuracy of these machines depends largely on the careful fitting and balancing of the drums, and their continuing to work without friction, but even under the most favourable circumstances, they will not register with sufficient correctness at varying pressures, the error generally tending towards insufficiency at low pressure, and rising above the real amount at moderately high ones.

A further improvement has been suggested and used by Mr. Siemens and others, on the principle of a Barker's mill, whereby the water is admitted into the interior of a chamber fixed on a spindle, out of which it flows by means of bent or curved hollow arms; the reaction of the outflowing liquid (for the vessel is entirely under water) causes it to rotate in an opposite direction; the spindle moves on a steel pivot, encased in a water-tight oil-chamber; the water is admitted through a dirt-box; the revolving chamber is furnished with retarding vanes, and the upper end of the shaft has a worm-wheel attached, which works the register.

The above meter has found most favour before the public, both in England and abroad, of all the meters yet introduced; but notwithstanding its superiority, it possesses many defects. It is expensive, and is not by any means certainly correct under all pressures; it is, besides, so very delicate, that it continually requires inspection and repair. It will pass water through at low pressures with a very insufficient registry, and will work backwards without difficulty.

A great step in the removal of all the above defects, both in this and every other meter yet introduced, is exemplified in an invention by Messrs. Cook and Watson, a meter which has only lately come before the public notice. It consists of an upper plate, indented on the the under side with a ring of thumb holes, and riding loosely in a chamber over a lower plate, through which inclined inlet holes are bored. The water rises through these holes, raises the upper disc, and acting against the square ends of the thumb-holes, causes it to rotate at the same time. This action of course requires some small power to commence, but as soon as the upper plate is lifted it must also necessarily rotate. When the supply ceases the upper plate falls, and forms a tight valve against the return of the water; and since during its period of revolution this plate floats in a film of incoming water, there are no wearing surfaces involved in the machine. Small stays are placed on the upper surface of the revolving plate, in order to produce regularity of motion under varying pressures, and appear, from the specimens I have at different times been enabled to test, to do so with complete success.

These machines are not expensive, and offer but small opposition to the flow of the liquid, and certainly appear to be the simplest and most practicable form of high pressure meter yet invented.

A very different description of inferential meter consists in the use of a rod of alabaster, or other slowly soluble material, encased in a glass rod graduated, and at its lower end in contact with the running water. It is kept pressed down, and as it dissolves the top descends and is supposed to denote the quantity of water which has passed. This seems very simple, but the readings must often be liable to considerable variation.

In presenting these remarks on water-meters, I must apologise for much insufficiency in the descriptions of the various ones I have noticed, and for any unintentional misstatements I may have been guilty of regarding any of them.

DISCUSSION.

Mr. Webb desired to know whether the small power which it was stated was requisite to set the last-mentioned meter in operation, would always be at hand under the ordinary pressure of the water.

The Chairman said, as he understood it, a small amount of pressure only was required to set it in motion, and then it would continually register correctly.

Mr. Pickstone said he remembered when Kennedy's meter came out, that it frequently registered against the consumers, and, of course, was soon put down. A meter, to be held in esteem by suppliers of water, must certainly register either absolutely correctly or in favour of the companies, otherwise there was no chance of its success at all. If it registered air as well as water it would do. Kennedy's meter, by occasionally stopping, registered against the supplies. As he was a director of a water company at that time, he remembered that on some occasions, in getting in the quarterly statements from parties to whom water had previously been supplied for steam-boilers per horse-power, they found that, whereas previously so many pounds a quarter had been payable, they had, in fact, nothing to receive; the meter had stopped, and, of course, the consumers had not informed the company. Chadwick's meter, on the other hand, went on ticking all the time, and registered air as well as water. As a consumer, he should certainly object to a meter which went on constantly ticking, when he knew perfectly well that no water was being used. It appeared, therefore, that for domestic purposes there was at present no chance of any meter being introduced; at the same time, as a private consumer, he should much like to consume water by meter at any reasonable price per thousand gallons, because he believed that private consumers paid a much higher rate for the water than would be properly chargeable to them if there was a fair average made of all consumers. When he paid £10 a-year for his water, he thought it was infinitely more in proportion than the smaller consumer who paid, say 12s. a-year; and when he was a director of a water company, it came under his observation that cottages paying a rental to the owner of £6 to £9 a-year, and paying a water rental of a few shillings a-year, consumed very much more in proportion than large houses. If the meter last referred to was satisfactory, if the working parts of it were not liable to get out of order, and the meter itself were cheap, probably companies would allow private consumers to use it at a reasonable price. He did not know whether they would, or if the public had a right to insist upon their doing so, for certainly it would be no use to ask unless they had the right to insist, for there could be no doubt that directors of companies would discountenance the use of meters by small consumers. But, be that as it might, it was of great importance that some accurate means should be possessed of measuring water for manufacturing and such like purposes; but it was essential that the meter should be fair to both sides. In the case of gas meters, consumers very often had a suspicion that they paid for 10, 15, or 20 per cent. more gas than they burnt, and sometimes when meters had been examined, it was found that as much as 25 per cent. more was registered than really passed through the meter. It was the public, therefore, who required protection, they being on the weak side of the question. It certainly would be satisfactory to the public to know that they only paid for what they consumed.

Mr. Henry Christie Beloe (Liverpool Water Works) said the question was of great interest to him, representing, as he virtually did, a population of 600,000, and it being his duty to see that they were properly supplied with water. Under these circumstances, the question of meters had been constantly brought to his notice, both with regard to their accuracy and more extended use, but he had always heard that the House of Commons set their face against the use of meters for domestic purposes. How far they might see fit to change their views it was not for him to say. No doubt, in the coming session of Parliament, when he was told the whole question of the water supply of London would come under their notice, that might form one of the elements of the discussion; but, so far as Liverpool was concerned, it would make no important difference there, because the water-supply belonged to the town, and the water was simply distributed to the public at the prime cost for interest of money and working charges. It had, however, often occurred to him that the use of meters would, to some extent, meet what he could not but think was the radical evil of all water supply, viz., the great waste which constantly took place. In Liverpool, they charged five per cent. upon the rateable value of the house for the water supply, including every purpose to which the water might be applied, which he considered a very low rate indeed; and their great grievance was the infamous waste of water which frequently went on; and how to control that waste was, he believed, one of the great problems of the day. A gentleman sent by the government called upon him the other day for information with regard to this matter, and with reference to the Bill which he believed was about to be brought into Parliament, and he soon found that his views coincided pretty much with his own on this subject. As to the waste of water in manufactories, there was a check, because, the corporation not being bound to supply water to them, they were charged for what they consumed, and at a proper price. It was contended, on the one hand, that if meters were applied to domestic purposes, they would engender filth and the discontinuance of the use of water in a very lamentable degree; but, on the other hand, it must be remembered that on all these matters there were evils on one side or the other, and he believed such a system would greatly check the disgraceful waste which he had referred to; for instance, he had known even respectable persons leave the plug of their closets running for hours, days, and even weeks at a time, and although there was power to bring such offenders before magistrates and fine them, this was a check which could very rarely be put in force.

Mr. S. C. Homersham said there were many places throughout the country where there was really no waste at all, and where it did exist, either in Liverpool or elsewhere, it was simply because the managers of the water companies did not know their duty. It would take too long to explain the whole particulars connected with this matter, but there were means easily provided and in operation in numerous towns, and no waste of any importance took place, and that was where the system of constant supply was in operation. To return to the paper itself, the actual meters in practical use by water companies might be reduced to some five or six. The first, and perhaps one of the oldest, was Parkinson's, which for measuring into a cistern under a low pressure was a very good one, but it was only applicable unto such a case. Then there was an inferential meter largely in use, known as Siemens's, and this, if the water was constantly flowing through a pipe, although the velocity might vary considerably, was a very good meter, and very reliable, but if the water was delivered into a cistern, as was the case in houses, and a gallon or a quart was drawn at a time, and then shut off again, it could not be relied upon, so far as his experience went. He believed that no inferential meter whatever could be made to meet these defects, not even the one referred to as No. 13. That required to be put in motion before it registered, and, if only a small quantity was drawn it would not register. There was another meter in use, known as Kennedy's, or the Kilmarnock meter, and this, when properly attended to, answered the purpose very well; and also the Manchester meter, which he considered cheap and satisfactory, although it was spoken of in the paper as rather expensive. It was largely used in the manufacturing districts in Lancashire, and he employed it in his own works. With respect to supplying water for domestic purposes by meter, it must be remembered that the Acts of Parliament only gave the companies power to charge consumers according to the rental of the house. Every Act of Parliament for a water company incorporated the Water Clauses Act, and by this Act, the company was bound to charge in the way he had stated. Unless this system was altered, meters could not be introduced for domestic purposes. In one instance, however, he had obtained the introduction of a clause by which, if more than a certain quantity of water per quarter were used, the excess was charged for at 2s. per thousand gallons; but, on the other hand, a minimum rental was charged, whether any water was used or not. This was done in the Caterham district, which, lying very high, there was a considerable demand for water for gardens and such like purposes, and it was considered only fair, that if extra water were used in this way, it should be paid for. It must, however, be recollected that water companies, unlike gas companies, did not manufacture the article which they supplied; they were, in fact, water carriers, and it did not signify comparatively whether the person used little or much. What they required to be paid for was the interest on the outlay for the fixed plant, the pipes, and so on; for instance, certain pipes were required to bring the water for some miles to Belgrave-square, and although many of the inhabitants were out of town for six or seven months in the year, they had to pay for the water during the whole time, because interest of money on the capital sunk was running on whether the water was used or not. In the same way in the district he had before referred to, the inhabitants were frequently away at the seaside for a considerable time, and if they only paid for what they consumed, a much higher rate must be charged in order to pay interest on the capital at such times.

Mr. W. H. Michael said there were two reasons why the legislature made a great difference between the supply of gas and that of water, as to the mode in which it should be supplied. In the first place, there had not been, up to the present time, any meter constructed so as to guage accurately the quantity of water passing through it, it either registered too much or too little, or it was so delicate in its construction that the impurities, which were always more or less present in water, soon interfered with its practical operation, and it ceased to become an actual register. This had been one main element in determining the mode in which the supply of water should be charged for, and, as far as he could see, the meter spoken most favourably of was open, more or less, to the same objections; however perfect it might appear, when particles of sand and vegetable debris got into it, it would probably cease to act. The second and more important point, however, was this:—The supply of gas was not an absolute necessity, but water stood in quite a different category, coming under the head of those things with respect to which the legislature had, to some extent in the past, and, he believe, would still more in the future, interfere with and render compulsory; they would compel people to use water in order to avoid injury to the public health. It was, therefore, and must be, impossible to charge the poor in the same ratio as the rich, and, in fact, the object was to make the rich use as little water as possible, and the poor as much as possible, and experience had shown that if the latter were charged according to the quantity used, none at all would be used in many poor dwellings. This was the main question, and in connection with it was another, the supply of water by local authorities. He was one of those who believed that the water supply of the country would never be thoroughly carried out until it was in the hands of the local authorities; though, if this were done, of course it must be upon the principle of fairly remunerating those who had embarked their capital in existing water companies. There was now, he believed, a great unwillingness to confiscate private property of any kind for the public good, and therefore he had no fear of private interest not being properly compensated. There was in the public mind at present, unfortunately, so small an amount of information as to the necessity of drinking pure water, that it would be the height of imprudence to introduce the consumption of water by measure, which must necessarily tend to still further restrict its use amongst the poorer population. It must be borne in mind that no system of sewage, in which water was extensively used as the carrier, could be of any public good, but, on the contrary, would be a great public nuisance, unless the water supply were to a great extent under the control of the local authorities. From having sat as a government commissioner, and taken part in local inquiries with regard to water supply, he would say that it was the duty of all persons to encourage the use of water in poor localities; and, therefore, looking at this from a public point of view, the water rate must be considered really as a tax, or local rate, imposed for the sake of a great public good; it was a local rate, levied, not in accordance with the quantity of water used, nor yet altogether on the principle which had been laid down, which would apply almost with equal force to gas companies, but to secure a great public good, and, therefore, the rich must pay for the poor, the reason being that by the use of water the community at large would benefit in the matter of the public health, and, therefore, the benefit would come back to the rich in the sweeping away of those diseases which now affected poor and rich alike, the rich suffering from the neglect of the poor. Much, therefore, as an accurate means of gauging the supply of water was to be desired, he saw no probability of the principle being generally adopted with regard to private consumers.

Mr. Casella said his attention had first been called to the subject of water meters by having been asked by a continental customer for a cheap, durable, and efficient water meter. He therefore made inquiries of the various water companies, but he was sorry to say the result was anything but satisfactory. He was obliged to reply to his correspondents that nothing very suitable had come under his notice, although several new meters were announced as forthcoming. Then his attention was called to the last one mentioned by Mr. Bodkin, which certainly seemed to him at first sight to answer the purpose better than anything he had seen before, and further investigation had confirmed this impression. It did not seem open to the objections which most others were.

Mr. Robert Rawlinson, C.B., said there could be no objection to water meters for commercial purposes, and if anything approaching perfection could be attained, it would be a great advantage, but if any one was looking for a meter applicable to domestic purposes he would advise them to at once discontinue the search, being convinced that if such were discovered it would not be used. It would be absolutely impossible to supply water by meter in this country for domestic purposes. It was quite true that under the present system the rich paid much more than the poor, but this could not be helped if the poor were to be supplied at all. He could refer to districts where there was a constant supply of water to every cottage at a payment of 1s. a quarter, whilst people resident in London had to pay according to their rental; and he had no hesitation in saying. because he was always very careful that water should not be wasted, that there were customers of companies in which he was interested paying 1s. a gallon, who used double and treble the quantity he did in London (and of a far better quality), although he paid 30s. a quarter. But what would be the use of introducing meters. The poor could not pay for water by measure if any appreciable price were put upon it; whereas he, like all careful persons, used so small a quantity that the companies would have to put an exorbitant price upon it in order to get their rental. He had lately visited a town for the purpose of making inquiries on this subject, when he found that meters were introduced, although generally the water was not measured; in other words, the consumer had to pay a certain fixed rental upon his rateable value, whether he used any water or not, but if he exceeded a certain stipulated quantity, then he must pay for the extra supply. That was a good illustration of the saying "Heads, I win; tails, you lose." Besides, there never yet was a meter which would register correctly when the supply was intermittent, and, therefore, they would be only applicable to cases such as those under the care of Mr. Homersham, who certainly managed his affairs most admirably where there was a constant pressure in the mains. He quite agreed with the latter gentleman, that the subject of waste was too long to enter upon on such an occasion. It was well worthy of a paper to itself, but he would say briefly that it generally arose either from ignorance or gross negligence, and the method of cure consisted in having proper fittings, properly put up and properly superintended. It would be as reasonable to expect a watch to go without winding up, or keep good time without ever being cleaned, as to expect water fittings to keep in order without being properly looked after. Where there was excessive waste, as there was in most places in England, it was entirely because the fittings were not properly looked after, and because they were of such a character that a careless servant might at any time leave them open, and thus a company had to pump in water at the rate of 30, 40, or 50 gallons per head, when it was now found by experience that from 6 to 10 gallons per head was a full supply, and amply sufficient for any community under any conditions. The question with regard to London was so important that it must press itself upon those who had the management of the matter, but certainly, if the government interfered, and said that the companies must supply water constantly under pressure, the companies would have a fair claim to dictate what fittings should be used, and to superintend them when in use, in order to see that they were kept in order.

The Chairman said one thing was quite certain, the tendency of all the remarks had been to show that the most perfect meter was the best, and that what was wanted was one which should favour neither consumer nor supplier. As a rule, the inferential meters were the least accurate, because they were apt to continue in action after the water had ceased to flow when stopped suddenly. With regard to the application of meters for supplying the poor, his opinion was, that if a really accurate self-registering meter could be found, it would be very desirable, for his experience seemed to show that where there was the smallest consumption there was the greatest waste; in his own town he knew that taps were frequently left running. If it were necessary, the poor could be supplied at a cheap rate per meter, so as to keep them in the same position as at present. Every day it became of greater importance to have a cheap and accurate water meter, and in conclusion he must say that the model referred to as No. 13 seemed the best inferential meter he had seen, though he thought it must be open to the same objection as others of its class. He begged to move a vote of thanks to Mr. Bodkin for his valuable and interesting paper.

The vote having been carried unanimously,

Mr. Bodkin said he regretted that through indisposition, the paper was not nearly so perfect as he had hoped to make it. With regard to the meter which had been referred to as No. 13, he might state that the small power which was required to set it in motion was simply that which was necessary to lift the upper plate of metal, which weighed only a few ounces, and therefore the meter possessed the advantage that water at a low pressure would not pass through it. If there were any head of water at all, however, it would lift the plate, and when lifted it must rotate and register the quantity of water passing. He might add that the stays, which he had stated were placed at the top of the revolving plate, to regulate the action under varying pressures, appeared to answer perfectly, for he had tested the meter at both high and low pressures, and found it perfectly accurate. On this account, therefore, as well as from its simplicity and cheapness, and apparent improbability of its getting out of order, he could recommend it as the best water meter which had come under his notice.

INDIA COMMITTEE.

A Conference was held on Friday evening, January 27th, Hyde Clarke, Esq., Treasurer to the Society, in the chair, when a paper on "Peat and its Profitable Utilisation in Indian Locomotives, and for other purposes," was read by Lieut.-Colonel Romaine Wragge. (See *Journal*, p. 201.) A discussion followed the reading of the paper, which was as follows:—

In answer to questions,

Colonel Wragge said that no alteration whatever was necessary in the wood-burning engines, they would consume peat, and with sufficient ease; but it had been found that the peat could be burnt more economically if a slight alteration were made, and consequently some of the engines had been adapted to its consumption. The cost of the haulage of peat was about three farthings per ton per mile to the railway company. He had calculated that that was what they would charge for coal, and peat would go in about the same space, or rather less. Of course, the company would not charge outsiders at the same rate.

Mr. Macpherson said that he had resided on the Neilgherries for nearly five years, and he thought that the statement that peat was very common there was likely to create an exaggerated idea of the matter. So far from its being common, and occurring almost in every valley, it occurred really in very few valleys. There was only one considerable peat-bog on the eastern side, where he had resided. The peat-bog at Wellington, which was the most accessible to the Madras railways, was unfortunately carried away in the monsoon of 1866, and its disappearance would necessitate their going right over the Neilgherries to Ootacamund. He believed that the cost for carriage alone would be equal to that of the peat. He disagreed with the statement that labour was very abundant on the Neilgherries. There was the greatest possible difficulty in obtaining labour there, and he saw no chance of its being cheaper. He might mention another matter, that there were only three considerable peat-bogs which had ever been worked. One was that of Wellington, which long ago had been abandoned by the government; another was the Segore bog, and that had been washed away long ago.

Colonel Wragge said that it had been lost through want of conservation.

Mr. Macpherson said that the third bog was that belonging to Colonel Morgan, and that also was gone; but long before it disappeared Colonel Morgan thought it wise to make very extensive plantations. That showed the faith which Colonel Morgan had in the peat.

Mr. Austin said he had devoted eighteen years to the subject, and had produced peat in the compact form which he held in his hand, and which was, in the first place, 50 per cent. heavier than coal, and would do three times the work of coal. Under ordinary circumstances, peat would not burn half as long as coal, or at the most, the very best peat that ever could be produced would only burn as long as coal, but the peat which he had prepared, and which was from Ireland, would last three times as long as coal. These balls continued to burn down to a small lump of potash, about the size of a pea. The peat balls were free from dirt and dust, and would burn in a furnace. He had proved that twelve cwt., burning under adverse circumstances, beat twenty cwt. of coal. If it were made in the square form, so great a density could not be obtained. His peat was first produced in the form of a cylinder, and then compressed from that gallipot form into a globe, and it was certain that by his action he produced a greater density than could be obtained in the brick or block form. Another disadvantage of the latter form was that bricks or blocks required handling, whereas a ball would roll to its destination. His object was simply to show that the peat was available in preference to coal. If it were not preferable, let it be dropped at once; but if it were available as an auxiliary and substitute for coal, than the sooner it was adopted the better. Peat was in development all over the world, and there was enough for three hundred years' consumption, but everybody stood looking at the thing. If the proper article were produced, there would be an immense rage for it. The author of the paper had shown that there was in India an immense mass of peat which could be worked. At present, they were paying through the nose for coal and wood in India, and neither of those substances was as effective as peat. The peat did its work without smoke, or smut, or sulphur.

Mr. Dadabhai Naoroji said that he should like to thank Colonel Wragge for being so persevering in prosecuting a subject which appeared to be so good for India. The only point which had occurred to him as calling for remark was the author's quotation of 75s. a-ton for coal in Bombay. He was not aware that coal was so dear. His idea was that it was not more than 50s. a-ton at the utmost. That was its price some years ago, and after the Abyssinian war it came down to 12s. or 15s. That, of course, was abnormal, but he thought that the average price was 40s., or less, for coal in Bombay. As to the general subject of the use of peat, he had not studied it.

Colonel Wragge said that he had taken the price of coal from the railway returns. It was possible that they might be wrong to the extent of a few shillings, but he was not responsible for them.

Mr. Maxwell Turnbull said the author was under the belief that timber was scarce in India. He (Mr. Turnbull) believed they might get it in abundance. All the divisions between the cultivated plots belonging to different ryots could be planted without costing one farthing. In every part of India, wood might be planted. In Bengal, they had talked about planting the date tree, in order to get sugar for nothing. There would be no rent to pay for the plantations, and the trees would form a nice division between the different holdings. If they relied on extensive plantations they could only be made in particular localities. He had a very strong impression that India, like most other parts of the world, was yet in its infancy, singular as that might seem after 120 years of peace. The question of fuel seemed only to be making its appearance. Before the time of the railway he always believed that there was a large quantity of coal. He wished to be informed by Mr. Austin whether the combination which he had produced was one which would apply to any vegetable matters. In India, there were several thousand acres of jungle, which, if they could be turned to account by Mr. Austin's process in the same way as peat, would be most valuable. It had been stated in that room that such jungles were not waste land, and that there were proprietary rights attached to them, although in some of this land there had not been a human foot for a thousand years. He himself knew of a million acres of such waste land. If the ordinary jungles could be utilised by Mr. Austin's plan they would be almost inconceivably valuable.

Mr. Austin said his machines were not adapted for the purpose named.

The Chairman said the subject which they had had before them was certainly of importance, and it had been brought forward in a very moderate way. They had had examples given them of the great value of wood fuel under particular circumstances, and of the resources of India with regard to coal fuel. Mr. Macpherson had given some very useful observations, obtained from local knowledge, but unfortunately he had not been able to give them the whole of the information which was required on the subject. He had been speaking chiefly with regard to the immediate neighbourhood of Ootacamund, and he had told them of the remarkable circumstance of the denudation and washing away of three great peat bogs. If it happened that the moment Colonel Wragge began his operations the whole of the peat-bogs would be washed away, it would be rather idle work for him or any one to engage in the utilisation of peat. He should have been glad if Mr. Saunders, or some geographer, had given them the benefit of his general knowledge on the subject, but he thought that if the meeting reflected upon the matter, they would see that the case could not be quite so hopeless as Mr. Macpherson seemed to imply. Peat bogs were not produced in a moment; they were the growth of a very long period; and if there were any other peat bogs in the Neilgherries they must be produced in the same way. He apprehended that Mr. Macpherson did not deny the whole of the evidence which had been brought before that meeting from several observers, who stated that there were bogs in nearly every portion of the Neilgherries. The question, therefore, related to the possibility of the utilisation of those peat deposits, and those analagous deposits which they might expect to find in other parts of India. He could only regret that ill-health had deprived them of the presence of Dr. Campbell, from whom they would have heard something of the northern hills. He apprehended that the subject was not one which related simply to the Neilgherries, but to every part of the country wherever peat was to be found, and he supposed it was to be found in the northern ranges as well as in the southern, and certainly they had had evidence laid before them that evening to show that peat could be used for a variety of purposes, and particularly for railway engines. The question was not whether peat could compete with coal or wood, or whether an engineer like Mr. Austin had been able to compass all the difficulties of an enterprise like that he had referred to, but it was a question of what was to be done in India where the coal had to be brought to the sea-board, and had to be carried at a very high rate into the interior. Then there arose a question whether it could compete with wood, with peat, or with coal produced on the spot. If, instead of the very great deposits of peat, the existence of which was stated by the authorities from whom Colonel Wragge had quoted, there were only small deposits, still those small deposits would be of very great value if they could only work the branch of railway to the Neilgherries. The development of all kinds of fuel in India was a matter of very great moment for India itself, and for the government of India in its various connections with Indian railways. If English coal were used, then freight, which formed a large portion of the expense, was consumed upon the ocean, but if Indian coal or Indian peat were used, whether it was carried from the north or from the south, the whole of the freight would be spent on the Indian railways, and would, therefore, tend to develop the traffic; consequently, the government of India, as guaranteeing Indian railways, had the greatest interest in throwing on to the Indian railway lines that money for freight which was now spent on the ocean; and the more money that could be spent on the internal development of India the better it would be for India and for this country, which, as had been already said, was so closely connected with Indian interests. Certainly, in some parts of India coal could be got for 15s. or 20s. a ton. The peat had not to compete with coal at a very low price, as in Ireland, but at a very high price. At some places in the interior of India the price of coal, as had been already shown, would be 60s. or 70s. a-ton; therefore there must be a chance for the local material, and it was worth while for the government to use every effort to utilise it. It must be considered a very important part of the office of the Forest Department to look after the conservation of peat bogs, because such bogs might be wasted almost as easily as a forest. A forest might be set on fire and destroyed in a very short space of time, or it might be destroyed in a longer space of time by a wasteful use of it. But even a peat bog, by being manipulated in a wrong way, might be swept away in those high regions either by a monsoon, or a sudden shower, or flood, making an avalanche. A very great and useful public work would be done if the Forest Department of India had charge of the peat-bogs, and, besides that, had their attention directed to the working out of such propositions as had been laid before the meeting by the reader of the paper. The more fuel that could be produced in India from its own resources, the greater the benefit conferred on the agriculture of India, because the question of fuel was, after all, a question of manure. If they burnt wood there were ashes, or other refuse; if they consumed peat, there would always be some ash, which was so far valuable, but there were many parts in India which had no advantages in the growth of timber at all. He thought that his friend, Mr. Turnbull, had been rather thinking of his own presidency in India than of those parts of India which were not so well provided with combustible material, and where it followed, as a matter of course, that what ought to be considered as manure was consumed as fuel. The fuel question and the manure question were virtually connected in India. They had had it very well put before them this evening that this was not solely a railway question, but one of the general extension of supplies of fuel in India. He had not had the advantage himself of being in India, but he recollected with regard to the Beypore iron works, of which the paper contained an account, that some years ago very just hopes were formed of those works being of very great value to India. The ore there was of the best quality, and it was lamentable to think that, for want of fuel, an enterprise of such great value to the country should be lost after all the labour of private individuals, and the anxiety of the government. Then, as to the sugar manufacture, that was of great importance, and ought not to be interfered with through the want of a proper supply of fuel. If they could introduce in any part of India, only to a very small extent, some form of peat, such as had been described in the paper, they would thereby economise other portions of fuel. The whole matter was one of very great importance in its bearings, and it had been laid before them in a practical shape. He hoped that the opportunity which had been given on the present occasion of affording the subject some publicity would be the means of ensuring to the proposer of this measure a greater degree of attention at home and in India than he had hitherto received. There remained to him but one duty, which was to ask the meeting to express their thanks to Colonel Wragge for bringing the subject before them.

Colonel Wragge, in reply to the observations which had been made, said that Mr. Macpherson did not think that peat was so abundant in India as he had stated. He had quoted from many gentlemen who had examined the hills, and who thought it was sufficiently abundant. He had in his possession a list of a hundred bogs, which list he could, if necessary, read to the meeting. Perhaps it would not be out of place for him to state, with reference to the abundance of the bogs, that the authorities themselves, on the spot, allowed that if a tramway were laid to the hills there would be sufficient peat to be of the greatest assistance to the railways for the next ten years, while the forests were growing. That was all that was wanted. The forests would be up by the end of that time if they were planted now. He only wanted to save the great expense of coal while the wood was growing. Mr. Macpherson was diffident as to his estimate of the cost of conveying the peat. He had already said that it would be perfectly ridiculous to entertain the idea of sending it by the Indian Carrying Company, who charged 70s. a ton for 54 miles. Of course, for the conveyance of valuable parcels to residents on the Neilgherry hills, he should take advantage of that mode of transit, as in that case the high freight would be no object. He should, however, have to frame a special transit for peat, and he had found that the prices would not be extravagant. From a detailed estimate he had made of the cost of organising a cart and bullock service between various peat districts and Madras, he could show that peat could be conveyed at about 4·8d. per ton per mile. There would be return freights; but making allowance for time lost on the return up-hill journey, he would put the price down at 6d. per ton per mile. The residents on the hills would effect a large saving by using the peat conveyance for return freights, and the proceeds from this branch of work would cover the whole cost of the transit of the peat. These calculations were based on the first year's cost, which would include the purchase of the oxen and carts. In subsequent years, the cost of transit would, of course, be less. Moreover, he understood that the price at Trichinopoly of ordinary bullocks was less now than when his calculations were made, owing to favourable seasons and a smaller exportation to Ceylon and elsewhere. The opening of the railway may possibly have had something to do with the fall in price, and probably the opening of the line to the Neilgherries would similarly affect the price of cattle there. With regard to the remark offered by Mr. Turnbull, who was of opinion that forests should be planted and jungles utilised, there was no doubt that his argument was a very good and proper one, but as it would take time to do those things, and they had not been done, and there was a demand for fuel, he simply proposed that the peat fuel should be introduced, and used while the wood was growing. With regard to Mr. Naoroji's remark as to the cost of fuel at Bombay not being so high as he had stated it to be, the returns were for the year 1867. It was not an exceptional year, but he had taken the price of that year because that was the time at which he began to work at the subject. Though coal might be cheaper now, it must be remembered that its price would rise when it was found that wood was scarce. At all events, it would be allowed that coal was even now very dear, and that it would be a very great advantage to get a fuel of equal power, weight for weight, at half the cost. There was no doubt about that point.

FOOD COMMITTEE.

The Committee met February 1st, 1871. Present—Messrs. Benjamin Shaw (in the chair), F. A. Abel, F.R.S., Rev. J. E. Hall, Hyde Clarke, Phillips Bevan, and Edward B. Savile, attended by Mr. Jenkins and the Secretary.

Mr. Richard Jones attended to give evidence with regard to his patent method of preserving meat in tins. He described his process as follows:—We put the meat into tins, either with or without bone, in joints or otherwise. The tins are filled quite full, and are soldered up entirely, with the exception of a small tube, about the size of a quill, which is soldered into the top of the tin. The tins are then put into a bath capable of holding 96 6-lb. tins. Along the centre of the bath runs a tube carrying 12 taps, into each of which may be inserted a tube from 8 tins, there being 8 stuffing-boxes to each tap, 4 on each side. The tube communicates with a vacuum chamber. The bath contains a solution of chloride of calcium, which boils at a temperature of from 270° to 280°. In commencing operations, the bath is gradually heated until it gets to about 212°. Communication is then opened with the vacuum chamber, and the result is, that as water boils at about 100°, *in vacuo*, the water is carried off in the shape of steam, into the vacuum chamber, where it is condensed. The tap is then turned, so as to shut off communication with the vacuum chamber, and the meat is then cooked at a high temperature, until complete preservation is effected. We then go on cooking the meat, occasionally turning the taps, just to do what engineers call priming, in order to draw off any fluid that may be in the tins. After it has been thus cooking for about two hours at 250°, it is in a preserved state.

The Chairman—Is it not virtually the same principle as that in ordinary use, only you have a better mechanical application for carrying it out?

Mr. Jones—Only they do not get rid of the air as I do, nor of so much moisture.

The Secretary said he had ascertained that in the process employed at Deptford the weight of the meat put into the tins was not diminished.

Mr. Jones said that in some of the other systems the tins were put into a chloride of calcium bath, with a small pin-hole in the top of each, for the escape of steam, and were kept at a temperature of about 218° outside, so as to ensure 212° in the interior of the meat. After cooking in that way for about four hours, the pin-hole was soldered up, and the heat increased to about 265° outside, so as to get a high temperature in the centre.

The Secretary said Mr. Jones claimed for his system, not that it made the meat keep better, but he accomplished the object in less time, and that the meat turned out more palatable.

Mr. Jones said he believed that, after a little more experience, the character of the meat would depend more on the cooking than on the preserving. At present, his product was rather more cooked than ordinary meat, but still it was far superior to anything of the sort he had seen. When the cook was more accustomed to the work, he believed he would be able so to regulate the apparatus as to turn out the meat in a splendid style. In reply to a question put by one of the members, Mr. Jones said the vacuum was produced by condensation of steam, and was as nearly perfect as possible.

The Chairman said he could understand that getting rid of the moisture would improve the preservation, but he did not see how it would improve the flavour.

Mr. Jones said, in the ordinary process, the flavour of the meat was extracted by boiling it in its own fluid. By his process the meat was done in half the time, because it was done at a higher temperature.

The Secretary remarked that, amongst the many tins he had seen opened, he had always noticed that there was a large amount of gravy and jelly which had come out of the meat; but when that done on Mr. Jones's process was turned out there was little or no jelly, and it appeared as if these were still retained in the meat itself.

Mr. Jones said that the moisture which came off was water only, and not worth 1d. out of 100 tins.

Mr. Jenkins asked if there were any loss of the neutral salts.

Mr. Jones said there was very little loss indeed—infinitesimal almost. The time taken for cooking a 4-lb. tin was two hours—half the time occupied in the other processes. He had not had the meat analysed, to see what was the relative proportions of the different constituents. He had received a note from Dr. Richardson, saying that the meat he had sent him had turned out splendidly. Specimens had been sent to India and Australia.

The Committee then proceeded to taste some meat preserved by Mr. Jones's process.

Mr. Jones, in reply to further inquiries, said that the meat did not require further cooking, but it might be warmed by setting the tin in boiling water for half an hour, first piercing a small hole in the lid. At the present time it was sold at 1s. per pound, but this was for English meat. The apparatus might be arranged that, when sufficiently cooked and preserved, any interstices in the tins might be filled up with water or gravy, as might be desired. The water, therefore, could be removed at the commencement of the process, when it was likely to do harm, and the fluid could be replaced when the cooking was done. He saw no reason why Australian meat, preserved by this process, should be more expensive than that sent over in the ordinary way. It lost about twenty or twenty-five per cent. in weight during the process. Neither McCall's nor Hogarth's process diminished the weight. Meat cooked before a fire lost about 25 per cent. in weight, and therefore, in his opinion, preserved meat ought to do the same. The expense of the apparatus was about £25 per bath. He understood that the Australian company put 8 lbs. of meat into a 6-lb. tin, by evaporating the moisture. There was, of course, no evaporation by the Aberdeen process, but considerable in those processes, when a high temperature is used as in the chloride of calcium process, but it was the practice to make up for this by putting in water at the commencement of the process. This accounted for the jelly found in the tins. He had hoped to have brought some specimens of preserved fish, which had turned out very beautifully, but had been disappointed.

Mr. Savile inquired what was the proportion of water in meat?

Mr. Jones said he believed about 70 per cent., if not more, but it depended a great deal on the feeding. The South American meat was very watery, indeed, one gentleman told him it was like a sponge. The Australian meat was much better fed.

Mr. Phillips Bevan said that before the Committee came to any opinion as to the relative nutritive qualities of the different kinds of preserved meat, it would be desirable to have them analysed.

Mr. Abel suggested that, in order to arrive at any definite conclusion as to the relative merits of different preserving processes, it would be necessary that the test should be applied to the same quality of meat; it should be either all Australian or all English. They had no data before them at present to enable them to judge of the comparative cost at which the meat could be supplied by this process. A chemical analysis would not be so valuable, in his opinion, as a report as to the condition in which the meat appeared, *i.e.*, as to the state of the fibres, of the proximate constituents, &c. A chemical analysis would simply show that there was so much water, so much fibrine, so much fat, and so on; and all these constituents would vary much with the different qualities of meat operated on.

Mr. Hyde Clarke said he had eaten several of these things, which seemed very good at the time, but he found they did not assimilate. But under some circumstances that might be from want of habit.

The Chairman said there was a chemical side and a medical side to this question. There might be all the proper constituents, but they might be combined in such a form as not to be easily digestible.

Mr. Bevan said in some cases there might be deleterious substances introduced in some of the processes.

Mr. Hyde Clarke said that might be so in some circumstances, but apart from that, there was the question of what doctors called tolerance. A Frenchman set down to a good substantial English dinner would not get on well with it, nor could an Englishman get on with a Spanish dinner.

Mr. Bevan proposed a resolution to the effect that it was desirable to have the various specimens of preserved meat analysed, in order to enable them to judge of the comparative merits of the different processes; but after some conversation he withdrew it, and said he would get it done himself for the *Food Journal*, which would answer the same purpose.

Mr. Abel said that, theoretically, Mr. Jones's system seemed almost perfect, as he made use of very efficient means for getting rid of the air, which was the main thing to be kept in view in meat-preserving, especially when it was sent to hot countries. The *rationale* of the process, therefore, seemed excellent, but whether the meat was over-cooked or not would probably depend on the skill and experience brought to bear upon it.

The Chairman asked why it was necessary to cook the meat at all.

Mr. Abel said the destruction of germs, which were now looked upon as the primary cause of decomposition, depended upon the exposure for a considerable time to a high temperature, so that cooking was probably unavoidable.

Mr. Bevan said he had recently had some very fine specimens of preserved meat from the Victoria Meat Company, sent over in boxes and enclosed in fat. This on taking home had been cooked, and turned out excellent in flavour. It was highly appreciated in the kitchen by the servants in the first instance, but when they heard where it came from, then they thought there was a "flavour" with it.

The Secretary asked if the meat he referred to was fresh or salted. He had had some specimens sent him of what he believed was the same meat, and this was salted. It certainly was a good specimen of corned-beef, and very palatable. He had referred to it on the occasion of Mr. Jones's paper, read before the Society on the 25th of last month, when specimens of it were exhibited.

Mr. Bevan said it was the same.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

As already announced, the Council in aid of this object will give six concerts in the Albert Hall, and a guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed is £2,548.

The following gentlemen have since guaranteed the amounts set opposite to their names respectively:—

G. J. Blake	£10
Samuel Davis (Enstow, Oxon)	25
Henry Ludlam	10

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

A subscription of one guinea entitles a member of the Society of Arts to a transferable numbered and reserved seat at each of the six concerts.

The prices to be charged to the public for admission to reserved seats at the concerts will be as follows:—

Arena for one concert	£0	7	0
Or subscription for the six concerts	2	2	0
Balcony for one concert	0	7	0
Or subscription for the six concerts	2	2	0
Amphitheatre for one concert	0	10	6
Or subscription for the six concerts	3	3	0
A box holding five persons for one concert	3	3	0
Or for the six concerts	15	15	0

In letting, preference will be given to a subscription for the six concerts.

Members of the Society of Arts will have the privilege of subscribing for a set of six tickets (transferable), admitting the bearer to a reserved seat, at each of the six concerts, as follows:—

The Arena	£1	1	0
The Balcony	1	1	0
Amphitheatre	2	2	0
Box holding five	10	10	0
Ditto „ for one concert (if vacant)	1	15	0

Special Notice to Members of the Society of Arts.

The price to members subscribing for sets of tickets for the six concerts at the Royal Albert Hall is 1*l.* 1*s.* up to the **15th MARCH**, after which date the price will be 2*l.* 2*s.*; and the above privilege to members can on no account whatever be extended.

OPENING OF THE ALBERT HALL.

Tickets to admit to the ceremonial at the opening of the Royal Albert Hall by the Queen, on the 29th March, can be obtained of Mr. Samuel Thomas Davenport, the financial officer of the Society of Arts:—Arena, 3*l.* 3*s.*; Balcony, 2*l.* 2*s.*; Picture Gallery, 1*l.* 1*s.* each.

CANTOR LECTURES.

The third lecture of the course on "Dyes and Dye-stuffs other than Aniline," by Dr. Crace Calvert, F.R.S., was delivered on Tuesday evening, the 21st inst. The last lecture will be delivered as follows:—

Lecture IV.—Tuesday, February 28th.

Yellow Colouring Substances.—Quercitron-bark—Flavine—Fustic—Persian berries—Annatto.

Black Colouring Substances.—Gall-nuts—Shumac—Divi-divi—Mirabolam—Catechu.

The third course of Cantor Lectures for the Session will be delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will commence on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

INDIA COMMITTEE.

The adjourned meeting on the paper by Mr. Dadabhai Naoroji, on the "Commerce of India," will be held on Friday next, the 3rd of March, at eight o'clock.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

The Exhibition.—Although it is of course impossible at the present time, before the Committees of Selection have completed their work, to enter upon any detailed account of the articles received for exhibition, there is certain general information that may be given, as shewing the likelihood of the forthcoming Exhibition being an approximate, if not an actual, realization of the ideas and hopes of its promoters, Her Majesty's Commissioners for the 1851 Exhibition. It may not be out of place to remind the public of the peculiar features that have been introduced, and which render the Exhibition of 1871 different in very essential and material points from its predecessors. In the first place, these exhibitions are to be annual and permanent, thus giving to industrial art the same opportunity that is afforded to fine art by the annual exhibitions of the Royal Academy. In the second place, by the reducing of the various industries into groups, and taking certain of these each year, the entire industry of the country will be brought under review every seven or eight years, fine art being a standing division of the programme. And, in the third place, by restricting the conditions under which exhibits have hitherto been received, and by making all articles undergo a preliminary sifting, through appointed committees of selection, all works that do not possess sufficient merit to warrant their exhibition will be excluded, as well as mere masses of natural products. Speaking generally, the restriction that has been placed upon intending exhibitors seems so far to have worked with good results; as, so far as can be seen, the exhibits are of high class character, and the senders, with the fear of rejection before their eyes, seem to have been careful to refrain from sending in anything of a very doubtful character. The number of articles received is also indicative of an extensive and complete collection, especially in the manufactures which will form the basis of the exhibition this year, namely, pottery and woollens. In both these manufactures, the whole of the trades connected with them will be represented, with the machines and implements used, and not the least interesting among these latter will be the potter's wheel, which will be shown in motion with potter at work. There is very little doubt, after looking at the articles received, that such an exhibition will take place which will mark an important era in both the manufactures referred to. Certainly, a finer or more complete representation of them has never been got together, and that, whether looking at it from an artistic point of view or from a technical point of view, the exhibition that will open on the first of May will afford the most complete survey of those trades that has yet been made. The Fine Art Section will include a large representation of an art of former days, namely, that of miniature painting, which, in view of a revival of art in this country, will be of exceeding interest. The buildings, and especially the fine art galleries, are most satisfactorily dry, and the means for heating them being now in full operation, any doubt on the subject is set fully at rest. The connection between the present new buildings and the portion of the building of the 1862 Exhibition which has remained, and bounds the Horticultural-gardens on their southern side, is being made. In a few days, the buildings thus united will become one grand and imposing whole. The connection consists of two passages, one leading from the grand entrance, in the Exhibition-road, of the Horticultural Society, and one underground, by which any block of visitors at the entrance will be avoided.

Royal Albert Hall.—A concert will be given to-morrow (Saturday) by the Wandering Minstrels, conducted by the Hon. Seymour Egerton, to the workmen employed by Messrs. Lucas and others in the Royal Albert Hall. This concert is intended to be a pleasant recognition of the individual efforts of each workman in carrying out the work allotted to him, and it will also prove a means of testing the accoustic properties of the hall. Over six thousand tickets have been issued to the *employés*, and a place in the picture gallery has been reserved for the use of subscribers who may desire to be present personally. The demand for tickets for the opening ceremony on the 29th March is very great, and a considerable addition has been made to the body of proprietors. In order to increase the accommodation, an amphitheatre tier of boxes has been erected.

All objects in the following list must be delivered at the Exhibition Building, at the entrances specified, on the days named below:—

		Entrances.
Feb. 25	Copies of pictures, mosaics, enamels, &c.	Prince Albert's-road.
,, 27 ,, 28	Painting not applied to works of utility	Prince Albert's-road.

STEAM BOILER EXPLOSIONS.

The Select Committee appointed to inquire into the cause of steam-boiler explosions, and as to the best means of preventing them, have published the first portion of the evidence received during the sittings which took place in the months of June and July of last year. Not being able satisfactorily to complete their investigations, they recommend that the inquiry should be resumed, and hereafter a complete report will be given of the results, with the opinions arrived at by the members upon this important subject. Of the necessity of this inquiry there can be no doubt. Taking the average of several years, it appears, on an average, that as many as 50 explosions occur every year, killing 75 persons, and injuring at least as many others. On comparing this with the loss of life consequent on railway-travelling, it appears that for every railway passenger killed from circumstances beyond his own control, three persons are killed by boiler explosions. These catastrophes have been so constant that explosions have come to be regarded as an established institution in this country—a sad but inevitable accompaniment to the use of steam.

For the purpose of dealing with this national calamity, certain suggestions were made by the chairman for the guidance of the committee. These were chiefly directed to the question as to whether it was beyond the power of man to avert such a continuance of accident; or whether they were remediable; if so, partially or totally; and what measures could be best adopted to prevent their continuance. In Manchester, a system of periodical inspection of steam boilers has arisen, which has proved adequate to the prevention of these catastrophes, so far as it had been adopted; and were this system followed by every steam-user in the country, explosions might be brought to an end. It was desirable to consider how the plan of periodical inspection could best be rendered general, and so administered that, while it should extinguish explosions on the one hand, it should not prove burdensome or in any way cramping to the steam-user on the other. Various plans had been proposed, and these might be classed under two heads:—First, those which are preventive indirectly; and, secondly, those which are preventive directly. The advocates for the adoption of the former propose that a penalty should be attached to explosion, so that every steam-user that burst his boiler should have to pay a heavy deodand. This, it is thought, would drive steam-users to take precautionary measures, and to enrol themselves with such associations or insurance companies as at present exist, and thus secure, without further legislative interference, the inspection of all the boilers in the country.

Those who recommend directly preventive measures, propose that inspection should be enforced by law in every case, though they vary in their views as to how the inspection should be provided. One plan is that all the boilers in the kingdom should be consigned to the supervision of the Board of Trade. A second plan is, that instead of the inspection being carried out by the Imperial Government from one centre, that it should be carried out by town councils and other local authorities, such authorities appointing their own inspectors. A third plan is, that while no inspection shall be undertaken by the government, either imperial or local, the government should render it an imperative condition, upon the enjoyment of the use of steam, that every boiler owner should have his boiler examined once a year, and certified as safe and trustworthy, the certificate to be granted by such boiler inspectors and insurance companies as at present exist, as well as by others which might spring up in future, and also by any other parties deemed suitable. But in order to secure the integrity of the inspectors, only those authorised by the government are to be allowed to grant certificates, so that the government, while it enforced the general adoption of inspection, would not undertake the duty itself, but instead of inspecting the boilers would overlook the inspectors.

Amongst the witnesses examined was Sir William Fairbairn, and we gather from his evidence that, in consequence of the numerous accidents upon which he had been called to investigate, an association had been formed at his instigation. In the first instance, it was proposed that the millowners and others employed in manufactures should establish themselves into a voluntary society for the protection of property, and the lives of those who worked and lived in the vicinity of boilers and of mills worked by steam. This suggestion was made about the year 1833-4; it was cordially responded to, and an association, strictly on the voluntary principle, with certain rules and regulations, was formed. For a small sum per boiler, the members were not only secured from accidents by the only means applicable to the purpose, but they were guaranteed to the full value of the boiler should an explosion occur. The results have since showed that not a single life has been lost from the commencement to the present time from boilers in charge of the association, which had worked far more satisfactorily than any other insurance company. The evil chiefly arose from want of careful inspection, and had all other companies acted on the same principle, boiler explosions would be almost unknown.

In the opinion of Sir William Fairbairn, the government should be requested to make it compulsory for every person using a boiler to have it regularly inspected by competent authorities, leaving the responsibility of finding such to the owner. That a quarterly inspection should be made of the valves, &c., to see that these were in good working order, and a certificate to be given to that effect, and once a year an inspection should be made both of the exterior and interior; in other words, a thorough inspection of every part of the boiler. All that would be required from the government would be to enact a law that every person having a boiler should be bound to have it inspected by some competent authority—either an association or an insurance company. No unregistered association should be considered competent; and when a boiler had been declined or condemned—what is not the case at present—it should be made imperative that the boiler should cease to be used.

Upon the subject of legislative interference, Capt. R. Robertson, R.N., the Surveyor-general of Steam-vessels under the Board of Trade, was examined, and we learn from the evidence given, that in his estimation all boilers should be inspected once a year, and a certificate given with regard to sufficiency; the inspection to be carried out by competent surveyors, and that local bodies in different parts of the country should appoint inspectors for the locality, subject to the approval of the Board of Trade, or some other public department; that such department should have the power of removing any incompetent person, or for any other cause; they should be appointed in the same way as the boards of guardians appoint medical officers and others, subject to the approval of the Poor-law Board, and as the local marine boards appoint examiners in navigation and others, under the Board of Trade; that is to say, that the different local authorities should ascertain the number of inspectors necessary in their respective districts, and should select proper men and nominate them to the Board of Trade for approval. That every new boiler before it leaves the works of the maker should be inspected by a surveyor, who should examine it under the direction of the Board of Trade, and should see that it is properly constructed, with all the necessary appliances, such as steam-guages, safety-valves, &c. That the owner of the boiler should not be relieved from any responsibility in consequence, because, in event of an accident, the jury would probably take this into consideration in awarding damages. That a fee should be charged upon every survey, which should be paid to the local authorities, and then the Board of Trade, or the local authorities, would pay the inspectors, either by fees or by salaries. Upon an inspection the surveyor should send a declaration of sufficiency, stating the maximum pressure which should be allowed to the boiler. The Board of Trade would keep the register and grant a certificate for twelve months; and in case of any person using a boiler without such a certificate, a penalty of one hundred pounds should be imposed.

We learn, also, from the evidence of Captain Robertson, the details of a system of inspection which he proposes should be adopted by the Board of Trade; that all boilers, in the first place, should be stamped and numbered, so that they might be identified; and that all boiler plates should have the maker's name on them, with the date, and that a register should be kept of every boiler, so that its history could be traced, and if an explosion took place the name of the manufacturer should be known. The rest should be left to local inspectors, but the Board of Trade should send their officers occasionally to see that all was working properly, and to assist also on coroners' inquests and inquiries into accidents. The reason of the few accidents in the marine service (for there have been only six explosions in sixteen years) he attributed as the consequence of government inspection. The very fact of the machinery being thus inspected, caused the owners interested in the matter to take very good care to keep up the efficiency of their boilers. And by means of the organisation at present in operation, the Board of Trade, in connection with the local authorities, were quite competent to undertake the care of the 100,000 boilers which exist in the United Kingdom.

After many similar opinions and suggestions elicited from other witnesses during the investigation, we are not surprised to find the Chairman has sanguine hopes, by the active co-operation of the other members of the Committee, that they shall succeed in ridding the country of the present scourge of boiler explosions, and, at the same time, of aiding the use of steam and the progress of science.

THE RESOURCES OF SZECHUEN.

Amongst the largest, most prosperous, and, at the present time, well-nigh inaccessible of the provinces of China, is that of Szechuen. Some valuable and interesting information respecting the products and hindrances to traffic may be gained from the last of the commercial reports of Her Majesty's Consuls in China. Here, we are informed, is a country producing within itself, at a trifling expenditure of labour or capital, some of the most valuable articles known to commerce. And this circumstance it is which gives to Szechuen and the regions around, which share the same soil and climate, such peculiar advantages.

Perhaps the most important of the products, both now and prospectively, is opium. This drug is grown over a very large area of China, where there seems scarcely any limits to its cultivation. For commercial purposes, however, there are but three descriptions, namely, the growths of Szechuen, Yunnan, and Kweichow. The cultivation is very profitable, and in Szechuen, where the climate is warm, and the season early, at least two crops, and probably three, are taken off the ground annually. Rice may also be grown in the fields where the poppy has been, as the means of damming up and irrigating the arable patches in the hill sides, on which the poppy grows, are always at hand, and the time of sowing the rice corresponds exactly with the time when the opium fields are cleared. Very little labour seems to be needed, and the gathering of the poppy juice becomes the work of the children of the family. The incision in the pod is made in the morning, and in the evening the juice that has oozed out is scraped off into a cup, where it gradually becomes black, and a few days exposed to the sun and air renders it dry enough to be packed. It is well known that the cultivation of opium in China has been forbidden by the Emperor ever since it attracted attention, and has only gained ground extensively in recent years. At the present time, the spread of the habit of opium-smoking seems to be exciting alarm among the wealthy and influential classes of the empire, and we are informed that a reaction has set in since they began by their example to discountenance the use of the drug.

Silk is grown in nearly every district, and in addition to the home consumption, which is very large, enough is provided also for the requirements of other provinces. The recognised centres of the most productive districts are Kea-ting-foo for the white kinds, and Pao-sung-foo for the yellow; both kinds are found together, in different proportions, in many localities. There are certain descriptions which are never sent out of the province. The native consumption must be considerable, as the people are everywhere well-dressed, and wear silk fabrics. The trade in raw silk, in former times, was chiefly with Canton, but since the revolution that has been produced in that place by the opening of the river Yang-tzse, this trade has been diverted to Hankow. The production of silk is apparently susceptible of indefinite extension. The cultivation does not interfere with other crops, as the mulberry-trees grow on the hills, in places not available for ordinary purposes. The long reel renders all Szechuen silk less available for foreign use than it would be if the usual usual length were adhered to; but this is a matter which could be remedied if there were sufficient inducement to do so, though it has been found nearly impossible to effect similar changes in some of the other silk districts. The people complain of the heavy taxes imposed of late years, and assert that the business has been thereby restricted.

The "insect wax" is another article which bears a high marketable value, and is produced at trifling cost. The hasty journey into the neighbouring province of Yunnan every year to procure the insect, includes all that can be called expense or labour in the production. The insect does the rest, and the proprietors are called upon to do little more than take the wax off the tree when it is ready, yet 500,000 taels would probably be a small estimate of the value of this article exported annually from Szechuen. Of the coarser productions, the rice, wheat, and other grain crops supply all the food required by the population, so they need to import nothing under that head. Of minerals, coal is found in abundance, copper, tin, quicksilver, lead, iron, silver, and gold. The country is rich in "ordinary exports," that is, the surplus beyond local requirements, such as the tung-oil, the tobacco, sugar, salt, and hemp, which are exported in large quantities, and would be thought important sources of wealth in any country. Thus, as regards food, the province is self-supporting, and the sale of the surplus of the common articles is sufficient to handsomely remunerate the industry of the people; while over and above all, the resources of the province are increased to an extraordinary degree by its fortuitous production of certain articles of high commercial value, almost peculiar to itself. It, in fact, is endowed with a large fund of ready-made wealth by the mere bounty of nature.

Whether, considering these facts, the trade of Szechuen in foreign manufactures holds the position it ought to do is one of the questions that more especially interests ourselves, who have large dealings with China. It is often said, and apparently with truth, that the demand for woollen goods is a criterion of prosperity in that country. In Szechuen, we find that woollens, as compared with cottons, are more extensively used than in any other part of the empire. Both cottons and woollens are found to be suitable to the wants of the people, and are regularly dealt in. Woollen goods being only used by few, are likely to remain more stationary, but the possible increase in the demand for cotton goods seems in the first instance to be only a question of price. There are certain obvious hindrances to the development of this trade, mostly tending to enhance the cost of goods, the removal of which, if practicable, would be worthy of effort. These are the high rates of freight prevailing between Hankow and Chung-King, the chief port of the province, also the length of time required, and the difficulties of the route. The distance from Hankow to Chung-King is 832 English miles, and the voyage occupies two months. It is attended with great difficulties, to avoid which the more valuable goods are sent by the mountain routes, but that mode of transit is too expensive for general merchandise. Along a portion of the river the upward-bound boats have to be dragged by main force around projecting reefs and isolated rocks, which form "rapids," whilst the downward voyage is still more perilous. Some merchants have calculated that, out of ten boats, seven arrive safely, one is lost, and two are damaged, while in the flood season the casualities amount to fifty in a hundred. The property is sometimes saved in a damaged state, but the more common rule seems to be that the boatmen and trackers make off to the nearest town as soon as a wreck occurs, when the natives come and divide the spoil. Although there may be some exaggerations in these statements, yet there are whole villages, apparently very prosperous, whose populations have no other ostensible means of livelihood.

A population of thirty to forty millions, and taken as a whole, are of the wealthiest in the world, is thus practically shut out, to a great extent, from the commerce of the world. If foreign ingenuity could be permitted to open a road through the 360 miles which divide Ichang, at present the highest limit of navigation, from Ching-King, either by steam, or the river, or by railway, the benefit to the Chinese government and people would be enormous. Traders could then travel freely, and not only would all existing trade be greatly stimulated, but increased intercourse with regions of such varied products would create new wants, and and develop branches of commerce at present unknown. Above all, foreign nations would be introduced to the most promising customers for their goods and probably, no country in the world would so amply repay such an enterprise.

EDUCATIONAL NOTES.

Physical Training and Drill.—In his speech on this subject at one of the meetings of the London School Board, Mr. Hepworth Dixon condemned the mistake of attending to the mind exclusively. He pointed out that, in the days of the Greeks and Romans, physical and mental training each held its own place in education. So long as the great nations of ancient civilisation remained, those two branches of education never were separated, and neither of them was ever unduly subordinate to the other. But in those dark, barbarous times, when the savages of the north and east swept over Europe, these great ideas of education were lost, because nearly all that was precious in ancient civilisation was also lost. He believed that amongst the very first of those who began to note the mistake of leaving physical training out of the system of education, our own countrymen were prominent. One of the first to write upon the subject was Sir Nicholas Bacon, the father of the great Francis Bacon, and the highest authorities afterwards adopted his ideas. John Milton not only coincided with the theory, but formed a specific plan of educating the youth of England by the method of what he called "heroic exercises," including fencing, marching, and the like. It thus appeared that our own countrymen had not been blind to the importance of physical education, though it had since been lost sight of in our great educational centres. And the same idea was handed down to a period within the recollection of men still amongst us. In North Germany, after the terrible political and military disasters which marked the times of the first Napoleon, the neglect of physical training was noticed, and four or five eminent men began to institute, in different parts of Germany, especially in Berlin and Leipzig, schools of physical exercise, and those schools had extended into every part of the Germanic world, including Austria and Switzerland, Scandinavia, and Holland. France, on the other hand, was lamentably deficient in them, and in England they were almost unknown. We had, as a country, certainly fallen into the mistake of subordinating physical to mental training, and had sunk at last into a state of what might almost be described for us, with our natural strength of stock—as physical decrepitude. This was shown by certain returns on the subject from the Horse Guards, from which it appeared that out of every thousand who enlisted the number of men who were rejected was more than one-third. He thought that in setting about the business of training up a new generation into a higher condition for well-being and well-doing, the London Board must begin at the very beginning; they must begin with the training of the physical frame; they must do their best to put the children into that order and condition in which the whole of their life, the whole of their play, would be utilised, so that their boisterous sports, their natural love of fun and riot, should be made, as it were, rhythmical, and conduce to their proper physical growth. In Switzerland, this sort of training began as soon as the child was six years old, and it entailed no material increase in the cost of maintaining the school. The result would be that we should have a disciplined population, and there was no doubt that the children would like the exercise. He was sure there would be no more popular part of the education managed by the School Board than that which would put it into the children's power to go through their play and exercises with a certain heroic cadence.—In connection with this subject may be noted a motion made by Mr. MacGregor, at the meeting of the London Board, on the 15th inst., which included, amongst other points, the importance of providing "playgrounds and facility for exercise," in reference to which Mr. Blanchard Jerrold observes:—"Playgrounds are as much wanted as schools, and without protected play places (a subject I would strongly recommend to the immediate attention of members of School Boards), the morals preached in class will be very much damaged in the open lanes and alleys that are now the only recreation-ground of town children. I maintain that a spacious play-ground should be attached to every school."

Examination of Schools.—The Southern Counties Education Society has transmitted a memorial to the Education Department on this subject, urging that a fair and uniform examination of schools can only be carried out by the scholars of a given age, say 10 years, being examined by papers, and that by the adoption of this system, notwithstanding the increased number of schools, the number of inspectors need not be very largely increased, those now appointed under different commissioners to examine parish schools, workhouse schools, and factories being available. The memorialists recommend that, in the issue and looking over of the papers, a body of retired schoolmasters be employed, which would offer the means of providing for a most deserving class of public servants at an easy rate, and establish uniformity of standard in the examinations, with standard certificate of merit to each school, available for any other arrangement that may be made by future legislation to provide for compulsory education.

The History of National Education.—In the preface to an abstract of the Education Act, which appears in the *School Board Chronicle*, the writer says:—"Education for the lower classes began in schools attached to the monasteries. Next in order of time came the grammar schools, generally accessible even to the poorest, but intended rather to encourage the training of exceptionally clever boys for the service of religion, the State, and learning, than for the education of the masses of the community. The next stage is marked by parochial and other charity school foundations, which, for something like 200 years, monopolised the lower class education of the country, and wrought a very large amount of good. In the first half of the 18th century, about 2,000 charity schools were established in these islands by the Society for the Promotion of Christian Knowledge. The strictly modern period began with the Sunday schools and the Lancastrian system, both of which were in full operation early in the present century. Working out Joseph Lancaster's method, the British and Foreign School Society and the National Society for Educating the Poor occupied the ground, side by side with the old charity foundations, till after the passing of the Reform Bill, when Parliament, which had been strongly moved on the question of national education by Lord Brougham and others, between the close of the Continental war and 1830, began to consider the propriety of granting subsidies from the Imperial exchequer. The first government grant, amounting to £20,000, was made in 1834, and this gift was continued annually till 1839, the money being dispensed till then by the Lords of the Treasury. In 1839, the Committee of the Privy Council on Education was constituted the authority for the distribution of the public money, but until 1846 the use of these funds was limited to the erection of buildings. Since then, grants have been made in aid of the conduct of schools, and the amount has gone on increasing from year to year till, in 1869, it rose to between £800,000 and £900,000, and the total sum of State aid to education, from 1839 to 1869 inclusive, was nearly £13,000,000 sterling. Meanwhile, many National Education Bills had been introduced into Parliament. The first was Lord Brougham's, in 1820. Sir John Pakington introduced one in 1856, and Lord Russell and Mr. Cobden followed with Bills in the course of the same year. Next came the Duke of Marlborough's Bill in 1868, which was the immediate predecessor of the measure finally adopted."

CORRESPONDENCE.

POSTAL REFORM.

The following letter has been received from a very large City firm:—

Before the new regulations came into force we never had any difficulty with the Post-office, as the rules were so simple that no misunderstanding could arise upon them. Since the late changes, however, we have had endless correspondence and trouble with regard to the new arrangements. The principal annoyance has arisen in consequence of the various interpretations of Rule 8 (Book-post, page 11, Postal Guide). We commenced sending our invoices open at the ends, and with a halfpenny stamp attached. Numbers of these were stopped, because the stamp went over the edge of the address-band, and thus fixed it to the invoice. This difficulty we got over, by having the address-band made a size larger than the folded invoice, so that the stamp could *not* get fastened to the contents of the wrapper.

Shortly afterwards, numbers of invoices were returned because the words "per rail," or "per Pickford," was placed at the bottom. The Post-office have since abandoned this objection. Receipts sent in a similar way were passed at first; then stopped; allowed to go again for a halfpenny; stopped again soon.

A similar result took place with statements of accounts. Credit notes, which are bought instead of sold invoices, cannot be sent by book-post.

Notwithstanding this apparently minute supervision, we received communications every day stamped in open defiance of the postal rules, and which have been, nevertheless, passed by the officials. For instance, *bonâ-fide* letters, open at the ends, are continually sent with a halfpenny stamp attached; postal cards are sent with pieces of paper pasted on. Bottles are received by sample-post in such numbers as to show that there is a regular system for forwarding them, though the practice is against the regulations. Our samples though only intended for that purpose, have often a considerable intrinsic value, which is expressly forbidden by the Post-office.

The contradictions of the present system are endless. For instance, samples must not exceed 12 oz. in weight, or 2 ft. in length by 1 ft. in width or depth, while books or papers may weigh 14 lbs., and may be 2 ft. long by 1 ft. in depth or width. Books may be of intrinsic value, samples may not. No card other than one of those issued by government will pass under a halfpenny stamp if it bear on it a written communication of the nature of a letter. A card a foot square may, however, be sent with an attached halfpenny postage stamp if the communication be a circular, or any other written document not of the character of a letter. Receipt stamps may not be affixed to postal cards, but, under a recent regulation, they may be embossed upon them if the cards are handed in singly, and not in sheets, to the Stamp-office at Somerset-house. Paper may be embossed with postage stamps, but a single halfpenny stamp cannot be embossed or printed on any but an address band. Newspapers, in consequence, have to be stamped with adhesive stamps at very great inconvenience, for the postal bands cannot be used to a large extent, because when addresses are changed the stamp cannot be cut out and used again. This last regulation puts a stop to the use of embossed stamps for envelopes, as well as for bands in all large establishments.

Under the new Act, the Post-office has the power of making a monopoly of newspapers, and, while the power is somewhat capriciously used, the Department has its time taken up with perfectly irrelevant work. Utterly meaningless distinctions are made between open packets when they contain newspapers, books, Parliamentary proceedings, or samples. Two ounces of samples cost ½d. for postage; two ounces of letters cost 4d., or eight times as much, and no examination is supposed to be necessary in the latter case as it is in the former.

Such is the present confused condition of our postal regulations, caused by the authorities agreeing to adopt ½d. as the unit of the postal charge, while they were still convinced that the charge ought to begin with a penny.

The greatest public inconvenience of all, the restriction of the packet post to *bonâ-fide* samples, we have not touched upon, as it does not affect us in our business. Nor have we dealt with the absurdly high charges and inelasticity of the Post-office order system, which might be almost indefinitely extended, were the Post-office to throw aside the trammels it has made for itself by its endless refinements and distinctions.

Sir Rowland Hill's postal rules are two, and take up less than a quarter of a page of the "Postal Guide." For newspapers, books, parliamentary proceedings, and samples, over five pages of the same work are required. In short, the Post-office have sacrificed the simplicity with which alone a great system can be economically and well worked, to the desire of maintaining a certain return in revenue. Whether they are right in this view of their duty, or whether the Post-office should be regarded, not as a revenue department, but as a monopoly of written and other communications agreed to by the public in return for the cheapness and speed of the delivery, are broad questions which we need not now discuss.

It will not be fair to conclude this letter without stating that most of the difficulties of interpretation of the new rules have been cleared up, and that their limits are now pretty generally understood. We should also state that the Post-office, differing from all other government departments, keeps up its old readiness to attend to any complaints or suggestions that may be made; and that when an alteration is refused, it appears to be, not from routine motives, but from the feeling that it is a matter of duty to defend the revenue against further encroachments.—We are, &c.

Sir,—The reasons for the application of the halfpenny postage to the envelope proposed by the Society of Arts, are unanswerable; but we venture to suggest that the movement for reform should be carried yet further, with a view to the adoption of a more comprehensive measure, viz., one that, based on sound commercial principles, should not only render unnecessary the halfpenny card, but also finally dispose of all difficulties with respect to the "sample post."

Either it does or it does not pay the Post-office to carry, for a halfpenny, a parcel of a certain weight and size. If it does not, why should there be a differential rate, which, in the case of a packet of samples, is wholly for the benefit of an individual seller and an individual buyer? Is not this the revival, in a new shape, of "protection to industry?" If it does pay, why should the advantages of the halfpenny rate be restricted to samples and printed matter?

It seems to be assumed that if a packet not exceeding two ounces in weight were allowed to be sent through the post for a halfpenny, packets of nearly this weight would form the bulk of those posted. But experience is against this view. Probably nine-tenths, and more, of the trade circulars, applications for votes, and other printed papers so widely distributed in halfpenny wrappers since the 1st October last, have been under one ounce, and even under half an ounce. Traders are well aware that lengthy circulars are never read. And, as regards letters, no doubt the chief portion of these would consist, as at present, of a single sheet of letter or note paper and envelope. Merchants, and even private correspondents, are mostly too busy to write more than is necessary.

The present system of special privileges for certain kinds of parcels necessitates the maintenance by the Post-office of an organised system of espionage, in order to ascertain if the enclosure in a halfpenny cover be really samples or really printed matter. This must involve expenses which would cease to be requisite if differential rates of postage were abolished. The saving in this respect, and in the cost of card and printing, would form, at all events, some set-off against any increased expense occasioned by larger and more numerous parcels.

It may be urged that, as a newspaper when weighing six ounces, or even more, is conveyed for a halfpenny, the halfpenny rate should, on the principles above stated, be extended to parcels of the weight of newspapers. But there exists a substantial ground for an exception in favour of newspapers. In these days of almost universal suffrage, it is of importance to the State that a knowledge of passing events—that is to say, of contemporaneous history—should be widely and rapidly diffused. May not any loss occasioned by the distribution, at a cheap postal charge, of newspapers of all shades of politics be deemed, to a certain extent, a contribution to the education rate?—We are, &c., Rich. Symonds and Son.

3, Ingram-court, Fenchurch-street,
February 22nd.

FIRE INSURANCE.

Sir,—I recently addressed a letter to the editor of the *Insurance Record*, on the subject of losses sustained by insurance companies on agricultural property and produce, specially referring to the increase in the number of fires affecting that class of risk; in connection with which I submitted a statement of 100 consecutive fires, recently arranged by my brother and myself, for various London and provincial offices, with their alleged and assumed origins; but believing it to be a subject of sufficient importance to justify my trespassing on your space, and one the consideration of which should not be limited to the insurance world, I desire, Sir, with your permission, through the medium of your *Journal*, to enlist the attention of those interested in the public weal thereto, as deserving the notice of statesmen, merchants, philanthropists, &c.—presenting, as it does, various features of interest to each—in the hope that the necessity of remedial measures being so apparent, such steps may be taken as may appear best calculated, if not to entirely prevent their recurrence, at least to effect a considerable reduction in their number and proportionate diminution in the amount of loss.

I think that even a cursory inspection of the statement given below will suffice to prove the necessity of devising some plan or organised system of repression, since out of the 100 fires—and those not selected, but taken in the order of their occurrence—to which I have limited at present my examination, no less than 75 may be considered as either wilfully occasioned, or the result of carelessness.

I do not propose to trespass unduly on your columns, or I might, when venturing to invite the attention of your correspondents and readers, observe that a majority of the fires under consideration occur on property protected by insurance, and proceed to inquire to what that circumstance is attributable; but I may be permitted to ask if, in one description of risk, only 25 fires out of 100 are the result of accident or unavoidable causes, what would an inquiry into the subject generally educe? I have, however, little doubt it would tend greatly to confirm the results now presented, and prove the necessity of Parliamentary interference.—

Losses on Farming Stock.

No. of claims.	Cause assigned.	Assessed amount of loss. £	s.	d.	Per-centage of loss.
42	Incendiarism	6,828	9	3	37·04168
18	Matches	2,153	13	5	11·68280
15	Unknown	1,828	4	0	9·91725
9	Sparks................	5,311	15	9	28·81432
5	Hot ashes	922	17	6	5·00622
4	Natural heating........	334	12	0	1·81507
3	Smoking..............	217	13	0	1·18066
2	Defect in flue or chimney	117	13	10	0·63843
1	Lightning	712	10	0	3·86502
1	Gun-wad..............	7	2	0	0·03851
	Total........	18,434	10	9	99·99996

I am averse to suggesting the adoption of any course affecting the liberties of the people, or to add to the burdens (already far too many) of the poorer classes; but, bearing in mind the immense destruction of valuable property, and but too frequently what is of still higher importance, the sacrifice of life from year to year, it behoves, I think, every well-wisher of his country earnestly to take a matter of this kind into serious consideration; and I may, in addition, remark that I have long entertained the opinion, based on the practical experience of several years, that if it was generally known that in every case when a fire occurred a judicial inquiry might follow, to be conducted by an officer specially appointed for that duty, or by the coroner for the district in which it happened, the object in view would be greatly promoted; and I may add that, in 1867, I gave evidence before a Select Committee of the House of Commons on the subject of fire-protection, and among their recommendations, as being pertinent to the subject, I may instance the following extracts from their report:—

"Your Committee, after giving due consideration to this subject, in recommending that an inquiry should take place into every fire, would prefer the police-magistate or coroner to the fire-marshal, mainly because in the courts of those two officers they have a ready-made machinery; and they, such being the case, are averse to the recommendation of the creation of any new offices; and they would recommend the coroner, because the coroner's court is a movable one, and he can constitute his court and conduct the inquiry in the immediate vicinity of the fire, and because till of late he was generally considered to have the power of inquiry into fires, and such power was exercised by some coroners.

"Your Committee would recommend that he should be paid for conducting the inquiry, partly by fees and partly by salary out of the rates. They do not think that the insurance companies should be called upon to pay any part of the expense, as it is not the duty of any private commercial company to prosecute for a public crime, and besides, the fire may take place on property not insured.

"And they would specially recommend that no claim should be settled by any insurance company without a certificate from the police, or fire brigade, or officer appointed to conduct the investigation into the origin of the fire; but this certificate should not debar the insurance offices from opposing the claim if they think proper."

Trusting that the importance of the subject will be deemed a sufficient apology for submitting it to your notice, and believing that if public attention is directed to its consideration, important and practical benefits will ensue.—I am, &c., Francis White.

262, Kennington road, Lambeth, S.E.,
January 21st, 1871.

TRUTH IN ORNAMENTAL ART.

Sir,—The word "truth" used in connection with ornamental art requires some definition. In Dr. Dresser's paper read before the Society, on the 8th inst., its meaning is rendered more mystical than ever in the following passages:—"If it"—ornamental art—"were but invariably truthful in its utterance, we could then reasonably expect that it would prosper, having the sanction of the Most High;" and, "to the ornamentist, I say, and this I do earnestly, that if our art is to prosper and to take hold of the affections of the noble and the pure, if it is to have the sanction of that Being who has given to man the power of producing the beautiful, it must be truthful in its minutest utterance."

Dr. Dresser quoted as instances of falsity in art all imitation marbling, wood graining, &c. Mr. George Augustus Sala, in the subsequent discussion, expressed his doubt that these were falsities of art, and asked, "What is pictorial art but one course of simulation of the grain of marble, of the texture of flesh, of the fluff of velvet, of the sheen of satin, of the texture of leaves and flowers, and everything beautiful in nature, including even the clouds?" And it cannot be said that the covering of the walls of an office with marbled paper is an art-lie, for no one is, nor is expected to be, thereby led to believe that the office is constructed of marble. This, however, refers only to what is not a falsity. But what is truth in ornamental art? Let us first consider what is truth in pictorial art, and see if it will lead us on to a reasonable conclusion.

It is easy to understand that a picture professing to represent the coronation of her Majesty, yet erring in the portraits and costumes, would be wanting in truth, however otherwise artistically executed, just as would a verbal or written description of that event which gave an inaccurate account of the persons present and the styles of their robes, be wanting in truth, however eloquently told. The introduction of any ideality of the artist into such a picture would be a falsity. To be true, it must be purely imitative or reproductive. It professes to represent a page of history, and should do it faithfully.

The effects produced upon the mind by pictorial art and language are similar; the one communicates images through the eye, and the other through the ear. But the imagery of the painting is more rapid and complete. But, when we speak of a purely ideal picture, which professes only to present to the mind a pleasing imaginary scene, we need not inquire, "Did this ever happen in reality." We know it has happened in the brain of the artist, or poet, and on that canvas only. It is a poem or romance uttered in art-language. Here we are content with consistency and the artistic truth of its perspective, its lights and shades, and its harmonies of colour and form, &c. If these are all there, it tells its ideal tale with truth, and is the art utterance of a poem or romance, which might also have been conveyed to the mind by words, like the historical subject.

But art strictly ornamental does not convey to the mind images and emotions which language would equally convey. It may rather be compared in its effect to the emotions produced by music, or tune without song. The sensations are similar. Truth in ornamental art is the accomplishment of its purpose or promise. What is its purpose or promise? It is to produce a pleasant emotion in the mind which is undefinable in words. I am now speaking of purely decorative art distinguished from pictorial art, even as an aid. If any natural objects are introduced, they are so many words mingled with the music.

That is considered to be the truest music which affords the greatest amount of pleasant emotion to the most cultured mind. That also is the truest decoration which produces the greatest amount of pleasant emotion in the most cultured mind. Such power is truth in ornamental art. It is true in the accomplishment of its purpose, as the aim of that arrow is true which reaches its mark. Truth in both music and decorative art is a harmony which the mind reecognises and enjoys. Yet sometimes, when the harmony is there, the enjoyment is marred by prejudice, arising from the adoption of mere fanciful rules and objections. Some feel quite sure that it would be an outrage against the truth of ornamental art to represent a rose, a sunflower, a tulip, and a convolvulus all springing from one root. They would call it untrue because naturally impossible. But true ornamental art is perfectly independent of the laws of botanical nature, being essentially not pictorial, but an arrangement of forms and colours, producing on the mind an art-tune or art-harmony. Those beautiful scrolls from the gates of Ghiberti, which Dr. Dresser and myself used to draw from when we were lads together at Somerset-house, are made to bear the fruit of the vine, the aloe, the castor, and the bread-tree, all from one root; but the result of the treatment is such a delightful harmony, that Michael Angelo declared the gate of which this ornament forms part fit to be the gate of Paradise.

Thus I claim that the evidence of truth in ornamental art is its power to please an unprejudiced, sensitive mind. As to the components of that truthful ornamentation, they are suggested by the genius of the designer; by an intuitive power which cannot be shackled by a set of rules and limitations, for no limit can be conceived to the variety and scope of the expression of beautiful forms and combinations. As in Beethoven's sonatas, even a discord may sometimes be utilised and made to add relish to the harmony. I would also remark, that the use to which ornamental art may be applied to enhance the value of inferior materials cannot affect the question of the truthfulness of the ornamentation itself. I, therefore, differ from Dr. Dresser in the opinion that if the pattern of a Turkey carpet be reproduced on a Brussels carpet, or that of a woven fabric on a printed fabric, the ornamentation becomes a falsity. The truth or falsity involved is not the truth or falsity of the ornamentation.

We must also bear in mind that what is false art to some minds, by failing to please, is true art to other minds in creating respondent pleasure. Thus the standard of truth in ornamental art cannot be compared to that of moral truth, which is defined, universal, and everlasting. The human mind may yet so advance during future ages of culture, that the most successful decorative devices of our time shall generally fail to please, and remain no longer true art, the standard of its truth being advanced to new combinations and treatment, just as a child may be pleased with the sounds from that barrel organ which shall truly torture the cultivated ear.

Yet the learned Doctor appears to attach to his ideal truth of ornamental art even a moral importance, and claims for it the sanction of the Most High—the Most High whose mere provinces are astral systems, with solar clusters for the counties, and worlds for the villages of his empire. It is startling to think of God withholding His sanction from the use of marbled paper or grained wood. The same connexion of the religiousness of the truth of ornamental art is shown in the passage where the decoration of the ceilings of the South Kensington Museum is denounced, and he says:—"Do you not know that whenever art has nationally departed from truthful utterance—when it has sought to deceive, rather than lead the mind upward to the fountain of all truth, that then has come its final overthrow. Pompeian art was false, and Pompeii was destroyed. French art, with all its prettiness, was not truthful, and France has fallen." When Pompeii was so suddenly overwhelmed with the lava and ashes of Vesuvius, was it because of her errors in ornamental art? But surely noble France has not fallen like Pompeii; and, if fallen, not for her sins in the mis-utterance of ornamental art. Let us speak with reverence of the decorative genius of France, and with friendly sympathy of her present sufferings, be assured that she will start up when her day returns, renewed in health, and more glorious than ever.—I am, &c.,

William H. Goss.

Stoke-on-Trent, Feb. 13, 1871.

THEORIES OF COLOUR

Sir,—"Take nothing as true on the authority of others" was a maxim of Descartes. It is well for science that she has inquisitive children, and it is her duty to satisfy rather than snub the most pertinacious. That amateurs in science and art are daily increasing in number is fortunate for England, as it guarantees a future in which both will receive intelligent criticism, and be forced from that tendency to apathy and indolence, to rest and be thankful, which grows upon professors when not exposed to the active inquisition of intelligent but unprofessional thinkers, a curse, as Goethe wisely says, cleaving to standing still.

The following positions may help to remove some vulgar errors respecting the theory of light:—

1. The sensation of light, according to the undulatory theory, is produced by the vibrations of an elastic medium (ether), the various sensations of colour by the different rapidities and wave lengths of that medium (ether). As the medium (ether) is, by supposition, but of one kind, it cannot be of different colours at one and the same time. Therefore, colours cannot be properties of the undulating medium. If colours were the properties of external objects, they would have, besides the undulations they communicate to the elastic medium, to emit colour itself, which is absurd, for then the vibrations would be useless for the offices which theory assigns them.

2. It is generally taught that the spectrum decomposes a beam into its several elements, as it were, which, when reunited, produce the sensation of white light, or whiteness. But it is also said that the red and the green of the spectrum, if combined, will, of themselves, produce the same effect, or white. Therefore the co-operation of all the rays of the spectrum are not necessary to the production of the sensation of white light. The spectrum is not, then, the result of a simple decomposition of a beam, but is composed of a certain number of binary rays in polar opposition, if such an expression may be used, or at least in various *maxima* and *minima* relations, which are the complements of each other, and compensating in their action upon the retina.

3. The spectra of what are commonly called primaries and secondaries, are to a primary a secondary, to a secondary a primary. These spectra, if the experiments be properly conducted, will be

experienced if the eye be closed against all external influences after the first impression of red, green, or any other colour produced by external rays. These after-sensations, therefore, are, in all probability, reactions in the retina, and show that the various sensations of colour may be induced in the eye, independently of any direct vibratory action from without, for they are not the residual components of the first sensations, but their opposites or complementaries. From which we may conclude:—1st. That colour is a phenomenon of our visual organisation. 2nd. That the phenomena of the ocular spectra demonstrate that impressions on the retina require compensation, a complementary or polar opposition, to re-establish a balance, and a binary system of relations similar to that in the spectrum.

The last paragraph in my former letter referred to a class of phenomena called the "ocular spectra," with which painters are more or less familiar, and must not be taken as denying the external existence of complementary rays. I have heard it stated that the rays from the binary stars are complementary.—I am, &c.,

CAVE THOMAS.

February 10, 1871.

SIR,—It appears to me to be quite useless to occupy your valuable columns with a correspondence in which the most simple natural facts are disputed. I had placed the theories I had advocated in these letters on record, in numerous of my art critiques, long before I saw Goethe's adhesion to them. I did not attach any importance to observations of effects of daily occurrence, so self-evident in nature. When I see the first refracted ray of light into darkness producing blue, I come to the conclusion light caused that colour; when the glow of morning and evening spreads inimitable riches of colour over the sky, I know of no other luminary but our source of light as the cause, and no other element than our atmosphere, with its varying densities, as the medium; and, as our atmosphere is darkness without the sun, therefore the first efforts of nature, her first principles and causes of colour, are the product of light and darkness. As a proof of this, take away the density of the morning and evening air, and substitute a pure, thin atmosphere, and all colour will cease. With these remarks I close this correspondence.—I am, &c.,

W. G. HERDMAN.

West-villa, Everton.

MUSIC AND DRILL IN PRIMARY SCHOOLS.

SIR,—In the *Journal* of the 10th inst., Mr. Jones, of the Hibernian School, Liverpool, answers the question, "How can we find time for the teaching of drill and physical exercises to the children of the poor?" by saying that we should hasten the coming of a phonetic system of reading and writing, by paying less attention to what is now regarded as correct spelling, and at once adopting some minor changes, to get rid of the worst absurdities. It has been alleged, and I believe truly, that the general adoption of a phonetic printed and written English alphabet, and a decimal arithmetic, would enable children to acquire the three R's easily and satisfactory in less than one-third of the time which they now spend in learning them incompletely and with difficulty. How best to bring about such a desirable end is a question which must deeply interest all friends of education. It is a practical question which can only be met by a practical answer. Leaving for the present the arithmetical part of the question, I cannot help thinking that the proposal of Mr. Jones and his friends is an undesirable one, in the present absence of all authority which would be recognised on such matters. Mr. Ellis's plan, which he submitted to the Society of Arts in April last, also appears to me (I speak with all the deference due to that gentleman's great attainments) to fail to supply a practical solution of the difficulty. I refer to Mr. Ellis's combinations of ordinary alphabetical letters and signs used by printers to phonetically represent, first, ordinary English, and secondly, dialects and foreign languages. In the existing variety of pronunciation, and the absence of any recognised guide, it seems to me injudicious to introduce further confusion by changing the use of the printed alphabet. But even admitting Mr. Jones and Mr. Ellis's plans to be good, what inducement is held out to ordinary people to adopt them? Can it be said that anyone by adopting them can do his writing in less time than is necessary at present? Increased speed is no serious part of their proposals.

I beg most respectfully to submit to the numerous readers of the *Journal of the Society of Arts*, who must be deeply interested in the question of how to gain such a valuable extension of school life for poor children, the following considerations. Believing that any present alteration in the forms or manipulations of alphabetic printed characters will only diminish the chances of future uniformity, I submit:—

1st. That the printed alphabet, and the mode of spelling in ordinary print should not be disturbed until there is an almost general consensus of opinion on the subject.

2nd. That such a consensus of opinion will be arrived at when, and not before, persons have generally experienced the benefits which follow the use of phonetic writing.

3rd. All persons will not become phonetic writers until you can make some stronger appeal to them than that, by so doing, they will confer a benefit upon posterity.

4th. An appeal that would weigh with all people would be an assurance that they would be able to write their language with more ease, legibility, and exactness than at present, in one-half, or less than one-half the time at present occupied.

The following questions immediately present themselves:—1. Does any known system of phonography (Pitman's, Bell's, or others), enable this to be done? 2. If not, can a system of phonetic writing characters be invented that shall enable it to be done?

The important consequences that would result from an affirmative answer to the latter question, lead me most respectfully to submit it as one worthy of the best attention of a sub-committee of the Society of Arts, who might perhaps recommend the Society to offer a premium to the inventor of the system of characters representing elementary sounds which shall combine, in the greatest degree, legibility, simplicity and elegance of form, and ease of joining.—I am, &c.,

J. B. RUNDELL.

Department of Science and Art,
February 15th, 1871.

PATENT LAWS.

SIR,—Your correspondent, "H. W. Reveley," in your *Journal* of the 23rd ult., comes down rather heavily on me. He says my "fiction of the ideas of an ignorant countryman is too futile to require notice." This is certainly a very easy way of getting over a difficulty. He complains that no one has disproved any of the arguments, &c., brought forward in his letter in page 27 of your *Journal*, for November, 1870. On turning to that letter I find, and give you the following specimen. In his fourth paragraph he says:—"If every production of the human mind were made the subject of patent-right, as would seem to be the drift of its advocates, where would be the benefit to the general public, for it would be in precisely the same position as without any patent-right at all?" Now, a patent represents some decided improvement, some decided advance on what was before, and this Mr. Reveley ought to know. His argument may, therefore, justly be stated thus:—"If every production of the human mind were made the subject of some decided improvement—of some decided advance on what was before—where would, &c., for the public would be in precisely the same position as without any such improvement or advance." This looks like the *reductio ad absurdam*, certainly, for common sense points out that, in such a case, the public, instead of being just as before, would be far in advance of what otherwise it would have been.

Again, in his last paragraph of the same letter, he quotes that old argument about necessity being the mother of invention. As my last dealt with that, and showed wherein it is certainly a fallacy, so many of his said arguments have been dealt with. Even in his present letter, in reference to the same point, he writes in his second pargraph:—"In another letter the same correspondent asserts that the ancient saying, that necessity is the mother of invention, has no force in this case, and that it is only true in reference to first principles. But the myriads of existing appliances of civilised life are not first principles, and were mostly produced thousands of years before patent-right was dreamt of." Now, the first sentence is certainly a distinct admission of what was shown, namely, that, from one point of view, this argument about necessity, &c., has no application whatever to the point in question; and this second sentence is a kind of excuse for still placing the same weight on the argument as before. He further says, in reference to my letter:—"He instanced railway travelling, electric telegraph, electric light, &c., as the produce of the patent laws," &c. Now, if Mr. Reveley will kindly read my letter again, he will find that he has misunderstood it; that my object in referring to these was, not to show that they were the produce of patent laws, but to show that, whatever may have called them into existence, it certainly was not necessity. His other remarks, founded on the same misunderstanding, are all equally inapplicable. But to our more immediate object in view;—and as we go along, perhaps your correspondent may find some of his arguments touched on.

As another illustration of the loose way in which those discuss the matter who would abolish our patent system without substituting any equivalent, take the fact that "there are so many patents which never remunerate the patentees." How often do you find this dragged before the public, and then left there. What is the object in so bringing it forward, or what deduction, if any, it is intended should be drawn therefrom, the public are left to find out for themselves. There must, however, be an object in view, and it very likely is, that because those who advocate a contrary course are compelled to admit this fact with regret. The mind has a tendency to take in the impression, that a fact so brought forward by one side, and admitted with regret by the other, must strengthen the position of those who thus brought it forward; this, however, does not always follow, and it certainly does not in this case. There may be also in view the deduction, that because so many useful inventions are constantly coming forward which never receive any remuneration whatever from patents, even when obtained—as, for instance, the sewing-machine,—the remuneration referred to, never having been received, could never have called the said inventions into existence, as their opponents assert it does and has done, and that, therefore, patents can have nothing to do with the calling of useful ideas into existence; and, as a further sequence, that our system of patents may be safely abolished, not only without any detriment, but with positive gain to the industry of the nation. If such are the objects in view, and it is difficult to think of any others, their fallacy will appear from the following:—Those who thus argue leave out of their calculations what may be considered as the mainspring of all human action, namely, hope, and hope plays a most important part in the matter under consideration. No matter who he may be, or of what sphere of life he may form a unit, or what may be his pursuit, the man, in whatever he does, is encouraged onwards by hope. It may be the hope of earning his daily bread, of meriting distinction, of doing good to his fellows, or simply of enjoying himself, but a hope of some kind (whether ever realised or not does not matter), he will always have before him. It is part of man's very nature to follow hope, and he does so as the shadow follows the substance. Destroy the substance, and the shadow vanishes. Deprive a man of hope in any form—of all hope—and that moment he disappears; he has destroyed himself in a paroxysm of despair. It may, therefore, almost be regarded as an axiom in human nature that man will not labour and work—will not live—unless he has a hope of some kind to encourage him on. The man who spends years in working an idea up to perfection, even though he should never receive a patent nor a reward of any kind, had, it will be found, from the very first a hope of one, and that it was this hope which cheered him on to the last. Had he not been in possession of the hope from the very beginning, he would never have worked the idea out. To this hope of obtaining a patent or a reward, the progress of industrial art during the current century has, undoubtedly, been mainly due, even though the hoped-for reward may never have been received. Any argument, therefore, or any deduction attempted to be drawn from the fact under review, can never have any bearing against a system of patents or rewards. Destroy this last, and you will certainly snap the main-spring of industrial art, the spirit of invention.—I am, &c., H. F. Alexander.

Edinburgh, January 21st, 1871.

Sir,—I had no intention of again noticing this vexed question, but a new correspondent, in Mr. Evan Leigh, has attempted, with colourable arguments, to rebut my assertion that they confer no real benefit to the nation at large.

I never denied the fame and celebrity of a certain description attending the system. Witness a usual form of notice with which we are familiar, viz.:—"Her Majesty the Queen having been graciously pleased to grant Royal Letters Patent to Messrs. Brown, Jones, and Robinson for their improved hair-pin, &c." which shows the desire of the patentees to impress the public with the idea that her Majesty guarantees the great perfection of their invention. Mr. Leigh also appears to have made the discovery that no invention without patent-right, however palpably useful, can be brought out; of course not under the existence of such laws—a discovery that is a self-evident truism; but if no such laws existed, "necessity" would enforce their adoption.

The proof of novelty is not so simple a proceeding as Mr. Leigh wishes to insinuate. The proceedings in Chancery, and the numerous trials a disputed patent has to undergo before the novelty can be settled, affords undeniable proof to the contrary, and the enormous expense of such trials makes them of rare occurrence. I need only refer to two notorious cases, viz., "Bovill's ventilators" and "Brett's capsules." But though few patents are disputed, a very large proportion are abandoned, as anyone may see by running down the weekly patent list; and as for utility, the public is the only judge after the invention is brought out. In the case of it not being adopted, or being superseded by something better, the patent-right becomes a total loss.

I should not have noticed his letter, only he introduces the subject of copyright, a matter I have never touched upon. The education of the people is in every mouth at the present moment, and what is more conducive to that end than beautiful pictures and good books? But copyright renders then utterly inaccessible to that very large portion of the population most in need of enlightenment and good taste. If artists and authors were real friends to the educational movement, they might put high prices upon their productions at their pleasure, but they should simultaneously publish cheap reproductions of their works, when infringement becomes impossible, and copyright, which did not produce the great poets and artists of antiquity or of the middle ages, would become a dead letter. The real fact of the case is that the battle of copyright is fought by the great publishers, just as the battle of patent-right is fought by gentlemen of the law and patent agents, who are the only parties materially interested in the continuance of such laws.—I am, &c., Henry W. Reveley.

Reading.

PREPARED COFFEE-LEAVES.

Sir,—In the very interesting paper on the preservation of vegetables by a cold blast process, read by Mr. Buchanan at the meeting of the Society on the 1st inst., allusion was made to dried coffee-leaves. It was stated that, "if it would be too much of a venture for private parties to expend labour and money in pioneering the way, it is suggested that it might be advisable for government or this Society to offer a prize to the producer or importer of a good sample of leaves cured in a British possession, and suited for trial in the market of Mincing-lane."

Having long ago been impressed with the value of coffee-leaves, properly prepared, as the basis of a cheap, palatable, and even nutritious beverage, I contributed a paper on the subject to the *Food Journal*, which appeared in the first number of that magazine, on 5th February, 1870. On the 11th of the same month, the *Ceylon Times* also printed a communication I sent the editor, of which the following is an extract:—

"In the island of Sumatra, coffee-leaves are roasted over a clean bamboo fire, from which smoke has ceased to arise, until they exhibit a brownish-buff hue. They are then separated from the twigs, the bark of which, after a second roasting, is rubbed off and used along with the leaves. Mr. Ward, who was for many years settled at Padang, in that island, says:—'The natives have a prejudice against the use of water as a beverage, asserting that it does not quench thirst, or afford the strength and support the coffee-leaf does. With a little boiled rice and infusion of the coffee-leaf, a man will support the labours of the field in rice-planting for days and weeks successively, up to the knees in mud, under a burning sun or in drenching rain, which he could not do by the use of simple water, or by the aid of spirituous or fermented liquors. I have had the opportunity of observing for twenty years the comparative effect of the use of the coffee-leaf on one class of natives, and of spirituous liquors on another—the native Sumatrans using the former, and the natives of British India, settled here, the latter; and I find that, while the former expose themselves with impunity to every degree of heat, cold, and wet, the latter can endure neither wet nor cold, for even a short period, without danger to their health.' This authority seems to place the high qualities of coffee-leaves beyond dispute, leading to the justifiable inference that a beverage which suits the peasantry of Sumatra so well could not fail, when once fairly introduced, to become a favourite among the coolies of Ceylon equally with the labouring population of Great Britain and Ireland.

"There is an especial point, however, which ought to be borne in mind by those who intend to prepare coffee-leaves for consumption in Europe—it is this:—The drinkers of China and Assam tea have been accustomed to three methods of preparation, viz., fermentation, partial fermentation, and non-fermentation. The black and red leaf teas, known as Monings and Kaisows, are illustrations of the first; the Pouchongs, Oolongs, and Namunnas, of the second; whilst the green teas are rapidly dried and roasted without undergoing any fermentation at all. It would appear that in tea the essential volatile oil, on which the flavour depends, is developed or considerably increased during fermentation; and although it is known that the distinguishing oil characteristic of coffee exists naturally, there is little doubt but that the quantity might be increased and concentrated by the adoption of a similar process of at least partial fermentation. I would also call the attention of your readers to a mode of packing leaves, which yields good results, and is much cheaper (inasmuch as freight is saved) than the usual plan of filling teas into chests. In China, the leaves so treated are known as "brick tea," a form of the fragrant shrub in use in Mongolia, Tartary, Thibet, Siberia, and Russia, to the extent of over 5,000,000 lbs. weight per annum. It is made in three forms, viz.—Large green, small green, and black bricks, the two former being unfermented. The fabrication is very simple, the leaves being moistened by the application of steam, then compressed in wooden moulds. Protected from the rain and sun, but having a free current of air circulating through and around them, the bricks are piled up in stacks to dry. When quite devoid of moisture each brick is enveloped in paper, thirty-six bricks built into an oblong figure, covered with dry, fragrant leaves, and matted over. Such packages are known as baskets, and weigh about 93 lbs. avoirdupois. Treated in a similar manner, there seems to be no valid reason why coffee-bricks should not be produced, and speedily take their position in the great markets of the world, as affording a beverage at once reasonable in price to consumers and remunerative to planters."

These remarks afterwards found an echo in the *South of India Observer*, and in May last year began to bear fruit. On that occasion, I received from a Ceylon planter two small samples of prepared coffee-leaves, with the request that I should value and report upon them. The following was the result:—

"No. 1. Large, broken, yellowish greenish leaf; rather herby; liquor rich, dark, fragrant, and strong. Worth about 1s. 2d. to 1s. 3d. per pound.

"No. 2. Small, broken, greenish yellowish leaf; leathery flavour; liquor richer, darker, and stronger, and, although fragrant, somewhat herby. Worth about 1s. 3d. per pound.

"The samples were not secured in lead, so that the leaves may have contracted the objectionable leathery and herby flavours by endosmose. Should sheet-lead not be readily obtainable for any future samples, vegetable parchment will do as well. It might be well also to subject the leaves to various degrees of fermentation, besides endeavouring to give them a curl or twist before they are altogether deprived of moisture."

Since this report reached Ceylon, the planter who sent the samples has turned his attention seriously to the best method of producing and curing coffee-leaves, so as to obtain quality and encouraging commercial results, keeping in view the fact that plants cannot be expected to yield simultaneously both leaves and fruit. Some time must necessarily elapse ere an average of his experiments can be pronounced reliable; meanwhile, it would be most desirable to have numerous trials made of leaf-cultivation and preparation in the hot valleys of India and Ceylon, where the coffee-plant yields abundance of leaves rather than fruit. To promote and foster this new branch of industry there could be no greater incentive offered than one of the Society of Arts prizes.—I am, &c.,

William Cochran.

289, Kennington-road, London, February 4th, 1871.

EGG OIL.

Sir,—In your *Journal*, published on Friday, Feb. 3, you have a paragraph from the *Food Journal*, headed "A New Oil." Yolk of egg oil, so far from being a new product, is a very old and well-known one. In the International Exhibition of 1862, the Russian Commission showed it in large quantities and various qualities, the best so fine as to far excel olive oil for cooking purposes; but the less pure and very yellow qualities are chiefly used in the manufacture of the celebrated Kazan soap, which was also exhibited at the same time.

Neither the oil for cooking purposes nor the soap are sufficiently cheap for general use; they are consumed only by the wealthy classes, as luxuries, the soap being regarded chiefly in the light of a cosmetic, and is a much valued addition to a Russian lady's toilet necessaries.

The mode of preparing the oil, as given in the paragraph alluded to, is so different from that which I have been told is the method, and so unlikely in itself, that I think it is also wrong; but as I have not seen it prepared I am not able to contradict it. One thing is certainly wrong about it, and that is the removal of the white part after boiling. The Russians know too well the value of the albumen to waste it in that way. They first remove it from the yolk immediately after breaking the shell of the egg, and then spread it out in thin films on plates, sometimes of metal, and then dry it as quickly as possible, after which it is powdered or broken up into small flakes, and forms an important article of commerce.—I am, &c., Thomas A. Archer.

Edinburgh Museum of Science and Art,
Feb. 9th, 1871.

NARROW CITY STREETS.

Sir,—Many of the short lanes in the City and in provincial towns are only wide enough for one cab, cart, or waggon; but with our want of system, vehicles pour in from both ends, and block quite needlessly.

Let the police authorities put up an arrow or hand (☞) allowing transit only one way, and in the next lane the reverse way, and so throughout the line in and out.

No inconvenience will be caused to anyone, but much time saved.—I am, &c., Hyde Clarke.

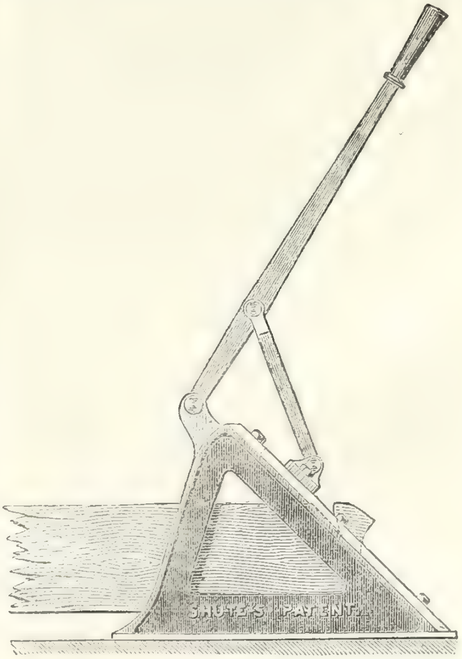
NOTICES OF PUBLICATIONS.

The School Board Chronicle.—The first number of this paper, which is to be published weekly, appeared on the 18th inst. It is to be divided into three portions. The first gives a record of the debates and proceedings of the school boards, especially the London Board. With regard to the second department of the journal, the editor says:—"While holding a neutral and impartial course editorially, we shall introduce into these columns the thoughts and experience of acknowledged authorities upon educational questions. Each writer will be responsible for his opinions, and, in most cases, will sign his contributions. Our contributors will discuss the great questions of the day with a view to a wise distribution of the educational pressure of the age. We have been fortunate in securing the services of eminent authors and scholars, who, acting as interpreters between the various parties on the boards, will suggest new thoughts and new ideas, concentrating in these pages all that is valuable in the experience of the past and the present. The educational work of other nations will be examined and discussed, and the past efforts of educationists in our own country will supply many incidents not unworthy of special note. Germany, Holland, and Switzerland will furnish special examples of elementary training, and France may be wisely studied as affording the best model in the way of art-teaching and technical education. These contributed articles will be supplemented by letters to the editor upon the controversial topics which are already finding expression in the debates of the new Boards. While a firm editorial authority will be exercised in the publication and revision of voluntary letters, a free and liberal licence will be permitted in the discussion of questions and principles affecting the educational progress of the day." The third department of the paper will be a review of educational books, and such other works as may fairly be discussed from an educational point of view. It may be mentioned that the first number contains a careful abstract of the Education Act; lists of the School Boards already elected; a full report of the meeting of the London School Board on the 15th inst.; brief notices of the meetings of the principal provincial Boards; papers and letters by Mr. Hepworth Dixon, Mr. Blanchard Jerrold, Lord Lyttelton, and Mr. J. M. Capes; reviews of several educational works, and a variety of miscellaneous matter bearing on education.

GENERAL NOTES.

The Camphor Tree (*Dryobalanops camphora*) is, according to *Nature*, one of the most interesting and important trees of Sumatra. This camphor attracted the attention of the earliest voyagers, and was then, as it is now, an important article of commerce with China and Japan. the people of those countries attributing to it extraordinary virtues, and paying a high price for it. The tree grows to a height of 100 or 130 feet, and forms a trunk 7 to 10 feet in diameter. The quantity of camphor contained in the trunks is very unequal; the young trees appear to contain little or none. It is said that, on an average, about nine trees are required to produce 100 lbs. weight of crystalised camphor. It is obtained by cutting down the tree and dividing the wood into small pieces, in the divisions of which the camphor is found. It differs in the form of its crystals from the camphor of commerce—is harder, more brittle, and does not so readily condense. Great quantities are used by the Bataks for the preservation of the corpses of their chiefs. The trees are spread over a portion only of Sumatra and Borneo, and generally occur in localities into which commerce and civilisation have as yet but little penetrated. Notwithstanding the continued destruction of the trees, for the sake of procuring the camphor, no means are taken for the future preservation of the species. This camphor is seldom seen in this country, except in museums. The Chinese eagerly buy it in preference to the ordinary camphor—their own produce—which they send in such large quantities into the European markets.

A New Mitreing Machine has been patented Mr. John Shute, 14, Cook's-court, Lincoln's-inn. It consists of a cast-iron frame, which embraces the wood to be mitred. The knife cuts as will be seen by the accompanying block; and as it cuts down, instead of across, and the bottom of the wood or moulding firmly rests on the iron beam, Bolection or relief mouldings can be cut without splintering. The price is three guineas.



Harleian Collection.—Lord Henry Lennox, M.P., Chairman of the Council of the Society of Arts, has been nominated by the Duke of Portland a trustee of the Harleian Collections.

Suez Canal and the South African Coal Trade.—The *Natal Mercury* speaks of this subject as follows:—"Our Indian correspondent, in his last interesting communication, expressed an opinion we have already advanced, namely, that the opening of the Suez Canal would be a gain rather than a detriment to this colony, in so far as the shipment of coal is concerned. It is quite true that the canal has drawn off all steam traffic to the east from round the Cape, and that steamers bound for India will no longer require to coal at any South African port. It is no less true that steamers to and from Suez must coal at Aden, and that the supply of coal at that port will need to be, say, ten times what it has been. If Natal can produce good steam coal, there will be a fair market for exportation to Aden. Indian coal is not suitable for use in steam vessels. Sailing vessels cannot navigate the Red Sea, and as steam vessels could not afford to carry coal such a distance as from England to Aden, that depôt must fall back on eastern sources of supply. There is reason to believe that the consumption of our coals at Aden would be greater than here, were there no canal. Especially would this be the case were the coals prepared here in the form of patent fuel, compressed into square blocks, packed closely, and therefore conveyed at a cheaper rate."

Australian Hops.—Hop-growing in Tasmania is every year increasing in importance as a colonial industry. New Norfolk is, as yet, the principal producing district, and a return, published by the Hop Growers' Association of the colony gives the acreage and produce of this municipality. In this there are returned 57 hop growers, 10 of whom cultivate less than an acre each. One cultivates as much as 70 acres, another 40 acres, and another 35 acres, while several have about a dozen acres under crop. The rapid extension of the cultivation of hops may be seen at a glance. Of the 57 growers, only 19 had plants of three years old and upwards. Three years ago, then, 19 may be taken as the number of hop-growers in New Norfolk, possessing 163¾ acres under cultivation. During the following year, the number was nearly doubled, the return showing 17 owners of plants two years old, whose names do not appear in the list of the previous year, adding to the ground under cultivation 70½ acres, but this did not represent the total addition, those who constituted the 19 having added 57¼ acres. Last year a further addition was made to both the number of hop growers and the acreage, the table showing the names of 11 new growers, with plants of one year old, in addition to those having plants of two and three years and upwards. Thus, while three years ago there were only 19 hop growers, and 163¾ acres under cultivation by them, there were on the 31st day of March last 57 hop growers and 388¾ acres under crop, yielding 105½ tons of hops. Satisfactory, however, as this is, it does not show the extent of the actual increase, which we believe has been considerable. In the Huon district, too, hop-growing has been established, and with the best prospects. There are many other localities equally favourably situated for the cultivation of this crop. The estimated yield of the New Norfolk district in 1866 was 45 tons. In 1867, it had increased to 70 tons. The estimated return in 1868 was calculated in round numbers at 100 tons, and for 1869, 105½ tons. The prices have varied from 1s. to 2s. per pound. There is still room for a large increased consumption of hops, and it will be the hop-growers' own fault if Tasmania do not supply Australia and New Zealand, if not entirely yet mainly. The English or American hop-growers can hardly expect to cope with those of Tasmania, and the present British export of 600 or 700 tons to Australia will, in course of time, cease if the brewers in the colonies can obtain their hops as good and as cheap on the spot.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

March 1.—On "The Patent Laws and their Administration, with suggestions for their Amendment." By A. V. Newton, Esq. On this evening Bernhard Samuelson, M.P., will preside.

March 8.—On "The Cultivation and Uses of Sugar Beet in England." By Dr. Augustus Voelcker, F.R.S. On this evening James Caird, Esq., C.B., will preside.

March 15.—On "The Different Methods of Extracting Sugar from Beet-root and Cane." By Ferdinand Kohn, Esq., C.E.

March 22.—On "Drill, the Complement of the Present School Teaching." By Major General Eardley-Wilmot, R.A. On this evening the Marquis of Westminster will preside.

March 29.—On "The Principles of School Organisation and Instruction, as Advocated by the Society of Arts, and their Bearing on Arts, Manufactures, and Commerce." By the Rev. W. H. Brookfield, M.A.

MEETINGS FOR THE ENSUING WEEK.

Mon. .. Social Science Association, 8. Professor Sheldon Amos, "On the Coolie Laws of Demerara."
Royal Geographical, 8½. 1. Mr. B. Begbie, "On the Benches or Parallel Terraces of River Valleys in British Columbia." 2. Mr. John Ross, "Discoveries West of Cooper's Creek, Australia."
Actuaries, 7. Major-General Hannyngton, "On the use of M. Thomas de Colmar's Arithmometer in Actuarial and other Computations."
Medical, 8.
London Institution, 4. Prof. Huxley, LL.D., F.R.S., "On the First Principles of Biology." (Educational Course.)

Tues. ...**SOCIETY OF ARTS, 8.** Cantor Lectures. Dr. Crace Calvert, F.R.S., "On Dyes and Dye-stuffs other than Aniline."
Royal Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. Hamilton E. Towle, "An Account of the Basin for the Balance Dock, and the Marine Railways in connection therewith, at the Austrian Naval Station at Pola, on the Adriatic."
Anthropological, 8.

Wed. ...**SOCIETY OF ARTS, 8.** Mr. A. V. Newton, on "The Patent Laws and their Administration, with Suggestions for their Amendment."
Pharmaceutical, 8.
Royal Society of Literature, 4¼.
London Institution, 4. Prof. Huxley, LL.D., F.R.S., "On the First Principles of Biology." (Educational Course.)
Obstetrical, 8.

Thurs...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. 1. Rev. S. Mateer, "On the Tamil Names of Plants." 2. Mr. H. P. Pascoe, "Contributions towards a knowledge of the *Curculionidœ.*"
Chemical, 8.
Royal Society Club, 6.
London Institution, 7½. Prof. J. E. Thorold Rogers, "On the Colonial Question."
Society for the Encouragement of Fine Arts, 8. Mr. Hyde Clarke, D.C.L., "Common Elements of Beauty in Race in Georgia, Circassia, the Holy Land, and Britain."

Fri.......**SOCIETY OF ARTS, 8.** Adjourned Discussion on Mr. Dadhabhai Naoroji's paper "On the Commerce of India."
Geologists' Association, 8. 1. Prof. T. Rupert Jones, "On the Range in time of the Foraminifera." 2. Mr. Alfred Bell, "On the English Crags—considered in reference to the Stratigraphical Divisions indicated by their Invertebrate Fauna."
Philological, 8¼.
Royal Institution, 9.
Archæological Institute, 4.
Royal United Service Institution, 3. Lieut.-Colonel E. H. Clive, M.P., "The Franco-Prussian Campaign of 1870, down to the Capitulation of Sedan, September 3rd."

Sat ......Royal United Service Institute, 1. Annual Meeting.
Associated Arts Institute, 8¼. Mr. W. Cave Thomas "Fresco Painting."

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FRIDAY, MARCH 3, 1871.

PROCEEDINGS OF THE SOCIETY.

THIRTEENTH ORDINARY MEETING.

Wednesday, 1st March, 1871; Bernhard Samuelson, Esq., M.P., Member of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Ainsworth, William Francis, Ravensworth-villa, Hammersmith, W.
Beale, John, Conduit-house, East Greenwich, S.E.
Herbart, Rev. T. W., the Vicarage, Southern, Essex.
Hills, Harris, Feering-house, Kelvedon, Essex.
Lee, J. Hutchinson, Balston, Torquay.
Tillyard, Ebenezer, 2, Serjeant's-inn, W.C.

The following candidates were balloted for and duly elected members of the Society:—

Barnett, Samson, jun., Lansdowne-cottage, 316, Essex-road, N.
Burn, Major-General Henry Pelham, 94, Inverness-terrace, Hyde-park, W.
McNiven, C., Perrysfield, Godstone.
Owen, Lieut.-Colonel Charles H., R.A., 27, Common, Woolwich, S.E.
Rooks, George Arthur, 16, King-street, Cheapside, E.C.
Rosenthal, Sigismund, 2, Red Lion-square, W.C.
Smartt, Walter, 11, Poultry, E.C.
Smith, Robert, 52, Downshire-hill, Hampstead, N.W.
Wragge, Lieut.-Colonel Romaine, India-office, S.W.

The Paper read was—

THE PATENT LAWS AND THEIR ADMINISTRATION: WITH SUGGESTIONS FOR THEIR AMENDMENT.

By Mr. A. V. Newton.

In bringing the subject of the patent laws and their administration under discussion at the Society of Arts, I am but renewing an attempt made in the year 1851,* at the Institution of Civil Engineers, viz., to fix public attention on the points to be considered and disposed of, preparatory to the enactment by the Legislature of substantial changes, calculated to meet the reasonable demands of the manufacturing community.

The subject, thus limited, being more than sufficient for one paper, I would gladly have avoided touching upon the policy of creating a legal property in inventions, but the practice that obtains, in discussing the patent laws, seems not merely to warrant, but to demand, a prefatory analysis of the objections which have been urged against remunerating inventors by conferring on them a legal property in their mental labours.

SECTION I.

As it is profitless to deal with generalities, the leading objections raised by gentlemen of eminence opposed to the policy of a patent law will be referred to and examined, recourse being had for my examples to that very useful volume compiled by Mr. Macfie, the member for Leith, into which all the evils, real or imaginary, that have been placed to the account of the patent law, are collected.

All students of Mr. Macfie's volume will allow that what the opponents of patent law realise to themselves as the chief difficulty to the wide acceptance of their deductions, is the close connection between copyright and patent-right, which privileges, according to general belief, must stand or fall together. It has therefore been their first object to distinguish between these two kinds of property, and to show that while the action of one is necessarily to limit the field of mental labour, the other has no such tendency. Whether copyright is or is not akin to patent-right, is, in my judgment, a matter of little moment, for I think that if patent-right cannot stand on its own merits, its analogy to copyright would fail in supporting it.

Perhaps the most formidable assailant of the patent laws is Sir Roundell Palmer, who, from his high legal attainments, and from the fact of his having been (as chief law officer of the crown) engaged in administering the laws, necessarily carries great weight with the public. In seconding a motion of Mr. Macfie, in the House of Commons, in the session of 1869, directed to the abolition of patents for inventions, he is reported to have said that "some persons imagined that there was a sort of natural or moral right in inventors to some such protection as was given by patents, and the principle was sometimes expressed in this way,—that a man had a right to the fruit of his brain. Now, he held that invention and discovery were essentially unlike copyright; copyright applied to a creation." But does not patent-right equally apply to a creation? and, if so, why should one be granted and the other withheld? An extract from a speech of M. Michel Chevalier, in Mr. Macfie's book, will serve to illustrate the similarity of the work undertaken by an inventor and a literateur, He says:—"In the detail treatises on mechanics. physics, and chemistry, in books of technology, with their accompanying illustrations, such as are now published, we find an indefinite quantity of combinations of elementary apparatus, especially of mechanical arrangements, and very often the work of professional patentees consists in searching through these so numerous collections for uses and arrangements which they combine and group." Now, is not this precisely the same kind of work as that performed by the author of "The Book of Praise," and for which Sir Roundell Palmer holds, I presume, a copyright? Sir Roundell Palmer further says:—"He could not allow that the man who was first in the race of discovery could claim for fourteen years or any other term, an exclusive property in a portion of the common stock of knowledge which was accessible to all who used the proper means of discovering it." Now, without questioning the phraseology of this sentence, which implies that knowledge may be hidden or unknown; but taking the expression as explained by the context, it may suffice to reply that the patent law does not confer on the first discoverer of a law of nature an exclusive right to the use or application of that law. This, in the abstract, Sir R. Palmer, as a lawyer, will admit, but possibly with the reservation that the first practical application of a newly discovered law, brought out concurrently with the announcement of the law itself, under the protection of a patent, substantiates the truth of the statement. Experience, however, shows that it requires the labour of many minds to reach such an end as this. Thus, in general, we have first, the experimental philosopher who infers the existence of the law; then, the demonstrator of the law's existence; then, perhaps, the definer of the law's limits; then comes the suggester of the uses which the law may subserve; and lastly, the practical exponent of its uses.

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* See paper intitled "An Inquiry into the Nature of Patent Law Protection, with a view to the Better Appreciation and Security of the Inventor's Rights," published, with the abstract of a three nights' discussion, in the "Transactions of the Institution of Civil Engineers," vol. x., pp. 193 to 219.

The patent law does not touch the discovery until it arrives at the last stage, as witness the course of discovery extending over a century, to which the electric telegraph of Cook and Wheatstone was due; and then, so far from "the facts which lay in Nature itself" being monopolised, the contrivances put forth under the stimulus of the patent law to utilise them are legion. This objection, therefore, of Sir R. Palmer falls to the ground. Equally untenable is that which his experience as an advocate in the courts of law suggested. In speaking of patent trials, he said:—"Everybody was aware that such litigation had acquired a reputation infamous beyond every other." But it may be asked is this a reason why patents should not be granted? If such litigation be "infamous," and I should be the last person to deny it, should not the character of the litigation be changed rather than the ground for the litigation destroyed? But more of this anon.

Without going the length of denouncing patents, Lord Stanley (now the Earl of Derby) when addressing himself to Mr. Macfie's motion, said that the objections which he felt to the principle of patents were threefold: First, "You could hardly ever secure the reward going to the right man." Second, "You could not establish any proportion between the public service rendered, and the value of the reward received nominally for that service." But if we admit, for the sake of argument, the truth of these objections, may they not be answered by the question, "Is there any need to ensure these results?" The motive for the grant of patents is not the apportionment of rewards, but it is thus expressed in the patent itself:—"We being willing to give encouragement to all arts and inventions which may be for the public good." The question therefore is, "Do patents afford the necessary encouragement?" and if they do, that is all the nation is concerned with. It is for the individual to secure, by his prudence, the reward which he has earned by his ingenuity; and it is no matter how great the reward may be which the patent affords, seeing that its extended use, while enlarging the inventor's profits, must, to a corresponding extent, benefit the public, however little comparative merit the invention may exhibit.

The third objection is, "You could not prevent very great inconvenience and injury being inflicted upon third parties." Here his lordship had in mind a race between some half-dozen men, who independently had hit upon the same invention, and who all equally deserved, while but one could secure the patent for that invention. This is but a supposititious case with which the public has no concern; which represents a risk that may or may not be possible, and that is as likely to be met with in any other field of speculative industry.

I do not care to traverse all the ground gone over by Mr. Macfie in his published "Notes" of a speech delivered in the House of Commons, on the motion above referred to; but as he cites the action of the Dutch Legislature with respect to patents, as a strong reason why the British Legislature should declare that, in the words of his motion, "the time has arrived when the interests of trade and commerce, and the progress of the arts and sciences in this country would be promoted by the abolition of patents for inventions," I will attempt to show, from his own book, that the cited case does not apply. In a speech delivered by M. van Zinnicq Bergmann, in the second Chamber of the Netherlands Legislature, on the discussion of the projected law for abolishing patent-right, he is reputed to have said:—"We are continually referred to England and the United States; but what is England? England is a country at the same time emancipated and in course of emancipation. Duly considered, England will be found to be internally in about the same state in which the Netherlands were before 1795, or before the end of the sixteenth century." Thus, according to this enlightened legislator, we have still nearly two centuries of lee-way to fetch up before we attain the position reached by the Netherlands, and are in the blissful condition, without disadvantage to the State, to abolish patents.

With respect to Mr. Macfie's main objection to patents, viz., that through their operation "British and Irish manufacturing pre-eminence is passing away," I do not care to meet it here, as an opportunity was afforded me at the Social Science Congress at Bristol, and again in the preparation of a petition, which was presented to the House of Commons at the end of last session, to show, by reference to the Board of Trade returns, that there was no ground for his complaint, but that, on the contrary, there was incontrovertible evidence to show that our export trade had grown enormously of late years, and was still on the increase.

Before leaving this part of the subject, it may be as well to notice a remark of Sir William Armstrong, in his address delivered as President of the Economy and Trade Department at the Newcastle Congress of the Social Science Association, in September, 1870. Speaking there in his favourite character of an anti-patent man, he said:—"Copyright involves no monopoly of ideas, but patent-right does. The field of authorship is not narrowed by copyright, but the field of invention is." This pithy statement has doubtless gained general acquiescence, but does it really mark a distinction between copyright and patent-right? I think not, and I will attempt to show that, in precisely the same way that patent-right involves a monopoly of the use of an "idea," so does copyright, and that, moreover, for an indefinite period. The "idea" of compiling, for example, such a volume as that well-known book of reference, "Hayden's Dates," is practically held by the publisher of that work under a copyright, the term of which is being constantly extended by the insertion of new matter. It is true that others might produce a rival volume, aiming at the same object, but so also may inventors attain, or seek to attain, by new and different means, like results to those reached by a successful patentee. The copyright, though it did not extend to a monopoly of the idea, effectually prevented for a time its being appropriated, by protecting from appropriation the combination of words embodying the idea, and thus necessitating years of labour in referring to original sources for the production of a similar work. Thus, indirectly, the copyright in this case played precisely the same part as a patent-right; and, although the idea might be, and was ultimately seized upon, yet the time required to appropriate it enabled the original work so effectually to occupy the ground as to bid defiance to subsequent competition. This example will suffice to show that, although, as Sir W. Armstrong truly says, "the field of authorship is not narrowed by copyright," yet the field of an author's remuneration is narrowed by the labours of another author, and that in precisely the same manner as are the labours of one inventor by those of another. And this holds good, more or less, wherever competition is to be found, quite irrespective of legal enactments, resort to which is not unfrequent to mitigate competition, a notable instance being the legal apportionment of certain districts to the several metropolitan gas companies.

Section II.

Having answered, as I trust satisfactorily, the objections raised to the principle of a patent-law protection, I come now to consider the requirements of a patent law, and to ascertain how far these requirements are fulfilled by our existing laws. A patent law should assure to inventors a saleable right to the use of their improvements, and thus enable them to obtain a reasonable remuneration for their labours. This implies not merely the creation of a property recognised by law, but the provision of adequate means for protecting the property so created from spoliation. That property is created by the action of the present laws, notwithstanding their defects, no one will deny, but who will dare to say that it is adequately protected? The wealthy owner, it is true, may maintain his rights, but how is it if a poor patentee is matched against a rich infringer? Moreover, as Mr. Macfie tells us, patentees are "trusted with letters of marque to prey, not on foreign commerce, but on British," and there is some ground for this assertion. Indeed, experience shows that it is absolutely necessary to provide against a great good being converted to evil uses. The cause of these acknowledged defects is now beginning to be admitted by our judges, but we are apparently as far as ever from securing a remedy. Yet the remedy for that state of things, which Sir R. Palmer denounces as "infamous," is of the simplest kind. It is not to be found in the erection of a special tribunal for the trial of patent causes, so often advocated, nor in the reconstruction of existing courts, though these may have their use, but in an official preliminary examination of every complaint of infringement, and likewise of every answer to such complaints, with a view of weeding out groundless actions and keeping asunder the parties to the dispute, or allowing them to go into court only to settle differences on ascertained and definite points. The policy of exercising a controlling power over intending litigants is not such an entire novelty as may, perhaps, be supposed, for under the Scotch Judicature Act, 13, 14 Vic., cap. 36, sec. 38, a somewhat similar process has long been pursued, as will be seen from the following extract, taken from a work by Messrs. Macfarlane and Cleghorn, entitled "Practical Notes on the Structure of Issues in Jury Cases in the Court of Session:"*—"It becomes necessary, therefore, preliminary to going before a jury, to analyse the record, and to review and collate it; to throw aside admitted points, and thus by laying out of view all unnecessary matter, the real question or questions to be tried stand out separately and disencumbered. It may, and does frequently happen, when a case is so analysed, that, contrary to the anticipations and views of both parties, there is truly no relevant matter for trial at all. When this occurs, no issue can of course be granted, the parties being either at once sent out of court, or obliged to amend their pleadings; or it may happen that, the parties being agreed on all the material facts, the hinging point is one purely and entirely of law. Neither in such case is any issue framed for trial by a jury, the discussion being left to be raised by the parties and disposed of by the court on the record as it stands."

Here then, we have a means of controlling the right of action, which lawyers are too apt to consider as the birthright of every British subject; and if this controlling power obtains in Scotland, why should it not be extended to England, more especially if it be limited, as is now suggested, to patent suits, the right to pursue which is at present granted without reserve, and has undoubtedly, in some few instances, been "used as letters of marque to prey on British commerce."

In a paper read before the Social Science Congress at Birmingham, I sketched out a plan, firstly, for subjecting the complaints of intending suitors, and the answers to their complaints, to a searching investigation, with the view of arresting *in limine* factious disputes; and, secondly, for shaping for trial cases possessing matter worthy of the attention of the courts. By reference to a variety of cases, I illustrated the working of the proposed amendments, and showed what an amount of litigation would be avoided, ruinous alike to plaintiff and defendant, both in temper and purse, by empowering an examining officer to bring the parties to a suit to a proper understanding of their respective legal positions, before allowing the suit to be commenced.

This course of proceeding has, from its reasonableness, been approved, in principle, by chambers of commerce, and also by the Patent Laws Committee appointed by the Social Science Association in the year 1866, whose report (drawn up by Mr. Webster, Q.C.) contains the following resolution:—"That no proceedings for the infringement of patents should be commenced, except upon the certificate of a competent examining officer. That the application for such certificate should be founded on a written statement, specifying the part of the invention alleged to have been infringed, and the manner of such infringement, by which statement the plaintiff should be bound in any subsequent proceedings upon the patent." A similar suggestion is made by Dr. Pankhurst, in a very clever and instructive paper which he read before the British Association at their last meeting at Liverpool, for he recommends "that, prior to the institution of proceedings for infringement, the report of an examining officer should be obtained, based upon the statement of the applicant as to the precise nature and extent of the infringement." In the same spirit, the *Times* of April 3rd, 1868, said:—"Perhaps it might be possible to provide some mode whereby causes of action might be brought under judicial cognizance, so to speak, *in ovo*, with a view to procuring an impartial opinion on their *primâ-facie* validity."

It would be tedious to quote the many expressions of opinion which our judges have, of late years, delivered, tending to show the necessity for the adoption of some system of weeding out from the cause list cases that, either from the character of the complaint, or the defence, or from their unprepared state, ought not to be brought into court; but I cannot refrain from giving the following examples:—

Lord Chancellor Westbury, in the course of the famous sewing machine case, "Foxwell *v.* Bostock," said:—"You see how much evidence is thrown away, and how much effort of the counsel becomes useless, unless you first of all determine what is the meaning of the specification." Again, in the case of "Fells *v.* Barnet," Mr. Justice Bramwell observed, that "he wished he had, by law, the power of certifying, in certain cases, that the plaintiff's attorney should pay the costs of the action when wholly unfounded." This may be considered a harsh measure, but it is the learned judge's way of meeting some of the difficulties which a preliminary official examination is intended to remove.

Mr. W. T. S. Danniel gives us the following as the result of his experience as a County Court Judge. He says, "I think that it is a very great advantage, in many cases, to the rightful suitor, that the power and influence of the judge should be brought to bear, at the earliest possible stage, upon the subject of litigation and the conscience of the litigants." If "examiner" be substituted for "judge," we shall find here not merely the principle but the system for which I contend; and its adoption would not only allay much of the enmity existing against patent-rights, by removing the cause therefor, but would be the means of increasing the saleable value of patents, by providing an inexpensive test of their validity.

Section III.

Passing on to that part of the question which relates to the mode of granting patents, I must say that, whatever may be my convictions as to the necessity of the case, I cannot overlook the fact that there is a strong bias of opinion as to the advantages of a preliminary examination before a patent is granted.

On referring to the resolutions of the Patent-laws Committee of the British Association, agreed upon in London in the year 1861 (of which Committee Mr. Macrory, the patent counsel, acted as secretary), I find the following:—"That all applications for grants of letters-patent should be subjected to a preliminary investigation before a special tribunal, and that such tribunal shall have power to decide on the granting of patents, but it shall be open to inventors to renew their application, notwithstanding previous refusal."

In the report already referred to as emanating from a Committee of the Social Science Association, one of the resolutions therein contained is:—"That patents should be granted only after examination and report of competent examining officers as to the novelty of the invention, as to its being the subject-matter for letters-patent, and as to the sufficiency of the provisional specification." Again, Mr. Aston, barrister-at-law, in a paper on the patent-laws, read before an influential meeting at the Manchester Institution of Engineers, in January, 1870, recommends "the exercise of discrimination in granting patents, so as to prevent them from being repeatedly granted for the same invention, and granted for alleged inventions that clearly have no claims to be so considered." So, also, Dr. Pankhurst, in his paper already referred to, suggests that "the grant of a patent should be preceded by an examination by competent examining officers.

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* T. and T. Clarke, Edinburgh; and Benning and Co., London.

I might multiply examples of this kind, but those cited will suffice to show how general is the conviction of the advantage and even necessity for a preliminary investigation. But do they who advise it know how much it involves? Mr. Aston seems prepared to accept the consequences, for he distinctly advocates the adoption of the system now in force in the United States.

It is well that we should understand what machinery is required for securing a preliminary examination before we decide on recommending its adoption. We gather from a speech of the late American Commissioner of Patents* that although he is provided with sixty-two examiners, they are overcrowded with work, and that a force of over three hundred *employés* is maintained in the Washington Patent Office. It is also clear that this staff has gradually reached its present proportions, for it is stated that "in the Patent-office, under the Act of 1836, the commissioner and one examining clerk were thought to be sufficient to do the work of examining into the patentability of the two or three hundred applications that were offered." In his last annual report, the Commissioner says, "Few persons realise the rapid growth of the office and the annual accretion of material. The models increase at the rate of one hundred square feet per week, or five thousand square feet per annum. The drawings increase at the rate of twenty cubic feet per annum; the files at the rate of four hundred cubic feet; the printed specifications at the rate of four hundred and twenty-five cubic feet; the printed drawings at the rate of four hundred cubic feet;" and it is the duty of examiners constantly to probe to the bottom this ever-increasing mass, in order to test the novelty of every application for a patent. Of course, if the English government is willing to accept this duty, neither patentees nor their professional advisers can object; but there is a great, and as I think, an insuperable difficulty in carrying out such an investigation. The means for effecting it do not exist, and they cannot be created by a word. The American Commissioner says that "an examiner should be a man of great patience, industry, and honesty, of varied and yet thorough mechanical and scientific attainments, with a good knowledge of patent law, and a mind capable of the nicest discrimination. Though many men offer themselves for the position, but few are fit to fill it." And again, "An examiner must familiarise himself with all the inventions that have been made in his class, not only in this country but in Europe. Their great number and complexity have rendered the study of them a profession to be acquired by years of labour." This is not an encouraging picture of the requirements for an office to be created, and which, judging from the experience of the Patent-office at Washington, will require the labour of many years to bring to efficiency. If, therefore, an examination is to be adopted, it must be introduced gradually, and at the discretion of a responsible commissioner. This is the only practicable plan; for it is evident that the examiners would have to be educated to their work. Had our Patent-office been conducted under the new law as it should have been, we might, by this time, have possessed some few men qualified for this new duty; but every obstacle that could be created has been employed, as if to frustrate this object. When Mr. Woodcroft was appointed to the office of superintendent of the specifications, he obtained the sanction of the commissioners to publish abridgments of the specifications, and no one connected with the office being found capable of compiling these abridgments, external assistance was sought. At the instance of a friend, professionally qualified for this work, I preferred his request for a subject to abridge for publication, but was met with the reply that the commissioners had ruled that no patent agent should be entrusted with that duty. Some years after, I discovered the key to the seeming mystery, why those who had prepared the original documents were deemed incompetent to abridge them. On examining a publication entitled "The Edmunds Scandal," compiled by Mr. Leonard Edmunds, of Patent-office notoriety, I found (at page 81) the following statement:—"The business of 'abridgments' was a job from the first conception; totally unqualified persons (patent agents, people of no calling or profession whatever) were, in the onset, employed on the work. I very soon made that discovery, and accordingly I insisted that none other than properly-qualified practising barristers, having a knowledge of the Patent-laws, should be employed. I believed I had taken effective measures to that end."

It will be readily understood what the best intentions could effect when they were carried out under the advice of a man of Mr. Edmunds' calibre. That these abridgments are, from their faulty conception and execution, of little use, is a small matter compared to the loss of the opportunity which their preparation afforded of educating men of suitable qualifications for the duties of examiners.

The American commissioner, in speaking of the task of examination, says:—"It would be impossible to make it (the examination) without a careful classification of the subjects of invention." Now this is precisely the thing which inventors have in vain sought for. A complaint of this want in the Patent-office was brought under the notice of the commissioners some four years ago, and it resulted in an order of a somewhat extraordinary character. It had been the practice in the Patent-office to remunerate the gentlemen engaged in making the abridgments at a liberal rate per specification, but the result not having proved entirely satisfactory to the public, the commissioners made an order that, after the 31st December, 1866, every applicant for letters patent should deliver with his provisional specification an abridgment of the same in duplicate. Thus, at last, the duty of preparing abridgments was thrown upon the patent agents, "people of no calling or profession whatever," as Mr. Edmunds called them; but a little fact was forgotten, namely, that the remuneration for this work was not provided for. The consequence has been, as might well be supposed, that the abridgments are worthless; and yet the commissioners have undertaken to publish them *verbatim*, at the expense of the nation, and to adopt them as a substitute for the paid abridgments heretofore issued by the Patent-office.

Preliminary examinations might, I think, at once be commenced, and that with good effect, but they could not be of that thorough character which all, or nearly all, the advocates for that course seem to desire. Thus, many applications which contain no proper subject matter for a patent, might, though the fact were ever so skilfully disguised, be rejected, if all applications were submitted to a competent authority. Even now, something of this kind is effected by the law officer. Thus, when spirit-rapping was in vogue, an application was lodged at the Patent-office, on behalf of an American inventor, for a means of testing the presence of spiritual forms, and rendering the same visible to mortal eyes; but protection for the invention was refused, on the ground that it was not a manufacture within the statute. Thus, we do get something for the payment, out of the Patent Fund, of some ten thousand a-year to the law officers of the crown.

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* Speech delivered before the American Institution, by the Hon. S. S. Fisher, late Commissioner of Patents.

Without going the length of condemning as impracticable the adoption of a thorough preliminary examination, the foregoing considerations will, I think, bear me out in these conclusions, namely:—

1. That preparatory to any attempt to work out this idea, complete analytical indexes must be made by persons fully competent to the task.

2. That considerable time must be allowed for the education of examiners, before the system can be applied.

3. That the cost of the work will be very great, and constantly on the increase, and will exceed the advantages that may be expected to accrue therefrom.

It ought also to be remarked, that if the system which I have suggested, of subjecting to an examiner all patents which are intended to be brought under litigation, were adopted, we should arrive virtually at the same result that would be reached by the preliminary examination of applications for patents, for the novelty and utility would be tested in the most effectual way, namely, by the aid of an alleged infringer, whose interest it would be to point out defects in the patent; and beyond this, the examiner would require to be satisfied as to the sufficiency of the specification before permitting an action to be based upon it. Thus, instead of more than three thousand applications per annum being required to be examined, we should have considerably less than thirty, the cost of examining which would fall upon the litigants instead of on the public, while the invalid patents would remain a dead letter, and be perfectly innocuous by reason of the controlling power of the examiner.

With respect to the cost of preliminary examination, I may state that if that course should be adopted, the Patent Fund will, while maintained by the present scale of fees, be ample to meet all requirements. By reference to a return, ordered by the House of Commons, on the motion of Mr. James Howard, it appears that, up to the end of 1867, there was a surplus of receipts over expenditure, since the commencement of the Act of 1852, amounting to £660,247 15s. 3d., notwithstanding the payment to the law officers and their clerks of £155,175 8s. for their perfunctory duties, and of the payment, in the shape of pension, to the law officers of Ireland and Scotland and their clerks, of £54,189, and this surplus is estimated to increase at the rate of £70,000 per annum.

Section IV.

Although a strong feeling exists in favour of a preliminary examination, there is a diversity of opinion respecting the nature and extent of such examination. Some would limit it to an inquiry into the sufficiency of the provisional specification, and to the invention therein described being a proper subject for a patent. Others would, in addition, extend it to novelty and utility; and others, again, would bring the complete specification under examination, with the view of giving definiteness and precision to the appended claims, thus incidentally withdrawing the privilege peculiar to English patentees, of embodying in the complete specifications the practical experiences of several months of public working.

As an advocate of the last course, we find Mr Aston, in his paper already referred to, suggesting "the deposit, before the patent is granted, of a precise description of the invention and claims given, in a complete specification, which should be submitted to a proper official examination before it is passed as sufficient." This is, in fact, a recurrence to the American practice, with which Mr. Aston says he is practically acquainted.

In proposing this change, I would ask, is Mr. Aston prepared to advise the adoption of the American equivalent for our six months' protection, or does he ignore altogether the claim of an inventor to the consideration shown by our existing law, in allowing practical experiments to precede the deposit of the complete specifications? For my own part, I think that the advantage of delaying the filing of the complete specification is so great and so obvious, that very strong reasons must be advanced, before inventors will consent to forego this privilege.

The substitute provided by the American law may be thus summarised. In the first place, the law recognises a property in an invention so soon as it is embodied in a practical shape, in the same way that our copyright law recognises a property in an unpublished work. In the second place, "caveats," embracing descriptions of unpublished inventions, may be filed in the secret archives of the Patent-office; and all applications for patents made subsequently to the filing of such caveats will be liable to be rejected, if they are found to interfere with these private memoranda. And, in the third place, patents, when granted, may be withdrawn, and re-issued with an amended specification, and claims appended thereto.

These are important privileges, and it is essential that we should understand their action. For this purpose I must again refer to the last annual report of the American Commissioner of Patents. He says:—"It has been held in one case that, upon an application for a re-issue of a patent, new matter might be introduced into the specifications and drawings. In another case, that upon the decision of an application for a new issue, the patent must be dated back to the date of filing (in one case four years), thus making infringers of manufacturers who were using the invention ignorantly during all the time that it was locked up in the secret archives of the office, and while it was impossible for them to know of the existence or character of the claims. In another, that an applicant who had filed an application and withdrawn it eight years before, might re-file it, and obtain a patent for seventeen years from the present date, although the same thing had long since gone into public use, and was incorporated in the mechanism of many subsequent inventions."

Are these new elements of doubt and uncertainty desirable adjuncts to our patent system? Yet it is these elements, as I understand from his paper, that Mr. Aston is willing to accept as a lesser evil than that of allowing patentees to define, on their own responsibility, the limits of their inventions. He complains, and not without reason, that most confused and elastic claims can be made by a patentee, so as to prevent the public from ascertaining what is intended to be claimed. But will an examination like that adopted in the United States afford a better result? I think not. To test this, I open, at hazard, a volume of the American Patent-office Reports, containing the claims of all the patents granted for the year 1859, and the first claim I see is the following:—"The arrangement of the frame A, hopper B, partition N, adjustable slide, M, valve, L, cylinder, H, concave, I, adjustable slide, J, and flexible clasps, K; the whole being constructed and operated as and for the purpose set forth." Now, here is a reference to every essential part of the patented machine; and the claim is evidently what we should, in England, call a combination claim. Does it clear the matter at all to name the several parts to be found in the combination; or would not the claim be as intelligible if put into the English form, as, for example:—"The arrangement of parts, as above set forth, as constituting my improved machine?" The latter specimen is, in my judgment, the clearer of the two. Although grave exception may be taken to some of our specifications, on the score of vagueness, yet, upon the whole, they are far more definite than those of any other country; and yet it appears to me most unjust that a patentee, in making his claims, should have to use some arbitrary formula, as is the case when registering under the Non-ornamental Designs Act, which formula cannot be made to fit all cases. It would seem reasonable that, when the public finds a difficulty in ascertaining the meaning of any public document, resort should be had to those whose business it is to understand and interpret it. If it should be determined to adopt a real preliminary examination of any kind, the executive duties of the Attorney and Solicitor-general, so far as concerns the granting of patents, must necessarily cease. This is a result which all the advocates for a reform of the patent laws appear to desire. The only disadvantage which I think can arise from this change is, that our future judges will be less able to deal with cases of infringement than those who, as law officers, passed a kind of apprenticeship to patent-law duties. I might speak of many changes in the law which require to be made in the event of any new legislation, with a view of cancelling certain injurious provisions unknown to the old law, and of removing some disabilities which have arisen in the working of the new system. But I pass on to matters of more importance.

Section V.

Under the old system of granting patents, oppositions to applications formed an important feature of the business, and it was considered by advocates for a reform that oppositions should be rather facilitated than discouraged, as the public would thereby be able to check the grant of patents which might otherwise injuriously interfere with established manufactures. The duty of hearing and deciding upon oppositions is still retained by the law officers, but their reading of their duties is, under the new law, essentially different from that of the old system. The stage of opposition being after the grant of provisional protection, it followed, as a natural consequence, in the mind of a lawyer, that a strong case must be shown to dispossess the proprietor of his protection. Thus, instead of two persons in possession of a knowledge of the same invention, one an applicant for a patent and the other not, being on the same footing before the law officer, as was formerly the case, he was led to consider that, in the absence of fraud, the applicant for the patent must receive the grant. So also if a patentee, speculating on the possibility or probability of a new application interfering with his rights, opposes that application, and fails to show a similarity of invention, he runs the risk of being mulcted in costs, the act of opposition being considered an unwarrantable interference with a private interest, instead of the vigilant exercise of a public duty. The effect of this practice has been to deter the public from opposing applications for patents, and thus applicants have only to fear the inquisitorial power of the law officers; in other words, the check which formerly existed to the indiscriminate grant of patents has been removed.[*] If preliminary examination, even in its most limited sense, should be adopted, the necessity in great part for oppositions will be removed; but, in cases where they are resorted to, the proper course will be to have them referred to the examiner-in-chief, or head of the Patent-office.

By the Act of 5, 6 William IV., cap. 83, known as Lord Brougham's Act, patentees were allowed to amend defective specifications on the certificate of one of the law officers, by entering a disclaimer to portions of the same, and introducing such amendments as did not extend the scope of the specification. By the same Act, the Judicial Committee of the Privy Council was empowered to examine into the merits of applications for the extension of expiring patents, and recommend to the Crown to extend the same for a term not exceeding seven years. Unfortunately, however, the merits of this law have been greatly circumscribed by the machinery devised for working it, for the administrative power was placed in the hands of men who seem unable, from their education and pursuits, to appreciate the intention of the legislature in passing the Act. Sympathy in the administrators of a new law with the interests of those for whom that law was enacted, is essential to the proper working out of the intentions of the legislature, and that is precisely what has been wanting in this case. The granting of disclaimers, moreover, not only needs the exercise of technical knowledge, to say nothing of a careful consideration of every phrase that it is designed to change, and a patient and intelligent attention to the objections which may be urged against the allowance of the disclaimer. Yet this duty is thrown upon the law officers, who rarely possess any technical knowledge of the subject under discussion, and are, perhaps, the most hard-worked men in the kingdom. It is not surprising, therefore, that in the notable case of Medlock's aniline dye patent a disclaimer was refused (or rather granted upon unacceptable conditions), although the amendment proposed was of a nature contemplated by the Act, and even suggested by the Lord Chancellor, whose decision rendered it necessary. Had the law officer who heard this case been aware of the fact that the Disclaimer Act was intended to prevent an infringer availing himself of an oversight of a patentee to rob him of his rights, such a judgment as that referred to could not have been delivered.

Again, with respect to the extension of patents, the patentee desiring an extension is compelled to go before a tribunal utterly ignorant of the exigencies of trade, and having no sympathy with him or his, unless the petitioner happens to be a poor fellow out of luck, or a disconsolate or poverty-stricken widow. In either of these cases, there is a chance of an extension being granted; but let a thriving manufacturer apply to the Privy Council for an extension of a patent from which he has derived, say, some ten thousand or even five thousand pounds during the fourteen years' working, and, though he may be able to show that the public has benefited to the extent of hundreds of thousands of pounds, he will be pretty certain to have his petition refused. If, however, the tribunal to which such matters are referred were practically acquainted with the labours in which inventors are engaged, if it understood the risks to which they are exposed, and the necessity which frequently exists for forcing an invention upon a reluctant public, the refusal of an extension of a patent would be the exception rather than the rule.

In the United States, when the proofs tendered show a patent to have been exceptionally remunerative, that is, in itself, indirect evidence of the invention being of a character to merit extended protection. But, according to our practice, the chief merit of the patentee, in the eyes of the legal branch of the Privy Council, is (and it is not very surprising) that he has been committed to an enormous expenditure in litigation.

As a contrast to this state of things, we have the fact, that when the late Mr. Elias Howe applied for an extension of his American patent for sewing machines, although his accounts showed a profit of £95,000, he obtained an extension for a period of seven years. This favourable decision was secured by the proof that the invention effected "a saving every year of more than one hundred and three times the amount of all the profits which Howe has ever received."

There is no reason why the same principle should not guide the ruling of the courts in both countries, for the aim of the laws is identical, viz., amply to reward successful inventors; but the standpoint of the two tribunals is different, and will always remain so until the tribunals themselves are assimilated.

In the United States, the duty of considering applications for extensions is imposed on the Commissioner of Patents, who is the controlling power in all matters relating to the grant of patent privileges, and who, therefore, by reason of his wide experience, is enabled to appreciate all the circumstances which may surround and bear upon the several cases submitted to his consideration. Under these circumstances, it is not surprising that some well-defined principles are found to guide the decision of the Commissioner. Thus, for example, in a recent decision (Singer's application for an extension), we find the Commissioner looking carefully to the interests of the public in a direction entirely unknown to our Privy Council, the members of which are ever changing, and are always collected at haphazard.

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[*] The following extract from a decision of a recent law officer will show the spirit in which this important duty is now performed:—"The objection appears to have been taken (there being no evidence before me) entirely upon a supposition that the one (invention) might interfere with the other, and by way of precaution merely In future, when this is done unsuccessfully, it will be right to give costs against the objector. As this is the first case of the kind before me I do not think it will be right to do so.

Mr. Commissioner Fisher, deciding against the Singer petition for extension, makes the following important statement in his judgment, wherein it will be seen that, in adjudicating upon extension cases, he, unlike our Privy Council, perceives a "divided duty":—"The public interest requires that when an article has come into general use, all barriers to its free manufacture and sale should be broken down as speedily as possible, consistently with individual right. If an inventor has produced a good thing, but the public are slow to perceive it, if he is obliged to spend the greater part of his original grant in preparing for its manufacture, in slowly bringing it to the public notice, and in demonstrating its utility, and if it appears that, at the expiration of his first term, if the exclusive right is taken away from him, it is probable that all incentive to further invention is likely to be destroyed, and no one else appears ready to step forward and take his place, it is obvious that the public interests might demand an extension of the patent."

Section VI.

Compulsory licenses have been suggested as an antidote to what have been termed obstructive patents, and with the object of removing a real grievance urged by opponents of patent-right. This proposal has, as might have been expected, met with much opposition, but public opinion is strongly inclining in the direction of controlling the power of patentees to their own advantage. It is not wise to assume, as the law now does, that patentees must necessarily know their own interests and act accordingly; for examples may be cited, although happily but few, where they have not only stood in their own light, but greatly hampered trade transactions by a stolid refusal to grant a right to work under their patents. One such example would be enough to show the need for a change in the law; but the establishment, by statute, of the right of the public to work under every patent on the payment of proper remuneration, would unfetter inventors who, following the lead of an original inventor and patentee, might, through superior advantages, enhance to the public the value of the ideas embodied in the original patent, instead of being driven to shifts, as is often the case, to avoid the ground covered by that patent, or working in uncertainty as to the possibility of bringing into use, during the patent's existence, important improvements thereon.

The difficulty of assessing the value of a license I hold to be rather imaginary than real. On a former occasion, when discussing this question,* I suggested two modes of fixing the rate of royalty to be paid by the licensee. The first was that for an improvement upon an existing manufacture the royalty should not exceed one-third of the pecuniary benefit derivable from the application of the invention. Thus, for example, if by introducing an improvement into a machine the cost of manufacture is reduced, say three pounds, without enhancing the value of the machine when constructed, the royalty payable to the patentee should be one pound. Or if the cost of the machine to manufacture remained the same, but the efficiency was increased to an extent that would command an increased profit on its sale of three or thirty pounds, then the maximum royalty would be either one or ten pounds.

The second plan was that "where a new manufacture is the subject of a patent, and no criterion for forming an estimate such as those above indicated exists, the basis for a settlement of the terms of royalty might be that the licensee shall be able to compete with the patentee in the market, while selling at the latter's fixed price of sale." In such a case the royalty must vary with the rate at which the patentee fixes or maintains the marketable price of his manufacture, the royalty being adjusted so as to ensure to the licensee a fair manufacturing profit, when selling at the patentee's prices.

A controlling power should, I think, be vested in some officer connected with the Patent-office, whose duty it should be (in the event of a patentee and a proposed licensee not coming to terms) to determine, 1st, whether a case has been made out for acquiring a license; 2ndly, whether the time has arrived for granting a license; and, 3rdly, what shall be the royalty within the limits already prescribed. Were such a system adopted as that above indicated, I think no difficulty could arise in the working out of compulsory licenses.

Section VII.

The last subject with which I shall trouble the Society relates to the payment of the periodical stamp duties on patents. It is well known that, by the Act of 1852, patentees are required, in order to keep their patents alive during the term of fourteen years for which they are granted, to pay, at the end of the third year, fifty pounds, and at the end of the seventh year one hundred pounds. These payments are made at the Stamp-office, and a stamp is required to be put on the patent itself, after which the fact of payment has to be recorded in the Patent-office, and a certificate endorsed on the patent itself.

Provision is made that if a patent be lost or destroyed, a duplicate may be obtained on which to place the stamps and the certificates of payment; but there is no provision against the sacrifice of a patent by the non-payment of the duties within the third and seventh year respectively, through oversight or accident, to say nothing of temporary want of means or other cause beyond the control of the patentee. The consequence is, that numbers of valuable patents fall to the ground, and go to swell the number of those which, failing to be renewed from other causes, are constantly referred to as a proof of the mass of useless schemes that are brought under the cognizance of the Patent Law.

A simple remedy would be to allow, as in Belgium, a period of grace within which a patentee, on the payment of a fine, should be allowed to have his patent stamped and certified, and no valid objection could be raised against this arrangement. The only course now open to a patentee is that costly and uncertain one of applying to Parliament for a private Act to revive his expired patent. Several applications of this kind have been made, and three only, as I understand, have been successful. It would surprise many persons to be informed how frequently patents are lost from unintentional neglect to comply with the provisions contained in the grants themselves.

In conclusion let me briefly recapitulate the deductions drawn from the foregoing arguments.

Recapitulation.

1. The objections raised by leading opponents of the principle and action of the Patent-laws having been examined prove to be groundless or untenable.

2. By subjecting all allegations of infringement of a patent, and all answers made to such allegations to an examining officer for the investigation of their merits, with the view of determining whether any, and, if so, what questions should be submitted to the judgment of a court of law, litigation would be diminished, and the value of patent property would consequently be enhanced.

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* See pamphlet entitled "The Operation of the Patent Laws, with Suggestions for their better Administration." Trubner and Co. 1861.

3. The preliminary examination of applications for patents generally demanded would be costly, and the means for effecting it have yet to be created.

4. The principle of an official examination, if adopted, should be limited to the provisional specifications, and the responsibility of providing a satisfactory complete specification should rest, as at present, with the patentee.

5. The law officers and the Judicial Committee of the Privy Council should be relieved of their respective duties of granting certificates of disclaimers, and of advising the Crown with regard to the extension of patents.

6. A system of compulsory licenses should be adopted in the interest both of patentees and the public.

7. For the payment of the periodical stamp duties on patents, if these are retained, grace should be allowed, a fine in lieu of the sacrifice of the patent being imposed, to ensure prompt payment.

DISCUSSION.

Mr. Fordred said he thought the complaints against the patent law might be divided under two heads. First, the amendment of the law itself, which all inventors admitted to be necessary, and secondly, the application of the law by the commissioners. He had an abstract of the annual surplus which had been paid over to the Consolidated Fund since 1862, which amounted to £577,000; and in the last two years over £60,000 had been paid over out of the pockets of patentees. The public would hardly believe, under such circumstances, that at the Patent-office they had neither got a clock, a piece of matting to deaden the sound of the tread, nor an index to the library. With regard to sending printed copies of specifications to foreign countries, he believed that the general effect was, that those printed copies were used against patentees in those countries. He had a case of that kind at the present time in the United States. Mr. Newton had referred to the question of the abridgments which inventors were compelled to furnish with their specifications, and seemed to think that they were intended to relieve the duties of the Patent-office. He thought they were meant to furnish the compilers of those abridgments with the idea of the patent, and was afraid that some day they might be turned against the inventor, if in his specification he had travelled beyond that which was met with in the abridgment. In fact, it was a preliminary statement of his claim. Every patentee would agree with him that, in filing provisional specifications, it was very difficult to state what the claim was, because at that time it was not known. One thing which deserved attention was that some restriction should be put upon the word "patent." It was attempted to be dealt with by one of the Acts of George IV., but had entirely failed through the miswording of a clause. He thought the word "patent" should be limited to patents actually in existence, and when a patent had expired it should be so stated.

Mr. F. W. Campin said a patent seemed to be regarded as a favour instead of a right. There was a notion in many people's minds that it was just a piece of favouritism, and not like other proprietary rights. With regard to whether we should have patents or not, it was too abstract a question to be settled off-hand. When it was said that all contested questions should be submitted to an examiner previous to their coming before a court of law, he thought that course might be open to very grave objections, especially if the examiner were to sit in his chambers without having public opinion brought to bear upon him. That was one of the great objections to such questions being now dealt with by the law officers. The first object the Attorney-General had to decide was whether there was any foundation for a supposed infringement. He quite agreed that opposition should be rendered more *bonâ-fide*, and be based on some substantial idea that there was something to be opposed. The whole system wanted revision. He thought they ought to establish a Patent Court, just as they had courts with regard to probates of wills, the administration of estates, and the Admiralty Court. With regard to the surplus fund, it should be borne in mind that one charge on a patent was the stamp duty, which went to the inland revenue.

Colonel Scott drew attention to various improvements he had made and suggested in the manufacture and treatment of cement, terra-cotta, and sewage matter. He referred to the impediments he had met with, arising from the prejudices of workmen, and, in one instance, of an eminent chemist, owing to which the public had been deprived of solid advantages which they would otherwise have obtained. He showed also how some patents of his had lapsed, and how persons with the necessary time, knowledge, and money, might have made use of them, and thus have secured benefits which by right belonged to himself. He was decidedly of opinion that the present state of the Patent-law was unsatisfactory, and needed amendment.

Mr. F. Hill said that he had laboured on the same committee of the Law Amendment Society with Mr. Newton, and it was, perhaps, not surprising that he agreed almost entirely with the paper which had been read. But there was a part of the committee's report to which Mr. Newton had not referred, which was, whether, affirming as they did that the principle of the Patent Law was right and just, it was not possible to devise another mode of rewarding inventors for their labour and expense, without having evils which certainly attached to the present law of patents. He thought the most strenuous advocate of the Patent-law must admit that, after all, it was but a balance of advantage, and Sir Roundell Palmer and Mr. Macfie, who objected to the Patent-law, were not wholly without a case. Instead of arming inventors with the powers of the law to defend their patent, which might entail upon them very great expense and anxiety, there should be a small court of examination, and that the patentee should make out the validity and value of his invention; then that the court, if they thought fit, might reward the inventor for his labours, and at the end of a given period the inventor might come again and bring with him persons conversant with the trade which had been affected by the invention, to show how far a particular article had been improved in quality or diminished in price, and according to the conclusion arrived at would be the reward given. If that plan were adopted, of course they must proceed with caution. But it had the advantage that, instead of the inventor being harassed by fears that others would adopt his plans, he was interested in diffusing a knowledge of his invention to the greatest possible extent, because by so doing his title to reward would be improved. It was proposed in the first instance that the fund at the disposal of this tribunal should be limited to the money which was contributed by the patentees themselves, which, as they had heard, yielded now £60,000 or £70,000 a-year. Anyone who was familiar at all with the lives of inventors, would be aware how much they were harassed in defending their inventions, and he need only refer to the cases of James Watt and Professor Wheatstone.

Mr. Walter Hancock said he believed one of the most monstrous absurdities in the present state of the law was, that a subject had only to go to the Crown, and say he was in possession of an invention, and demand, as matter of right, a grant for fourteen years of the monopoly of the invention; and he considered himself seriously aggrieved if the Crown, in the exercise of its discretion, did not consider the invention of sufficient value to confer the grant of such a monopoly. He had no sympathy with those, although their authority was very high, who advocated the total repeal of the Patent-laws, because he did not see any other course or plan by which, in a commercial country like England, the inventor could be rewarded according to the money-value of his invention. If he fixed his price too high, if the public could get the article for a sum immeasurably lower, they would wait till the patent ran out. There were three classes of inventors, or rather three types of men to be construed. The true inventor was usually a thoroughly honest man, and he wished to get a monopoly of his invention because he believed it to be good and sound. Then there was the speculative inventor, who rushed to the Patent-office with some idea that he might have picked up, without making it out at all, and if he had a patent, he derived as much value as the man who had spent over his invention ten or fifteen years of his life. Then, again, there were the traders, who took out patents to shut out their rivals; and one point he thought of vast importance was that there should be really a *bonâ-fide* examination before a grant was made. The theory of the law was, that there was such an examination. Every applicant for a patent was referred to one of the law officers of the crown, who was paid for doing what it was utterly impossible he could do, because, as a rule, he had not the technical and scientific knowledge necessary to enable him to say whether the invention was really new. At the British Association meeting, in Manchester, the matter was discussed very fully, and it was agreed that the only inquiry should be an investigation into the novelty of the invention, and not into the merits or utility of it. He did not think the difficulties of a preliminary examination were so great as Mr. Newton supposed, upon the score of cost, but he believed it must be done if they were to have the Patent-laws properly administered. They had a surplus fund of £60,000 or £70,000 every year, which clearly ought to be devoted to the proper administration of the Patent-law, because it was derived from patentees. A *bonâ-fide* honest inventor would be desirous to have such an investigation, because he would prefer being told at once that an invention had been taken out before, and that his supposed invention was not novel. Then he would refer to the fact that an enormous number of patents were taken out for the self-same object, and upon this subject he referred to vulcanised india-rubber and stranded copper wire for telegraphs.

Mr. W. A. Gilbee considered that the present law wanted amendment. He would not only adopt preliminary examination, but would also suggest an enactment from the French law, with a view to avoid multiplicity of patents. He desired to suggest that a short Act should be passed so as to allow French inventors, prevented by the war from completing their patents, to renew their application. The French Government had done as much for us.

Mr. Thomas Webster, Q.C., proposed a vote of thanks to Mr. Newton for his able paper. He thought it right the meeting should know that Mr. Newton had been for nearly 30 years the unvarying advocate substantially of the system put forth in the paper. In 1850 and 1851, Mr. Newton was about the only person engaged as a patent agent who had the courage to come forward and condemn the existing system, and from that time to the present he had advocated the amendment of the law. Upon the subject of examiners, he (Mr. Webster) thought they were agreed that some examination should take place, but not to the extent it was carried on in America. He believed that if in England we erred in doing nothing, in America they erred in doing too much. But there was an intermediate course of examining provisional specifications, which would have the effect of warning inventors, and reduce by at least two-thirds the applications for patents, with the consent of the inventors themselves, who, owing to the non-administration of the Patent Act of 1851, had no means of obtaining the necessary information. He had paid considerable attention to the subject, and believed that the Act of 1851 contained a power, if properly administered, of doing almost every thing that every body had advocated. If the law officers were aided in the way in which it was intended, they should be, by Lord Granville's Act, which was lost at the end of the session for want of time, and the intention of which was not carried out by the Act of 1852, nine-tenths of the grievances they now heard of would be put an end to. He thought the intervention of the law officers was a good system, because, after a preliminary examination, a mind was wanted to bear upon conflicting rights, and therefore, assuming the theory of granting patents was right, he thought they should not create a power of property and a power of litigation in every individual who might think it right to make application. He did not think it would be right to have a Patent Court, as had been suggested, nor did he think the analogy held good between a Patent Court and a Court of Probate, or a Court of Admiralty. Those courts dealt with existing rights or wrongs, whereas a Patent Court, as suggested, would have to deal with property created by the will of an individual.

Mr. Lloyd Wise seconded the resolution, and said that as it was so late an hour he would communicate a letter on the subject to the *Journal*.

The Chairman, in putting the resolution to the meeting, said he felt himself somewhat embarrassed in expressing fully his opinion upon the subject of Mr. Newton's paper, inasmuch as he had given notice himself to move for a committee in the House of Commons to inquire into the law and practice of patents, and that motion would come on in a week's time. Mr. Fordred had alluded to the vagueness of the objections which were raised. He could not agree entirely with that. He did not think the statements of the opponents of patents were vague; but the question arose whether those statements, granting them to be true, were not merely objections to the existing law of patents and its administration. An abuse was brought forward, and on the strength of that abuse patents were condemned *in toto*, and that was a distinction which any tribunal to which the future existence or abolition of patents might be referred ought very seriously to bear in mind. With regard to what fell from Colonel Scott, he could only regret that he did not sum up what he said by telling the meeting the moral of his remarks. His own reading of them was the advice to intending patentees which *Punch* gave to parties about to marry—"Don't." He would allude to the consistency with which Mr. Hill, Mr. Webster, and Mr. Newton had all adhered to their views, which they had now entertained for something like 25 years. He thought that consistency testified largely to the soundness of the views entertained by gentlemen of enlarged experience, because they found that, with their prolonged experience, their views remained the same. He believed the point upon which Mr. Newton appeared to be doubtful, and upon which Mr. Hancock had expressed no doubt whatever, was, perhaps, the cardinal point upon which the whole discussion would have to turn, namely, whether there should not be a preliminary examination of patents. Without expressing a definite opinion, either in favour of or against that plan, he could confirm by his own experience, as a manufacturer and as a patentee, nearly everything which Mr. Hancock had said. On the question of expense of examination, he would remark that the total number of patents sealed in this country, during the year 1869, was 2,400, or thereabouts, and, dividing that by 300, it would give eight patents per diem. He did not think that for that number of patents they would need to have 60 examiners and 300 assistants. As to the publication of the provisional specification, he was perfectly aware that objections might be made to early publication; but the difficulty which occurred to him was, how a man could oppose unless he knew what he had to oppose. With reference to the question of licences, there was a difficulty which Mr. Newton had not altogether met, but probably he might do so in his reply, namely, that of the qualification to be demanded of a candidate for a license.

The resolution was carried unanimously.

Mr. Newton, in reply to the various observations which had been made, said Mr. Fordred had disposed of certain allegations which had been made without any foundation. Mr. Campin's objection was only a matter of words. There should be an open tribunal when an action was intended to be commenced. If Mr. Campin would read the paper which he (Mr. Newton) read some years ago at Birmingham, he would see that it must necessarily be a public examination. The proposition was simply that when a patentee alleged that his patent had been infringed, he should go to a proper officer and ask for a certificate to enable him to bring an action. The officer would at once look at his patent, see whether it was valid, and if so call upon the alleged infringer to show cause why an action should not be allowed to commence. Then the alleged infringer would give his reasons why he had a right to do what he had been doing. Those particulars would be handed to the patentee to be disposed of, if he could. Therefore every step in the process would be open to both parties. The public would not be invited to look into the matter, and the alleged infringer would never hear of it, if the officer appointed to examine decided that there was no case. He thought there was a good deal in Mr. Hill's suggestion. There would always be patents which stood in the way of the public, and if a competent authority should say a patent ought to be bought up with some of the money that now went to the Exchequer, and so cancel the patent, a great good would be done, and no evil to any one. Mr. Hancock had dwelt upon the necessity of a preliminary examination. He (Mr. Newton) had no objection to it, but it appeared to him a difficult matter. As to patents of addition, if there were competent persons to examine them, that idea might, with great advantage, be adopted, but, as carried out in France, it was a very bad thing indeed. He would like to suggest that, in any future legislation, they should not give up the good things they already possessed.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

As already announced, the Council in aid of this object will give six concerts in the Albert Hall, and a guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed is £2,548.

The following gentlemen have since guaranteed the amounts set opposite to their names respectively:—

G. J. Blake	£10
Samuel Davis (Enstow, Oxon)	25
Henry Ludlam	10

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

A subscription of one guinea entitles a member of the Society of Arts to a transferable numbered and reserved seat at each of the six concerts.

The prices to be charged to the public for admission to reserved seats at the concerts will be as follows:—

Arena for one concert	£0	7	0
Or subscription for the six concerts	2	2	0
Balcony for one concert	0	7	0
Or subscription for the six concerts	2	2	0
Amphitheatre for one concert	0	10	6
Or subscription for the six concerts	3	3	0
A box holding five persons for one concert	3	3	0
Or for the six concerts	15	15	0

In letting, preference will be given to a subscription for the six concerts.

Members of the Society of Arts will have the privilege of subscribing for a set of six tickets (transferable), admitting the bearer to a reserved seat, at each of the six concerts, as follows:—

The Arena	£1	1	0
The Balcony	1	1	0
Amphitheatre	2	2	0
Box holding five	10	10	0
Ditto " for one concert (if vacant)	1	15	0

Special Notice to Members of the Society of Arts.

The price to members subscribing for sets of tickets for the six concerts at the Royal Albert Hall is 1*l.* 1*s.* up to the **15th MARCH**, after which date the price will be 2*l.* 2*s.*; and the above privilege to members can on no account whatever be extended.

OPENING OF THE ALBERT HALL.

Tickets to admit to the ceremonial at the opening of the Royal Albert Hall by the Queen, on the 29th March, can be obtained of Mr. Samuel Thomas Davenport, the financial officer of the Society of Arts:—Arena, 3*l.* 3*s.*; Balcony, 2*l.* 2*s.*; Picture Gallery, 1*l.* 1*s.* each.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. W. Fothergill Cooke and Professor Charles Wheatstone, F.R.S., in recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Council invite members of the Society to forward to the Secretary, on or before the 22nd of April, the names of such men of high distinction as they may think worthy of this honour.

POSTAL REFORM.

A meeting of the Society, for the discussion of this subject, will be held in the Society's rooms on Monday morning, the 13th of March, at 12 o'clock, when the chair will be taken by Lord Henry G. Lennox, M.P., the Chairman of the Council.

CANTOR LECTURES.

The fourth lecture of the course on "Dyes and Dye-stuffs other than Aniline," by Dr. Crace Calvert, F.R.S., was delivered on Tuesday evening, the 28th February.

The third course of Cantor Lectures for the Session will be delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will consist of Five Lectures, commencing on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

INDIA COMMITTEE.

The adjourned meeting on the paper by Mr. Dadabhai Naoroji, on the "Commerce of India," will be held at eight o'clock this evening, Sir Bartle Frere, K.C.B., K.C.S.I., in the chair.

On Friday, March 10th, a Conference on the subject of "The Claims of India Cotton" will be opened by Sir Thomas Bazley, Bart., M.P. The chair will be taken at eight o'clock, by John Cheetham, Esq., M.P.

THE LIBRARY.

The following works have been presented to the Library :—

Symons's Monthly Meteorological Magazine for February, 1871.

A Pamphlet on Evaporation and Evaporation Guages. By G. Dines, Esq., F.M.S. Presented by the Author.

Report on the Questions between Great Britain and the United States, with respect to the North American Fisheries. By the Anglo-American Association.

Journal of the Linnæan Society for February, vol. xi., No. 50.

Proceedings of the Royal Society of Edinburgh. Session, 1869-70.

Recueil de Documents sur les Exactions, Vols, et Cruautés des Armées Prussiennes en France. Part 1. Published by the International Society for the Help of the Wounded. Presented by Messrs. Johnson and Sons.

Transactions of the Royal Society of Edinburgh. Vol. xxvi., Part 1. For the Session 1869-70.

Quarterly Weather Report of the Meteorological Office. Part 3. July—October, 1869.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

Albert Hall.—On Saturday last, February 25th, about 7,000 persons assembled in the hall, at the invitation of Messrs. Lucas Brothers, the contractors for the building, whose labours are now coming to an end. A concert was given by the amateur musical society known as the Wandering Minstrels, under the directorship of the Hon. Seymour Egerton. Though the concert was nominally given to the workmen in the employ of Messrs. Lucas, and their friends, a large number of other persons were also present; and not only were the accoustic properties of the hall tested, but the arrangements for the entrance and exit of visitors were also tried. The hall is built to seat a large number of persons—namely, 9,000—so that special facilities are required not only to ensure an easy disposition of the audience, but to ensure, in case of an emergency, a rapid clearance without the chance of a block or crush. This point has been carefully considered by the designers of the hall, who thoroughly understood the responsibility which rested upon them; and the fact that on Saturday last the large audience was dispersed in a few minutes, without the slightest trouble or difficulty, is a proof that the means they have taken to ensure these ends have been effectual. It may be interesting to the public to know that each part of the hall has its separate exits, so that a crush between two streams of persons is avoided. The following is a list of the exits:—Front porch, 3; east porch, 3; west porch, 3; amphitheatre, 6; arena, 4; gallery, 2; conservatory, 4; orchestra, 4—29 in all.

British Section.—The 28th of February was the last day for the reception of articles sent for exhibition by British exhibitors. The Committees of Selection, who have not yet sat, will at once commence their labours, and the large number of articles received will be reduced to the limits laid down. The difficulty of the work of selection may be gathered from the fact that about three times the number of paintings have been received that can possibly be exhibited.

Foreign Section.—Belgium has been the first foreign country to show up to any extent. Some hundreds of cases have arrived, which are rapidly being opened, and their contents arranged under the superintendence of M. Corr Vander Maeren, the Belgian Commissioner. Spain, Italy, New South Wales, Russia, China, and Tunis, have also sent a portion of their exhibits.

Machinery in Motion.—The motive power for machinery in motion in the west galleries will be provided outside the building, and conveyed by means of steel shafting 3½ inches in diameter, supported upon cast-iron columns 12 feet high, which are erected at intervals along the gallery. Messrs. Hargreaves, of Bolton, are the contractors for its erection.

BOGOTA EXHIBITION.

A decree has been issued by the President of the United States of Columbia, for the establishing of a series of exhibitions of the natural products and industry of the country, including the spontaneous productions of the woods and unpeopled territories. Articles manufactured of such natural products will be admitted, even though the manufacture shall have taken place in a foreign country, such as mats, carpets, of cocoa-fibre or wild straw, textile fabrics, lassoes, cloths, &c. The object of the exhibition is to draw the attention of manufacturers in other parts of the world to the materials of the country, and afford them an opportunity of seeing and testing such materials. Essays will also be written descriptive of the articles, giving full particulars regarding them. The exhibition will take place in the building for the School of Natural Sciences, and all articles are to be sent in duplicate, so as to admit of their preservation in the National Museum, and of their being sent for exhibition at the London International and other exhibitions. A commission has been appointed to carry the scheme out, and a considerable sum of money (20,000 dollars) has been voted out of the national treasury towards the necessary expenses. The following is a list of the products to which the first exhibition, which opens on the 20th of July, will be confined:—

Vegetable Products.

Textile substances, as American aloe, *fique cumare*, wild cotton, vegetable wools, *majagua canamo*, cocoa nut fibre, *nacuma*, *palmiche*, &c.

Industrial substances, as *caucho*, gutta percha, &c.

Dye woods, as brazil, pale brazil, mulberry, *brompeto*, *dividivi*, &c.

Oleaginous substances, and oils from them, as cocoa, *coroso*, *cuesco*, *gaque*, *higuerilla*, *muelle*, &c.

Cabinet woods, as mahogany, ebony, rose, *palisandra*, *diomate*, &c.

Building woods, as oak, *lignum vitæ*, *comulá*, pine, &c., but principally with reference to maritime and river construction.

Woods for other kinds of industrial, agricultural, or domestic purposes, as *macanos*, palms, canes or reeds, *guaduas*, *chusques*, &c.

Vegetables used in the construction of buildings, as leaves and straws for roofs, &c.

Resinous substances, as *gaque*, storax, odoriferous balsams, &c.

Wild fruits, that may be used for industrial purposes, as those which serve for food for hogs, for cattle and goats, or which have seeds which may be used in the arts, with a description of their applications, as cocoa, the *jaboncillo*, the *tagua*, &c.

Vegetable barks useful in the arts, as those of the *majagua*, *guasimo*, *guarumo*, &c., with description of the uses to which they are applied.

Forage plants, or wild grasses from the woods or desert plains, which may be introduced into other regions.

Animal Products.

Bees-wax and honey, domestic or wild; pods and silk already spun from wild or domestic silk-worms; pods of silkworms, the textile substance of which may be spun or be turned to other uses; skins, *anas*, hair, plumes, and other spoils of wild animals; dried birds and quadrupeds, or other dried animals, &c., which may become articles of commerce.

Tortoise, armadillo, caiman shells, &c.

Pearl shells; marine products which may be turned to any industrial account, as periwinkles, fish bones or spines, salt and dried fish, oysters, *ostiones*, dye periwinkles, &c.

Minerals.

Samples of iron, copper, lead, zinc, tin, mercury, nickel, and cobalt ores.

Iron pyrites.

Gold, silver, and platina, in their native states.

Argentiferous galena.

Coal, petroleum, and asphalt.

Rock salt and water of salt waterfalls, known or not.

Stones and rocks for buildings, as marbles, jaspers, serpentines, onyx, granite, *tranquita*, hard stones for mills, slates, &c.

Precious stones, emeralds, &c.

Limestones and lime obtained from them.

Bricks and fire-bricks, as kaolin, &c.

Products for Export.

Indigo, starch, sugar, balsams, cocoa, coffee, *carei caucho*, copper, native and in bars, pearl shell, hides of various kinds of domestic and wild animals, sweetmeats, Chingalee and other mats, &c.; caparisons, &c.; ipecacuanha,; liquors, as superior cane brandy, aniseed, dill, *mistelas* (drink made of wine, water, &c.); rum, &c.; Peruvian bark, *ratania*, *sugú*, tobacco, *taguas*, sarsaparilla, *zuelas*, and other like articles, which are now exported.

EDUCATIONAL NOTES.

The Scotch Education Bill.—This Bill was read a second time without a division on Monday last. In the course of the debate, several members complained of the inadequate time allowed for the consideration of the Bill, but the principle of the measure was generally approved. In his reply, the Lord Advocate explained the main differences between this Bill and that of 1869. The latter proposed to establish only one Scotch Board, which was to be at Edinburgh, and was to have the exclusive power of determining when and where national schools were to be established. When that central board had determined that a national school was to be established in any locality, then a school committee was to be called into existence in that locality. But by the present Bill there would be established, within six months after its passing, a school board in every parish and district in Scotland. There would be plenty of school boards, and every one of them would be charged with the duty within its own district which was proposed to be conferred on the central board at Edinburgh by the Bill of 1869. The central authority must of necessity be in London, because when Imperial money was to be given, it was considered desirable, if not essential, that the administration should be in a government department immediately answerable to the House of Commons, though, he confessed, there was an undesirable exception in the case of the Irish Education Department. As this central authority would administer the Imperial money in the shape of Parliamentary grants, it would be its interest to see that the local boards were not extravagant, because any extravagance on the part of those boards would have to be met, according to the provisions of the Bill, by a corresponding increase in the Imperial grants. The central authority, therefore, would provide that useful and efficient check in the expenditure of money which would be required. The department would be made a Scotch department, administering Scotch education with reference to Scotch feeling and opinions as far as it was proper and expedient so to do. The Bill having been read a second time, was ordered to be committed that day three weeks.

Night Schools and Government Aid.—In reply to a question put by Mr. Gathorne Hardy on Monday last, Mr. W. E. Forster explained the present position of night-schools. The Department had come to the conclusion that the night-school system required careful revision, for there were many night-schools which, although, doubtless, of much advantage in a social point of view, were almost valueless educationally, and it did not seem right to ask the House for money unless they gave substantial educational results. Under these circumstances, it had been determined to alter the mode of examinations, which, in future, would be conducted either by the inspectors or by other officials, and not left in the hands of the managers solely. It had also been determined to allow government aid to night-schools not connected with day-schools, and the amount of the grant had been considerably increased. At present, all that was required was, that the schools should be open on forty evenings in the year, and that those who were presented for examination should have been present on twenty-four evenings; and it was felt now that it was desirable that the number of evenings on which the schools should be open should be increased to eighty, and the attendances required to fifty.

Remission of School Fees.—This has formed a subject of discussion at several of the school Boards. At Liverpool, a Nonconformist member proposed an amendment on the bye-law for this purpose, excepting all but the schools of the Board from the privilege, but on the question being put to the vote, a large majority were in favour of the clause in its original form, whereby, in cases of poverty, the Board will, with respect to schools provided by the Board, remit, and in respect to other schools, will pay the whole or part of such fees as the parent is unable to pay. At Birmingham, also, the subject has been debated at great length, the point being one upon which there is a strong difference of opinion upon the Board, one party contending that it is expedient and economical to pay the fees of poor children in schools already in working; while the other party are of opinion that there should be no free admission to what are understood to be denominational schools, but that special provision should be made of a purely unsectarian character, for children whose parents are unable to pay the fees. A similar discussion has taken place at Wolverhampton.

The Endowed Schools Bill No. 2.—Mr. W. E. Forster, in reply to a deputation from the Scholastic Registration Association, explained why he saw no prospect of introducing the above Bill this session. He said that when they had seen the working of the Endowed Schools Act and the Elementary Education Act of last year, they would be in a better position to see what should be done further. After the Endowed Schools Act shall have set the new schools at work, some steps must be taken to see them kept up to their duty. He had said at the time, although he thought it an effective Bill for reforming the endowed schools, and starting with good schools, it would be impossible for Parliament to leave them alone without some security that they would be kept up to their work, and this would force a measure on Parliament. Then there came a very important question, how far it will be possible to make use of the school boards as links between primary and secondary education; and on that it was impossible to give an opinion until the working of the school boards had been seen.

Physical Training.—Dr. Parkin, in a letter to the *School Board Chronicle*, comments upon the remarks of Mr. Hepworth Dixon, quoted in last week's *Journal*. He points out that the desired result of strengthening the body by exercise will not be attained unless the individual takes nourishment, not only in sufficient quantity, but of the proper quality and proportion, and "that if there be a deficient supply of food, the development of muscle will be prevented, notwithstanding the exercise or the gymnastics; for although exercise favours the flow of blood to the muscular tissue, it also promotes its return, or its absorption, at the same time, and in an equal ratio. On the other hand, if the composition of the blood be faulty—if there be a deficiency of azotised principles—precisely the same results will follow. There may be a development or accumulation of fat; but there can be no development, or at least not a sufficient development, of muscular tissue. Under such circumstances, exercise, so far from being beneficial, may be injurious, by weakening instead of strengthening the muscular system." In conclusion, he says:—"If, therefore, we are to begin at the beginning, as Mr. Dixon tells us, we must look, not to physical training, but to the supply of food, for it is only on this foundation that you can build up a strong and healthy population. These are the reasons that have induced me to recommend the introduction of industrial training in the new elementary schools; so as to enable the children to obtain hereafter, by their skill and habits of industry, not only increased wages, but also an increased and better supply of food."

Music and Drill.—It will be remembered that lately a deputation from the Society waited upon the Right Hon. W. E. Forster, for the purpose of urging upon him the importance of these subjects being made compulsory in all State-aided schools. In the new revised code, just issued, music is excluded from the subjects for which payment will be given. Drawing is also excluded on the ground that it is one of the subjects for which the Science and Art Department offers rewards. Drill is not included in the paying subjects, but attendance at drill, under a competent instructor, for not more than two hours a week, and twenty weeks in the year, may be counted as school attendance.

Waste of Educational Resources and Condition of the Poor.—The following passage from Mr. Bartley's work, "The Schools for the People," just published by Messrs. Bell and Daldy, forms a striking proof that the Education Bill of last year was not passed before the need for better organisation had reached a climax:—"As an example of the complete impotency of the recent regulations to reach children neglected by their parents, I may mention the following case, which came under my special knowledge. In pursuing inquiries at the East-end of London, in February, 1870, I took particular interest in a sharp little fellow with whom I became acquainted. He was about twelve years of age, and his residence, if it could be called such, was within a mile of the Bank of England and the Mansion of the Lord Mayor. It was also within fifty yards of a Church of England and a vicarage. Taking his home as a centre, and striking a half-mile radius, the following institutions were to be found: at least twenty churches of the National Establishment, with vicars, curates, district visitors, Sunday schools, &c.; a still larger number of Dissenting chapels, with numerous ministers and other helpers; nineteen elementary schools aided by government grants, twenty-seven other elementary schools, and an innumerable number of dame schools and such like places of instruction. In spite of all this machinery, this wretched boy did not know his own name, except that he was generally called 'Diddlego;' could not, of course, read; nor had he the slightest knowledge of the very elements of religion. Were this an exceptional instance it would stand for nothing, but within that very half-mile radius at least twenty thousand children are at this moment quite in the same position, or one but very slightly removed from it."

France and Education. — The following is extracted from the "Fortnightly Review," by Emile De Laveleye:—The most formidable corps in the French armies was, it used to be said, the Turcos and the Zouaves. They met men in spectacles, coming from universities, speaking ancient and modern languages, and writing on occasion letters in Hebrew or Sanskrit. The men in spectacles have beaten the wild beasts from Africa. In other words, intelligence has beaten savagery. Are we to be surprised at this, when we know that war, like industry, is becoming more and more an affair of science? Who does not know the immense sacrifices that Germany has made for the advancement and diffusion of knowledge — spending, for instance, £20,000 sterling at Bonn in a chemical laboratory, £40,000 at Heidelberg in a physical laboratory. Little Wurtemburg devoted more money to superior instruction than big France. A thing unheard of, France made the very fees of the university students a source of revenue. She gave, without counting it, more than £2,000,000 sterling (between 50,000,000f. and 60,000,000f.) for the new opera, and she refused £40,000 for school buildings. Last year, on the deck of the steamer which was conveying us to the inauguration of the Suez Canal, M. Duruy, the one man of merit who ever served under the Imperial Government, told me the tale of his griefs in the ministry of public instruction. He wanted to introduce compulsory education; the Emperor supported him; he had all the other ministers against him. He had organised 15,000 night schools for adults; it was with difficulty that he succeeded in carrying off £40,000 against the fatuous resistance of the Council of State. There was the whole system of public instruction to reorganise, and he could get nothing. They preferred to employ the gold of the country in maintaining the ladies of the ballet, in building barracks and palaces, in gilding monuments, the dome of the Invalides, the roof of the Sainte Chapelle. It was in vain that men like Jules Simon, Pelletan, Duruy, Jules Favre, cried out, year after year, "There must be millions for education, or France is lost." The Government was deaf. It denied nothing to pleasure, to luxury, to ostentation. It denied everything to education.

CORRESPONDENCE.

ORNAMENTAL UTILITY.

Sir,—Few can fail to be impressed with the earnestness and love which influences everything which Dr. Dresser has to say in reference to his highest aspiration —excellence in art, nor can one refuse admiration for the valour with which he attacks many of our traditional notions of art-excellence; but as the enthusiasm of religious belief has always given birth and fostered intolerance, so the genuine earnestness and sincere belief of the art disciple (beautiful as we may acknowledge it in the abstract), is always attended by a certain intolerance of lay criticism. It will be familiar to many how some of our leading ornamentists attach themselves with fervent affection to particular styles, and how each one is prepared to do battle for the *credo* he reverences, and is satisfied that his own opinion on this particular subject is the most worthy of respect. This perhaps is inseparable from earnest conviction, unless along with that love of truth which Dr. Dresser considers indispensable to the disciple of art is added that larger gift of charity, without which all other Christian virtues are lifeless.

The great public stand without the circle of those influences which directly affect the ornamentist as a teacher. As a rule, they know not the Greek, the Renaissance, or the Mediæval; they are not affected in their choice of carpets or floor-cloths by the question whether the Pompeian is degraded art, or whether this or that style is or is not approved by the *cognoscenti*. They see and they take that which they like best, and no other will they have, not that I would imply that they do not most frequently select that which the ornamentist would approve as good taste, but that they are not guided in their selection by any consideration of what is high or what is degenerate art. It appears to me that the appreciation of art productions cannot be forced; it must have a natural growth, as it is dependent so entirely on the refinement as well as on the moral character of a people. The education of the mind and the elevation of the moral sentiments lead to a more truthful appreciation of the value of art, and until there is less necessity for school boards and primary education in this country, the honest and conscientious art-teacher will still have to deplore a want of sympathy and a lack of appreciation in the mass of the people.

The manufacturer stands between the art teacher as ornamentist and the public as pupils, so to speak, and he has often to draw largely on the tolerance and patience of the teacher, for the short-comings and waywardness of the pupils. The art teacher says to the manufacturer, "You ought to lead, not be led, by the public; you ought to place before the public those things which are good for them, not those things which please them best."

"Yes, that is very good, Mr. Teacher, but suppose my friends the public will not have your teaching, but prefer the wares that are ornamented more to their taste, in a style that may be less noble, less truthful, and less beautiful, to the art master? I cannot afford to wait for my profits until your pupils have learned to love your teaching, and I must make profit, or I cannot afford them even the modest modicum of art I can now offer them."

Fitness is most important in design, and again the manufacturer and the art teacher may disagree. A lady enters a shop, and requests to be shown patterns of floorcloths; she likes many designs—excellent maybe of their kind—but they will not do for her, and finally she chooses the worst and most glaring specimen, the white predominating, and in patches; and for reason says, "Yes; you are quite right, these are better and I like them better, but you see, I have a very dark passage, and none but this pattern with plenty of white in it could be seen." And how many dark passages and dark rooms are to be found in this great city. Such wants must be supplied, though such glaring effects shock the sensitive in art when they see them exposed in the full light of noon-day.

If I have viewed this subject from a low stand-point, that of utility, it is not from any want of sympathy with Dr. Dresser's views, or any lack of docility, or desire to benefit by much that is morally great and good in the ideas that he has given us in his very interesting paper.—I am, &c., Frederick Wallace.

Linoleum Works, Staines.

Sir,—I should be sorry to prick Dr. Dresser's bubble, for I think it a very pretty one. It is interesting to watch how small a modicum of soap it takes to make it, and he might have blown it, and his own trumpet as well, as long as he liked without any interruption from me, if he had not laid down the law on subjects he knows nothing about with more than usual arrogance and conceit.

2. I have nothing to say against his platitudes about truth, beauty, and the eternal laws of harmony, &c. Everyone knows such things are profitable properties, without which an art-critic could scarcely manage to live. They are useful, too, as clouds into whose obscurity he may escape from the attacks of an enemy, or the too intelligent curiosity of a disciple.

3. I do not object to such statements as "Pompeian art was false, and Pompeii was destroyed; French art was not truthful, and France has fallen." I only think how many beautiful sites on the sunny slopes of volcanoes are now open to the enterprise of our builders, if they will only employ our eminent historian and artist as their architect, and I heartily sympathise with the deep regret the poor French must now feel that, instead of surrounding Paris with forts, they had not called in Dr. Dresser to decorate it, for I am quite of opinion the remedy would have proved completely successful.

4. Neither do I object to Dr. Dresser's criticism on the work done at the Museum, for I know that the value of criticism entirely depends on the learning and taste of the critic, but I do object to a man who has scarcely entered the threshold of art, who has no right even in the outer court of the temple, braying out his condemnations as if they were oracles from the Holy of Holies. Here is a man who cannot draw the figure with even moderate ability, setting himself up as judge of the greatest periods of art, and abusing the authorities at South Kensington because they encourage the study of a style which includes in the list of its votaries some of the greatest names in the world.

5. Dr. Dresser will continue to think, write, and draw as he does till he begins to learn art, and I am quite serious when I say that I think that would be a great pity. He is perfectly sincere, does very well as he is, while a deeper knowledge of art would probably completely paralyze and confuse him. He has the "flat" malady very full out upon him. (This is a disease common to the infant artist, which, twenty years ago, assumed the proportions of an epidemic.) He has experience in his own line, makes many happy combinations of colour, and I, for one, would gladly sit under him if he would only talk about such things as he understands.

6. And now, I have a graver charge to bring against the Society of Arts. What would the medical world say, if the College of Physicians lent their rooms and the *prestige* of their name to some enthusiastic herb doctor, who, entirely ignorant of anatomy or chemistry, proceeded to prove to the students that his herbs were the only true antidotes for all the diseases of the flesh? Would not the medical world blame the College of Physicians rather than the poor herbalist? And has not the art world some right to expect that such an institution as that of the Society of Arts should take care that the lectures delivered in their halls are not the crude theories of half-developed artists, but sound instruction from experienced and learned men.

7. And now, Sir, would you allow me to say a word about art theories, for I, too, have a theory about art, and my theory is, that theories of art are the curse of the age. We have now had more than thirty years of them, and I am convinced that if half that time had been spent in work, we should long ago have been in the full swing of a great era of art. A man must have used his wits to very little purpose if he has not long ago perceived that, with very few exceptions, the theories of the day are either the sophistries spun by the weak, with the vain attempt to keep the strong within the narrow limits of their own capacities, or they are the dogmas of critics, by which they can easily condemn those they do not understand. They are cheap patent Procrustean bedsteads, on which the critic in imagination lops off the limbs of the giants he has tied to them; but, if we trace these theories to their source, we invariably find nothing more than the "*I.*" "*I* say so."

8. A theory, like a mummy, is enshrined in many cases. The outside is very gorgeous; it is written over with the names of the gods, and with symbols and mysteries; but, when you have taken off case after case, and roll after roll, each more tedious and intricate than the rest, you come at last to a poor, little, black, wizen monkey of a man.

9. I know only one use of art theories, and that is a very small one. If an artist talks to me on such subjects for a quarter of an hour, I know what he can do quite as well as if I saw his work. And I have had many a talk with theorists of all sorts, and I always say to my friend, that is a very pretty theory of yours, and now will you come for a walk with me into Kensington Museum, and into the library there, and we will fit it on; and I invariably find that in half an hour we have condemned most of the great men that ever lived. I am bound to confess that this result hardly ever weakens the confidence of the true theorist. If Raphael differs from him, so much the worse for Raphael. But I say to my friend, "No doubt my taste is depraved. I attribute that to the fact that I have been born and bred in that obscure quarter of the globe called Europe, and so I admire works which your Oriental tastes condemn. I am a plain man and no philosopher, and these things which you have proved to be on wrong principles, seem to me the great works of great men, who probably knew their business quite as well, perhaps even better, than a novice, or even an amateur."

10. The only cure for art theories (but that is a certain one) is art power. If the theorist is lucky enough to attain to this, he quietly drops his theories, for, if he is a wise man, he knows he has made a fool of himself, and he sets honestly to work to learn his business and redeem, if possible, the time he has wasted in nonsense. It will be a happy day for art when its votaries work instead of talk, and are no longer disturbed by the idle theories of the ignorant. Thanking you, Sir, for allowing me to speak, I am, &c.,

F. W. Moody.

FRESCO PAINTING.

Sir,—Under the most advantageous circumstances "fresco" can never be permanent, for even in Italy it perishes after a certain time.

The "Last Supper," of Leonardo da Vinci, in the Cathedral of Milan, has passed away; when I last saw it, only a few patches of colour were discernable here and there. Italy is reputed to be a dry climate, yet it is much more difficult to preserve bright steel from rust there than in this country. As our walls invariably consist of soft materials, to which no plaster or cement can permanently adhere, damp and noxious gases may permeate between the two, and contribute to the destruction of the painter's work. In all Italian buildings hard siliceous stone only is used, which retains the plastering for ever. Several attempts were made in the latter part of the last, and early in the present century, to rival the supposed "encaustic" process of the ancients, by means of enamel colour burnt in, but such a process can never be a substitute for the freedom of even fresco painting, neither is it possible to make it present a real artistic effect. Some persons have also endeavoured to revive a sort of imitation "encaust" by means of the very confused descriptions to be found in the works of Pliny, Vitruvius, and others, but they all seem to direct the wax and the colours to be ground up together.

Now, it is well known, that Pliny wrote down hearsay information, himself knowing nothing about the matter, and Vitruvius, of course, could know nothing of chemistry. In this state of uncertainty, I prefer to go to the solid example of wall-painting, as adopted in the public and private buildings of the city of Pompeii, where I have seen the walls of a kitchen decorated with representations of hams, joints of meat, sausages, and fowls, as brilliant in colouring as the day they were painted, though twenty centuries have passed over, and the walls had been exposed, when I saw them, for several years through the modern excavations. The colouring matters were submitted to Sir Humphrey Davy, who could, of course, discover the elements of which they were then composed, but certainly not the manipulation by which they were produced.

The simple mode adopted by the house decorators of that luxurious city, is now known to be nothing more than ordinary distemper painting upon dry stucco, varnished over with melted Punic wax, this coating being afterwards sunk into the stucco by holding a brazier of lighted charcoal in its vicinity, and thus the colours were rendered proof against both time and weather. This is the version of the so-called encaustic painting; for if fire was used in any way, the Greek term for fire was applied to the whole process by all the old writers.

Of late years, Canova applied this process to white marble statues required to stand in the open air with perfect success; that is, that he gave the statues several coats of white wax, and sunk it in with a gentle heat. The once white marble statue of Her Majesty the Queen, in the Royal Exchange, if it be possible to efface the stains of the tears of soot running down the marble cheeks, could again be rendered permanently white by this simple process, and occasional washing. In its present state, it is a disgrace to civilisation, and especially to those gentlemen who may be in the habit of frequenting that noble building.

In order, therefore, to obtain durable wall-painting, we must use only hard materials for the walls, upon which any cement or stucco will permanently adhere, the last coat of which should invariably be composed of good white lime free from grit, made up with ground white marble chips instead of sand, to be had in any quantity from the marble quarries; there are mountains of such material at Carrara. This stucco, when well worked up, presents a superbly beautiful face, and is universally employed for handsome buildings in the South of Europe, and in the Levant.

Chalk and paper are two great enemies of English building and English taste, the one alluring us to build with soft materials, and the other, ornamental paper, a French invention, to shameful deceit, in trying to hide our utter inability to produce good stucco for internal walls and ceilings. No chalk is to be seen in Italy.

As I am upon statuary, I may, perhaps, be permitted to recite a fact that will show that John Bull can occasionally commit blunders that would do honour to our good-natured brothers of the Emerald Isle. The bronze statue in Hyde-park, called the "Achilles," was cast in moulds taken from the group of Castor and Pollux, on Monte Cavallo, at Rome. The left arm of the marble statue is engaged in pulling down a rearing charger. In the Achilles, the sculptor has placed a heavy shield on that arm, here engaged in supporting a heavy weight, and has left the muscles as they were arranged for a pulling-down effort. I may also observe, that the founders of the Achilles neglected to remove the core upon which it was cast, and in consequence, it gradually washed out with the weather, and for some years covered the lower part of the figure very disagreeably with mud.—I am, &c., Henry W. Reveley.

Reading.

PATENT LAWS.

Sir,—As I had not time in my last to give the letter of your correspondent, Mr. Reveley, more notice than what I then did, permit me to call attention to a few more points in that letter. I refer to his letter which appeared in your issue of 23rd December.

In his first paragraph, he refers to his arguments against the utter impracticability of the improvement of patent law. It need not be pointed out that an argument against the impracticability of a thing must be an argument in favour of its practicability, which, it may be presumed, is anything but what your correspondent would wish to express. It has also been shown that one of these weighty arguments of his, on which he appears to put so much stress, must either support what he intended it should destroy, or is, I am sorry to say, nonsense. Again, I have never been able to get any explanation of the fact, notwithstanding the thousands of years which elapsed before, it is only since this system of rewards was introduced—some few years back—that science and art have made the rapid strides they have. This is a difficulty which cannot be got over, but your correspondent evades it as "too futile to require notice." Still, again, it has been distinctly shown that his argument, derived from necessity, has, from one point of view, no reference to the matter whatever, which he has been forced, though reluctantly, to acknowledge; and that, from the other point of view, it had largely to do with the calling of inventive talent into play, and yet you have seen all that he has said in its defence.

In the second last paragraph of his letter in your issue of 20th ult., he writes:—"I fully agree with him (that is, myself) in regard to the term 'necessity,' so far at least as the existence of these laws oblige every person connected with trade and manufactures, by means of patent right, to overthrow, defeat, and put down all his professional brethren." Now, I put it to yourself and readers to say if there is anything in any of my letters which can justify your correspondent in ascribing such sentiments to me? Most decidedly not. I have, therefore, to request that he will not do so again; it may help to hide the weakness of his position, but it is not right.

As to the reference, in his last paragraph, to the American Congress, anyone who has watched the enactments of that august body knows well that many of them have been very foolish indeed; and, if it now abolishes this system of rewards, it will only add another to the number. But to the immediate object in view.

Let us now examine the distinction which it is laboured to make out in favour of copyright, when the distinction—which is a very great one—is certainly against it. Of course, the remarks which follow have no reference to Mr. Reveley. Although I think him wrong on some points, it affords me pleasure to know that he is consistent, and that when he would sweep away patent-right, he would sweep away copyright as well.

Both copyright and patent-right represent a system of reward. Both bestow the reward in the same form, that of a monopoly. They also both represent proprietorship in ideas, or in the fruit of a man's brains; only the one represents a literary idea, and the other a mechanical one. They are, therefore, undoubtedly the same in principle. The main points of difference between them, not only do not change the principle, but they do not even affect it. This will appear from the following:—

The conditions under which the result of copyright and patent right reach the public vary considerably, but that only necessitates a corresponding difference in the legal machinery connected with each, so that the reward due may reach one as easily as it does the other. Copyright, as a rule, represents a literary idea only; patent-right, however, represents not only a mechanical idea, but of a necessity a literary effort as well, and one, too, which in many cases surpasses by far anything which you will find in scores of copyrights. Romances, &c., as a rule, consist of the simplest kind of writing there is, namely, descriptive; and you may seek through hundreds of such before you will find a literary effort which will surpass that of clearly defining, in a few words, some abstruse mechanical idea.

The most important distinction between the two lies in their comparative value to the nation. Take all the novels and romances that have ever been the subject of copyright in one mighty heap, and there is still no comparison between their value to the nation and that of the modest little piece of mechanism, the sewing-machine. Or what three copyrights will represent three literary ideas which can surpass in their value to the country that of the three mechanical ones of the steam-engine, the railway, and the electric telegraph? Many of the novels protected by copyright, instead of being of any value to the nation, are a positive curse to it, and are ruining hundreds of its youth of both sexes. What have such cost their authors? Only a few sheets of foolscap, and a fraction of the time which it would take to work out a useful mechanical idea. Yet the authors of such works are to be rewarded and protected, whereas the authors of ideas such as the steam-engine, the sewing-machine, or other like useful mechanism, which may have taken hundreds of pounds to perfect, are not only not to be rewarded, but are to be robbed of the fruits of their brain. And why are they thus to be robbed? Because their ideas are "productions of the human mind" (as if the ideas of copyright were not so); and all productions of the human mind are held to be the property, not of the individual, but of the public at large. Are not lawyers, doctors, and other professional men, all protected in the production of their minds? True, they have no "copyright," no "patent-right," but they have a "legal right." If you ask them for their opinion, for the "production of their minds," they fall back on that right, and insist (and justly, too), on your paying for it; and if you refuse, the law will protect them, and compel you to pay. The great difference, therefore, between "copyright" and "patent-right" lies, undoubtedly, in the comparative value of the two to the nation, that of the former being small indeed. Hence, the continuation or not of "copyright," although the principle is the same, affects the community but little; whereas, the possession, at as early a date as possible, of the valuable practical ideas which "patent-right" represents is of the utmost importance to the nation.

It would be well if those who draw a distinction between "productions of the human mind," which they claim as public property, and the ideas of "copyright," which they do not so claim, would define clearly wherein it lies, as it evidently is a very fine one. Obviously, if the ideas which "copyright" represents are not admitted as productions of the human mind, they are certainly productions of the human brain; but the drawing of distinctions between the two is certainly splitting hairs with more than mathematical nicety.—I am, &c.,

H. F. ALEXANDER.

Edinburgh, 25th February, 1871.

SIR,—With reference to my promise to address some remarks to you on the subject of Mr. Newton's paper on the Patent-laws, I beg to say that, as want of time will prevent my writing sufficiently early for this week's issue of the *Journal*, I propose to reserve my letter for the following number. Your insertion of this note will oblige,—Yours, &c., W. LLOYD WISE.

PREPARED COFFEE LEAVES.

SIR,—As the subject of preparing coffee leaves is being followed up (not by a dry blast process), but by the ordinary method employed in the preparation of tea, it may be useful to draw attention to the following points:—

1. What is the object of introducing coffee-tea as it is called; is it better or cheaper than ordinary tea?
2. If it is really good, how is it that it has been recognised by no one but the natives of Sumatra?
3. It would be worth while for the Society of Arts to discover (as I said at their meeting), what they are doing before they offer a medal for coffee leaves. Granted that a volatile oil may be produced, or rather elaborated, by oxidisation, the oil of vegetables is not, so far as I know, of much use as a flesh-former; but, on the other hand, the volatile oil in coffee leaves has hitherto proved itself decidedly disagreeable, when it has not been destroyed.
4. Dr. Stenhouse informs me that the results of his analysis afforded 1 per cent. of theine or caffeine; now, if this gives any idea of the feeding qualities of coffee leaves, I think the Society of Arts will do well to let the Sumatra folks enjoy their "rice and coffee" undisturbed, rather than foster the introduction of an article which might be cheaply produced for purposes of adulteration.

—I am, &c., JAMES MCPHERSON.

49, Hereford-road, Bayswater, W., March 1st, 1871.

GENERAL NOTES.

◆

The Society of Wood Carvers visited the exhibition of the Art-workmanship specimens on Friday, the 10th of February.

The Aurora Borealis.—Professor Zöllner has published the result of some experiments made upon the spectrum of the aurora borealis last October. The conclusion which he draws is, that if the light arises from incandescent gas particles of our atmosphere, the temperature at which it takes place must be very much lower than is required to render the same gases incandescent in Geiseler's tubes, so that the region in which the phenomenon occurs must be of extreme tenuity.

Artificial Fuel.—An invention for remedying the actual want of fuel in private houses in Paris during the siege is referred to by *Nature*. They prepared cylinders of clay impregnated with bituminous substances; these combustible cylinders were used like the ordinary charcoal which is necessary in Parisian cookery. The earthy matters, of which the proportion is not greater than necessary, remain in the furnaces like ashes left by the combustion of charcoal. It is stated that it is proposed to continue the use of this kind of artificial fuel.

Gas Wells.—Gas wells of a very remarkable nature have been discovered in Ohio, and described by Dr. Newberry, of the Geological Survey of that state. Near Millwood, two wells give out oil; two or three miles below these, in the valley of the Kokosing, borings have been made; and at the depth of 600 feet the augurs struck into vertical crevices, and sunk several feet without resistance. From these borings such a volume of carburetted hydrogen issued as was unparalleled in any of the oil explorations. The wells give out salt water intermittingly, throwing it to a height of more than a hundred feet. The gas of one of those wells, lighted at the end of a pipe two inches in the clear set in the well-head, produced a jet of flame twenty feet long, and as large as a hogshead. The gas appears to be pure, and in quantity sufficient to light a large city.

The Wolf Rock Lighthouse.—Mr. James N. Douglass, the engineer of the Trinity House, at the evening meeting, on Friday, the 17th inst., gave an account of the erection of the latest of our lighthouses, constructed by the Corporation of the Trinity House, on the Wolf, a very dangerous, rugged, porphyry rock, situate about nine miles south-west of the Land's End. The late Mr. James Walker furnished the design. The cutting out the foundation began on March 17, 1862, and on July 19, 1869, Sir Frederick Arrow, the Deputy-Master of the Trinity House, laid the last stone of the tower. The exact height of this tower is 116 ft. 4¾ in., and its diameter at the base, 41 ft. 8 in. It is built of granite, each face stone being dovetailed horizontally and vertically, and secured by strong bolts of yellow metal. The stonework was prepared at Penzance, and conveyed to the rock in barges by means of a steamer; and in the latter portion of the time the blocks were lifted into their position by a steam-winch—probably the first employment of steam power upon a tidal rock A fog-bell, weighing 5 cwt., is fixed on the lantern gallery. The light is of a perfectly distinctive character, being a dioptric light of the first order, exhibiting alternate flashes of red and white at half-minute intervals. The illuminating power of each beam is estimated at 31,500 English candles, or units of light. The light was first exhibited on January 1, 1870, and has since been regularly continued from sunset to sunrise every night. The total cost was £62,726, and it was effected without loss of life or limb to any of the persons employed, the average being seventy in number at one time. It contains seven rooms, adapted for living, sleeping, and stores and apparatus.

Wool Product of California.—The production of wool in California, in 1870, exceeded 20,000,000 lb. The average price was about 20 cents, the whole clip being worth 4,000,000 dollars. It is estimated that 1871 will see an increase of 25 per cent. in the quantity produced.

A New Kind of Leather.—Fifty skins of the anaconda snake have, according to a New York paper, been tanned by Schayer Brothers, at the Boston Highlands, for boot-leather. The largest of the skins was 40 feet in length. The tanning process was similar to that observed in the manufacture of alligator leather, the product being a highly-finished quality of leather—glossy, mottled, pliable, and, from the appearance of the grain, exceedingly durable.

Miniature Turbine.—The *Berg und Huettenmœnnische Zeitung* describes a small turbine, the diameter of which is only three inches. There are 24 passages of the water, each of which has an area of one-tenth of a square inch. It is driven by a fall of 35 feet, the water being led by a small pipe, having a sectional area of half of a square inch. This turbine is used for driving a lathe, in which an iron shaft of four inches diameter can be turned. The turbine, when not loaded, makes 2,288 revolutions per minute.

Prevention of Rust.—Dr. Crace Calvert states that iron immersed for a few minutes in a solution of carbonate of potash or soda will not rust for years, though exposed continually in a damp atmosphere. It was believed long ago by soap and alkali manufacturers that the caustic alkalies (soda or potash) protected iron and steel from rust, but that the components of these salts preserved the same property as they do in a caustic state new. It does not seem to matter whether the solution is made with fresh or sea water.

Nutrition of the Blood.—In Professor M. Foster's sixth lecture on the Nutrition of Animals, at the Royal Institution, some time was devoted to the consideration of the blood, which was described as an independent living tissue, composed of white and red cells or corpuscles and fluid plasma, and dying as soon as it escapes from the body, when it coagulates. Its fluidity and motion appear to depend upon mutual actions and reactions between itself and the blood-vessels, by which a certain equilibrium is maintained, and every particle in its course seems to obey a command. The death of the blood is not irrevocable; and blood from which the clot has been removed has been injected into the veins of exhausted persons with great advantage. Blood is really an epitome of the body, as it contains a very little of every part of it. All the products of digestion pass into it; by it all the tissues are formed; and with the food it also conveys the all-important element, oxygen.

Wool Imports.—The imports of sheep's wool last year were 873,927 bales, being about 6,300 bales below the imports of 1869. The falling off was principally in Cape, East Indian, and German wool. The Australasian wool imports were larger by about 50,000 bales than in the previous year, having reached the high figure of 549,264 bales. In goats' hair or wool, there has been a considerable decline in the last three years. Assuming the yield of the home clip for 1870 to have been equal to that of former years (which, according to a paper recently read before the Statistical Society in London, taken as an average of the four years 1867 to 1870, amounts, in round figures, to 160,000,000 lbs.); and considering that stocks of the raw material in the hands of consumers and dealers are admittedly very light—only importers of fine colonial wools holding rather more than the usual quantity at this time of the year—it appears, beyond all doubt, that the consumption of wool during 1870 has been on an unprecedentedly large scale, that more machinery than ever is profitably employed, and that the woollen trade altogether is decidedly in a most healthy state.

Gun Cotton Ivory.—It has been discovered that camphor, triturated with gun cotton, and subjected to hydraulic pressure, produces a hard white substance, which, if coated with a compound of gun cotton and castor oil, resembles ivory, to which for many purposes it is superior. In order to detect what takes place in this curious transformation, Professor Seely placed fragments of camphor in a test-tube, and closed its upper end with a plug of gun cotton; the tube was then set in a water-bath, when, in a few minutes, the tube became filled with red vapour, and the gun cotton exploded with violence. It has long been known that camphor must be added to alcohol before gun cotton will dissolve in it.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

March 8.—On "The Cultivation and Uses of Sugar Beet in England." By Dr. Augustus Voelcker, F.R.S. On this evening James Caird, Esq., C.B., will preside.

March 15.—On "The Different Methods of Extracting Sugar from Beet-root and Cane." By Ferdinand Kohn, Esq., C.E.

March 22.—On "Drill, the Complement of the Present School Teaching." By Major General Eardley-Wilmot, R.A.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal Institution, 2. General Monthly Meeting.
London Institution, 4. Mr. R. A. Proctor, M.A., F.R.A.S., "On Astronomy."
Victoria Institute, 8. Rev. W. W. English, M.A., "On Biblical Pneumatology and Psychology."
Farmers' Club, 5½. Mr. E. Tattersall, "On the Supply of English Cavalry Horses."
Society of Engineers, 8 Mr. Thomas Wilkins, "The Machinery and Utensils of a Brewery."
Social Science Association, 8. Dr. Letheby on "Legislative Measures for Preventing the Adulteration of Food and Drink."
Royal United Service Institution, 8½. Captain J. C. R. Colomb, on "General Principles of Naval Organisation."
Entomological, 7.
British Architects, 8.
Medical, 8.
Asiatic, 3.

Tues. ...Civil Engineers, 8. Mr. Alexander Beazeley, "On Phonic Coast Fog Signals."
Royal Institution, 3. Dr. Foster, "Nutrition of Animals."
Pathological, 8.
Ethnological, 8.

Wed. ...**SOCIETY OF ARTS, 8.** Dr. Voelker, on "The Cultivation and Uses of Sugar Beet in England."
Geological, 8. 1. Prof. A. C. Ramsay, on "The Red Rocks of England of older date than the Trias." 2. Rev. P B. Brodie, on "The 'Passage-beds' in the neighbourhood of Woolhope, Herefordshire, and on the discovery of a new species of *Eurypterus*, and some new land plants in them." 3. Mr. William Whitaker, on "The Cliff-sections of the Tertiary Beds West of Dieppe in Normandy and at Newhaven in Sussex."
Graphic, 8.
Microscopical, 8.
Royal Literary Fund, 3. Annual Meeting.
Archæological Association, 8.

Thurs...Royal Institution, 3. Dr. Odling, "Davy's Discoveries."
Royal, 8½.
London Institution, 7½. Prof. J. C. Rogers, M.A., "On the Colonial Question."
Antiquaries, 8½.
Royal Society Club, 6.
Mathematical, 8.
Society for the Encouragement of Fine Art, 8. Conversazione.

Fri.......**SOCIETY OF ARTS, 8.** India Conference. Sir Thomas Bazley, Bart., M.P., "On the Claims of Indian Cotton."
Architectural Association, 7½. Mr. G. H. Birch, "Christian Symbolism."
Royal Institution, 9. Dr. W. B. Carpenter, F.R.S., "The Latest Scientific Researches in the Mediterranean and Straits of Gibraltar."
Astronomical, 8.
Quekett Club, 8.

Sat......Royal Botanic, 3¾
Royal Institution, 3. Mr. O'Neil, "Spirit of the Age."

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FRIDAY, MARCH 10, 1871.

PROCEEDINGS OF THE SOCIETY.

INDIA COMMITTEE.

A Conference was held on Friday, March 3, on the subject of "The Commerce of India," being an adjourned discussion on a paper read before the Society on Feb. 15th, by Dadabhai Naoroji, Esq. Sir Bartle Frere, K.C.B., G.C.S.I., presided.

The Chairman said, since the adjournment, he had had two or three notes from gentlemen who volunteered to defend the government of India against what they conceived to be charges brought against it in the paper, but he believed the meeting generally would agree with him that this was not in the least necessary. No one could be more jealous than he himself of the good name of the Indian government, but he considered that no charge requiring a defence was brought forward. There was simply a statement of facts, which admitted of being proved or disproved, and whatever might be the result of the discussion, it was one in which the government of India above all ought to rejoice.

Mr. Briggs desired to concur in the opinion of some speakers on the previous evening, that the paper, good as it was, to some extent partook of the nature of a bill of indictment against the Indian policy of our government, but still he saw no reason why it should not be so, for he could not understand why the government should not be called to account for their Indian as well as their home policy, if necessary. It was not a party question, but one of life or death to the great masses of the people of India, who numbered some two hundred millions, and to an empire which it was said was the brightest gem in the English crown. If this were the case, why should it not be polished up a little, so as to bring out some of its native but dormant brilliancy. Without dwelling on the figures adduced, he should like to know how the value of the imports into India had been calculated, whether at the cost price or the price which they realised; and as an illustration of the importance of this question, he might remark that, some nine or ten years since, himself and others subscribed about £70,000 to purchase machinery, which was exported to India, for the purpose of developing the agricultural wealth of that country. When it arrived there, however, so many obstacles were thrown in their way, that the enterprise had to be given up in despair, and the whole of the valuable machinery was sold for less than £18,000. He should like to know whether, in such a case, the value would be computed at the larger or smaller figure. Upon the first head of Mr. Dadabhai Naoroji's paper, "What was the real extent of Indian commerce," he would merely say that it must depend upon the surplus produce of the soil after the support of its own people had been provided for. As to the second point, "The reasons why it was limited," he admitted that they were various, but there was one which underlaid the whole of the others, and that, he regretted to say, was a point upon which little had been said. That was the question of the land laws. He had said before, and did not shrink from repeating, that until a sound code of laws was adopted for alienating the lands for the mass of the people there was no hope for India. Before offering a people the power of self-government, they must be fixed to the soil, and then they would learn to respect law and order, and have a powerful stimulus to patriotism. Then, and not till then, would they find out what was their real interest, and conform to that old, but good proverb, "Honesty is the best policy." This was the key to the solution of the whole problem, moral, social, material, political, and economical. It was only by the adoption of such a policy that means would be found for the execution of railways, canals, irrigation, and cheap transit generally, so that the means of distribution might be perfected. It had been stated that there were many millions of acres of culturable waste lands, and government was blamed for not opening them up; but, judging from the past history of attempts to do so, it would be clearly seen that until the land laws alluded to were an accomplished fact, you might as well "call for spirits from the vasty deep" as expect the government to do these beneficent works. A guarantee for the loyalty and affection of the people had also been spoken of, but on this point also he would submit that no better guarantee could be found than a law which enabled the mass of the people to become land-owners in fee simple, by complying with the easy conditions of settling down and conforming to the just laws of citizenship. To give an illustration of his views, he would draw attention to a letter copied from the *Delhi Gazette* in the *Asiatic* of January 24th last, in which Mr. Login reported that the yield of cotton upon ground which he had been cultivating was 247 lbs. per acre, or nearly five times the average amount on the native system, and there were still fifty days remaining, during which, if the present rate continued, he expected to get 5 lbs. per acre per day, so that there would be a total of nearly 500 lbs. per acre. If this was the same Mr. Login who read a paper before the Society of Arts, he ought to be recognised at once as a grand pioneer of that mode of culture which would be the only way to regenerate India. To show the native mind what they got for the 10 or 12 millions sterling which they sent annually to England, he would take Mr. Login's estimate at the lowest figure, that there might be no exaggeration, viz., five times the present average. Now, Mr. Dadabhai Naoroji put the present value of the production per head of India at 80s. per annum, which, taking the population at 200,000,000, made £800,000,000; multiplying this by five, you got £4,000,000,000, which would be the produce, according to Mr. Login's estimate, if the land were properly treated, the truth of which had been demonstrated by actual experience. Surely this was a profit sufficient to satisfy any reasonable man. True, it might be said that this has never yet been realised, but whose fault was that? Such men as Lord Canning had brains enough to devise a scheme for the alienation of waste lands, and this was the foundation stone, worth at least £2,000,000,000. Then such men as Sir Arthur Cotton, whose energy was shown in facilitating distribution, by means of steam-ships, and increased production, by irrigation, was worth another 1,000 millions. Then came such men as Mr. Login, whom he had just quoted, whose engineering skill could not be surpassed, and the result of such action as his was worth another 1,000 millions. He omitted other names, because he considered other statesmen were to be accounted good, bad, or indifferent, according as they utilised by their legislation the brains of the class of men he had just described. It was evident that if cause and effect were not correctly recognised in these matters, the interest and sympathy of the public would not be enlisted in the cause, and their support could not be expected, and this was evidenced by the present state of affairs. Was not only the Queen's speech destitute of any allusion to Indian matters, but when the Indian Budget was brought on scarcely a score of M.P.'s were to be found at their post, and even many of these left before the conclusion of the debate. All honour, however, to those who remained, and whose names, and those of their constituencies, ought, in his opinion, to be inscribed in letters of gold.

Mr. Tayler said it must be a cause of great regret to all who really took an interest in India, that some of the statements made by Mr. Dadabhai Naoroji, in his very able paper, had been the cause of some misapprehension. He used the word "misapprehension," because he felt convinced that all who were acquainted with the able author would feel it was perfectly preposterous to impute to him any desire to exhibit disloyalty to the government, or to raise any vexatious antagonism to the present authorities. Englishmen were apt to attribute to the natives rather a leaning to that over-subserviency to the powers that be which was disapproved of in this country. It was therefore painful to think that an assembly of Englishmen should in any way censure or disapprove of such a manly, frank, and independent declaration of opinion as that which was presented in the paper. He should be very sorry to think that the natives of India, many of whom would no doubt read the record of what had taken place, should be impressed with the idea that Englishmen condemned in others what they admired in themselves. He did not propose to enter into the question of the amount of clothing the ancient Britons possessed at the time when India was in a state of high civilisation, for he thought the present condition of affairs was more important; and certainly, if each native of India at the present moment were to add only one small piece of cloth to his habiliments, it would be an exceedingly interesting fact to Manchester, and would be a source of immense profit to English manufacturers. Statistics, of which he had the greatest abhorrence, were generally a most fruitful source of controversy, and Mr. Cassels had disputed to a certain extent those cited in the paper. At the same time he was sure, if any gentleman were to go into them, it would be found that there were considerable elements of confusion. For instance, he considered it rather unnecessary to go back so far to those bad times, as Mr. Gladstone called them, and to take an average of seventy years' imports. He thought a period embracing the last ten or twenty years would have been amply sufficient. However, the real point at issue was this—Mr. Dadabhai Naoroji's statement was, that the rule of England was a foreign rule, and that any foreign ruler would take from the subject kingdom a certain amount of money, under the name of tribute or something else; and taking this at ten or twelve millions, he said nothing was given in return in the shape of material, tangible money. He did not for a moment suppose that it was meant to imply that nothing at all in the shape of moral return was made, or that security to life and property, an immunity from external danger, a certain administration of justice, and the blessing of education to a certain extent, though not so great as it ought to be, had not been given to India. If anyone were to deny that, he need only point to Mr. Dadabhai Naoroji himself as a signal illustration. The question was, Did England do her duty adequately to the people subject to her? What were the facts? After a whole century of struggle for supremacy, partly by honourable means, partly by judicious treaty, partly by questionable intrigue, and partly by most unquestionable spoliation, the English nation had become at last the paramount power throughout the whole of British India. This was not to be disputed. The question was, had England done its duty to India? Here were two nations brought into contact, one strong in the strength of advanced civilisation, of wealth, of situation, and of political power, the other weak in semi-barbarism, ignorance and superstition. The two were brought together, and the weak nation was now under the dominion of the strong, and subject, he hoped willingly, but, certainly, without open resistance, to its power. These people possessed a country, one of the most magnificent in the creation, with noble mountains, glorious rivers, miles of cultivated fields, and possessing unlimited capabilities of yielding everything man could wish to enjoy; yet these 200 millions of people were weak, poor, and impoverished. In auspicious seasons they reaped, by their patient labour, a scanty subsistence; but if heaven denied them the early and the latter rains, they died in tens of thousands, and the whole land was whitened with their bones. Did the British government fulfil its trust to these poor people? He must say, he thought it was a question more easy to ask than to answer. Of the glitter, pomp, and pride of outward circumstances there was more than enough. There was a covenanted and uncovenanted service, unequalled in the world; there were laws, though many of them were unsuited to the people; there were courts, where justice was professedly equally administered; the Viceroy was a live lord, and scarlet and gold glittered around the government house; the whole outward paraphernalia was magnificent; but in spite of all that, he maintained that we had abused our trust, had neglected the poor, had paid far too much attention to the outside of the platter, and that whilst wash after wash in meretricious plaster had been laid on the exterior of the sepulchre, the inside of it was full of unclean things, and too often, he feared, of dead men's bones. What was to be done? At this moment the rich middle-classes, the native millionaires, and the salaried officials, uttered shrieks, as Mr. Grant Duff said, when any unwelcome taxation was imposed upon them, their voice was re-echoed through the press, and their cries were heard and attended to; but who was there to speak, or agitate, or think for the 200 millions of poor people who, according to the *Times*, lived on 2d. a-day, and required but a few rags to clothe them. Were these people adequately represented, and justly taxed? He would entreat those who had any interest in the councils of the empire, to impress it upon those at the head of affairs that now, when a certain breathing time was allowed us, when there was an increase of productiveness in the land, and consequently contentment of the people, they ought to propose to themselves the question whether England was doing her duty to this immense nation which was placed under her charge. For this purpose, the great points to be aimed at were, first of all, the increase of artificial irrigation, of what was truly called the water of life; the increase of rapid locomotion, in order that the surplus produce of the land might be distributed; the release of the poor from the oppression of usurious money-lenders (which he was glad to see, had already been initiated by Lord Mayo); the proper equalisation of taxation, and the relief of the poor from the duty on their only luxury, which was in reality a prime necessary of life, for to those who lived entirely on vegetables salt was absolutely essential to health. Yet a taxation of 7 per cent was imposed upon their poor pittance. In conclusion, he would repeat that the foundation of all successful adminstration in India, of all stability, and all essential success, might be summed up in this one sentence:—First, the productiveness of the soil; secondly, the contentment of the people.

Mr. Kazi Shahabudin said Mr. Hyde Clarke had complained that although the title of the paper was the commerce of India, the discussion had been on the government; but he seemed to have forgotten one great point, that in India all the results affecting the material and intellectual conditions of the people were traceable to the action and agency of the government, contrary to what took place in England, where, if anything went wrong, the people themselves were to blame. In India, everything being done by the government, it must both take the credit for what good it did, and also accept the blame for its shortcomings. Anyone taking up the trade returns, and analysing them, would find an extraordinary state of things—that the exports exceeded its imports by millions. This was a startling fact, because no country could be in a prosperous condition where it existed. He might illustrate it in this way: If a merchant in Bombay sent £100 worth of goods to England he must get back, not only his £100, but a profit to cover his expenses, and to support him. If he got only £92 he could not say he was prospering, and the end would be that he must close his concern. Now, in the trade of India, there were other items mixed up in the returns which were not commercial. To continue the same illustration. If the Bombay merchant had a friend in London, and sent to him saying he was in difficult circumstances, and his friend sent him a loan of £15, you could not call that a commercial export; it was no return for goods sent, it was only a loan, which stood to the credit of his English friend, and must be repaid. In the same way, these loans formed a large portion of Indian imports. Mr. Cassels said that India, in the ten years before 1866, imported £180,000,000 of bullion, and so it was; but, taking this fact apart from the whole of her commerce, it was apt to give an erroneous impression. Persons not understanding political economy might suppose it was all imported and hoarded, that it was all profit, but he could see no difference between bullion and other merchandise. It was just like piece goods or hardware. Now, taking the ten years during which this amount of bullion was imported, the exports were, during that time £438,000,000, and the imports, including the bullion, £405,000,000. In these imports were included £101,000,000 of merchandise, not commercial imports at all, either debt contracted in England or money advanced for the purpose of railway loan or otherwise, and all this £101,000,000 really stood to the debit of India; thus, there was a balance against India of £134,000,000 in ten years, or at the rate of about £13,000,000 a-year, which was the estimated transfer of wealth from India to England. Mr. Cassels also stated that of late years the exports and imports were nearly equal, but that exports from India must always be in excess of imports. He would only say that any student of political economy would agree with him, that neither India nor any other country could prosper if her exports were kept in excess of her imports to the amount of millions. If this were the case, he needed to be considerably enlightened. The question would naturally arise, what must be the condition of a country, and what were the causes of this state of things. The question had been answered in two ways; one answer had been given by Mr. Dadabhai Naoroji, and the other answer had been given in various ways; for instance, that the present government was a great improvement on the former state of things. He did not consider that an answer. It was a great mistake for anyone to suppose that the natives of India were not sensible of the benefits of English rule. Those who held this view did not do justice to his countrymen, or to the education given by the English government, but a comparison with the former condition ought not to be any source of satisfaction. The same might be said of England. Notwithstanding all the improvements of modern times, the nation were still clamouring for more. His friend, on the other hand, said the actual condition of the country was best estimated at its produce, and this he put at 40s. per head; the 100 per cent. for the opium, salt, and other taxes, and human industry, his figures came to about 2s. per head of the population per week, and this had been confirmed in Parliament by the Under Secretary of State for India. If any other confirmation were required, he would appeal to those who had passed through the country and lived among the people. The report submitted by a government official in Madras, stated that the cost of living in government gaols, including clothing, was 3 rupees per month, and it was admitted that the diet given in gaols was not available for the masses. Again, Mr. Elliot, an officer in the North-Western Province, said the diet in the gaols was large and generous, and that the half-agricultural population did not know what it was to have their hunger fully satisfied. Bombay was the most flourishing presidency, but the condition of the masses there, with which he was well acquainted, having been a government official, was not much better; in fact, the masses generally were no better than paupers. Very recently, Mr. Cave quoted the price of grain at Jubbulpoor, and inferred therefrom a high state of prosperity; but how many Jubbulpoors were there in India? There were hundreds of places not far off where grain was as cheap as anything could be, and the price of labour very low indeed, so that such an isolated instance was no criterion whatever.

Mr. Maitland thought the main question was, what could really be done for India, rather than whether all the details of figures given were absolutely correct. It was not his intention to defend the government of India in every respect, but some statements had been made in the paper which, if they passed without comment, would, he believed, tend to produce effects which the writer would be the first to regret, for an over-statement was always a source of weakness. Now, in dealing with the commerce of India, Mr. Dadabhai Naoroji had compared it, taking the computed value per head of population, with the exports and imports of English colonies in North America, Australia, and elsewhere; but it had been often said that figures would prove anything, and when statistics were given, it was of the utmost importance that correct deductions should be drawn from them, or they would do more harm than good. He contended that one might as well take as a comparison the empire of China. It had a very fertile soil, and one of the most hard-working and thrifty populations in the world. The country was of such vast extent, that it was impossible to say exactly what the population was, but it was estimated at from 300,000,000 to 350,000,000; and taking the exports of tea, silk, &c., that came from there, and dividing them by the number of the population, the result would be most astonishing. The fact was, that large parts of the empire of China were so far removed from the seaboard that it was quite impossible that they ever could export any quantity of produce. The country was so imbedded in Asia that it was not possible for large parts of the interior, however industrious the population, to do more than produce enough for themselves and their neighbours. And it was the same with India to a great extent. As he heard Mr. Grant Duff say the other evening, one great difficulty in governing India was, that with the revenue contributed by 150,000,000 of people you had to govern as well as possible, in a scientific and proper way, 200,000,000. The meaning of that was, that a large portion of the population were not producers; they were still in a state of whole or partial savagedom, and a large number were so far removed from the sea coast that their bulky produce could never be exported. It was absurd, therefore, to draw a comparison between such a country and England, covered as it was with a network of railways, or with Australia, with a population of perhaps 2,000,000, everyone of whom almost was a producer of something. An American would laugh at the idea of taking an average per head of exports of all the individuals subject to the United States government, including the Red Indians; and on the same principle, only that portion of the population within reach of the seaboard ought to be taken into account. The same with regard to imports. It was said that Australia imported goods to the value of £6 per head, as against 2s. per head for India, but it must be remembered that from time immemorial India had been the seat of manufactures herself. He remembered the time when large quantities of piece goods came from India to England. It was useless, too, to go back so far as 70 years, especially when the statistics of a more recent period showed great improvements. In 1853, he went out to become a partner in a house in India, and he left in 1864, and during that time he witnessed remarkable changes, and the same had occurred between 1864 and the present time. He did not speak without knowledge, having had the honour to be President of the Bengal Chamber of Commerce, and a member of the

Legislative Council of Bengal. He could say without hesitation, and would refer to any of his brother merchants in India to confirm the statement, that from 1853 to 1864, and again from 1864 to the present time, there had been an immense development of the commerce of India. He wished there were ten miles of railroad and canal for every one yet made, but still it was no use shutting one's eyes to what had been done during the past few years. Again, Mr. Naoroji had spoken of poor India being drained of its talent and brains, all the government officials coming home after a time, but there was a constant succession of able men to replace those who left, and it was quite a mistake to suppose that those who had been in India, when they came home, forgot her, and took no interest in her welfare. The real question, however, was, what could be done to improve the condition of India? The scheme of decentralisation was about to be brought into play, and no doubt the paper which the chairman had read in that room a short time ago was not without its influence in that direction. Railways were extending, and one very satisfactory feature in the case was, that some of the native princes were coming forward to contribute funds for this purpose. Another thing which he much wished to see, and which, as far back as 1857, he had pressed upon the attention of the Indian government, was the abolition of the export duties on articles of Indian produce, particularly those which had to compete with the produce of other countries. At all events, those duties should be very moderate, and not like the present high duty on rice. He believed this would now receive attention, for he noticed that Lord Mayo, in advocating the establishment of a Department of Agriculture for India, said he doubted whether, if such a department had existed, it would be possible to impose or maintain export duties on the staple products of the country. In conclusion, he hoped it would not go forth to the people of India that the House of Commons paid little or no attention to Indian affairs, for he was pleased to see what an improvement was being manifested in this respect, a much larger attendance than usual having marked the introduction of the Indian budget.

General Sir Arthur Cotton said he could not agree with the last speaker, that there were districts in China and India which must always be cut off from all foreign commerce, the fundamental fact in the question of foreign commerce being that every part of the world was accessible to every other part. It was simply necessary to make internal transit so cheap that anything could be conveyed almost any distance, and that was one of the most essential points of the present question. It was said that there were parts of India inaccessible to the ocean, but this was the very point in dispute, and to say that they always must be so was begging the question. The Western States of America were completely cut off from the rest of the world; but now, by means of canals and railways, they were brought into communication with the seaboard, and their produce was conveyed thousands of miles, and brought into competition in the markets of the world. It was a matter of unmixed satisfaction to him to see Mr. Dadabhai Naoroji and other native gentlemen standing up, meeting Englishmen face to face, and discussing these questions; and he hoped other intelligent native gentlemen would come forward and do the same. There was, however, one main source of fallacy in almost every statement put forth with regard to India, and that was that the difference in the value of money was not taken account of. Now, this difference between England and India was at least three to one, and sometimes four to one, at the present moment; and when 2s. a head in India was spoken of in comparison with other places, it ought really to be 7s. or 8s. per head. If this fact was not kept in view, it falsified every inference. Again, as to going back 70 years, he thought we had quite sufficient to bear of our own sins without answering for those of our grandfathers, and the question was, what had been done during the last few years, and what was doing now? From 1858 to 1867, the import of bullion into India above the exports had been 164 millions, or about 16½ millions a-year, and he submitted that that was a *bonâ-fide* increase of wealth to India. No doubt, they had sent home the value of it, having sold produce beyond what was consumed for their own use, which had enabled them to import this amount of money. Then, when comparing the imports of British manufactures into India and into Australia, the 1s. 9d. per head in the former case must be multiplied by at least three, as he had before said, in order to make a fair comparison, and in the next place the difference of climate, and consequently the amount of clothing required, must be borne in mind. If all the natives of India had to clothe themselves in pea-jackets and warm trousers, there would of course be an immense increase in this respect. Some doubt had been thrown on the rise of prices in India, but it was a positive fact that the fall in the value of money during the last fifteen years was at least equal to two to one, and this was an immense boon to the natives in its bearing on the land-tax. Fifteen years ago, this tax was one rupee an acre, and it was the same now; but at the present moment they only had to sell half the produce to raise the tax as they formerly had. Mr. Tayler had touched upon one of the most important points when he said that there was no provision for hearing the voice of the masses of the people of India. That was the grand fundamental evil, for in the present state of things there was no possibility of their being heard. If a tax was imposed which affected the merchants, or the zemindars, or the planters, or if anything was done which affected the government officials, there was no end of discussion about it, but a financier might lay a tax on the poor people's salt, and nobody said a word. That was a most terrible evil, and one which ought to be remedied. The slaves in America were never allowed to speak, nothing was heard of them, they had no representation, but the result was a concussion which shook the whole Union to its basis, and ended in the destruction of half a million of people, and a debt of £400,000,000. This was the simple result of treating the mass of the labouring classes with contempt and indifference. The masses of the people could not be left in this position with impunity. The case of the Orissa famine had also been mentioned, and Mr. Dadabhai Naoroji had been found fault with for complaining that rice had been exported from India whilst thousands were dying with famine. In his opinion, however, he was perfectly right, and that famine was one of the greatest blots that ever fell upon a nation. At the moment that hundreds of thousands were dying for want of food, 50,000 tons of rice were being sent away to England. Could anybody say that the government could not have stopped those ships, brought them to Orissa, and discharged them there? How Europeans could have stood by and seen that awful calamity, and not bought one shipload of rice to save the lives was most astounding in his eyes. It was no use ignoring this lamentable fact. While agreeing that the country was in a state of impoverishment such as ought not to be, he at the same time agreed that there had been a very great improvement made, and that things were now vastly improving. The main point was to increase the production and cheaper transit. It had been well said that a country rich in roads, arsenals, and stores possessed in reality a public fortune. India was one of the poorest countries in the world, because she was in want of highways and ports, and systems of irrigation, and other arrangements for developing her wealth. France was a wealthy nation, because for ages past her rulers had devoted themseves to the creation of these modes of communication, which rendered available her productive soil and the efforts of her industrious population. At the present moment there were in India twelve vast works of irrigation on hand, which if completed would irrigate fifteen millions of acres, produce sixty millions worth a year of produce, and give 15,000 miles of cheap transit, and nothing was wanted but to push them on. He was sorry to say, however, that as soon as the East Indian irrigation works were purchased by the government they were immediately stopped, though they were in a forward state of completion. He could not conceive a greater blunder.

Mr. Dadabhai Naoroji, in replying, said he felt exceedingly thankful for the way in which his paper had been received and discussed; and, notwithstanding that some few remarks had been made, as was supposed, in opposition to his views, he could not but congratulate himself that his main points had been maintained and developed much more forcibly by other speakers than by himself. He had, however, been in one or two instances slightly misunderstood, as he would endeavour to explain. He had purposely avoided drawing any comparison between the past and present, and had introduced the statistics showing the excess of exports over imports merely to show how fallacious were the statements sometimes put forth on the highest authority, and although this was no doubt unintentional, it was none the less misleading. In a question of commerce, in which figures were the basis of the whole argument, it was absolutely essential that they should be accurate, and he must therefore be excused for saying that a great deal more care than was usually given was required in drawing conclusions from the statistics to which he had referred. He had never denied that some progress had been made during the last fifteen years, but upon this point also he would venture to use the following illustration:—A strong man knocked down a weaker one, and, to use the words of Mr. Grant Duff, almost ground him to dust, and then, after giving him a glass of water to revive him, said, "See how I have benefited you; I have given you a good glass of water, and now you are ever so much better." Down to 1850,* India was being continually impoverished, and then the government themselves, being aghast at the results, began to look about to see what could be done. They soon struck upon the right path, which was, to send back to India the wealth which had been drained from her during 70 years, to the extent of hundreds of millions. £100,000,000 had been lent for the purpose of constructing railways, but this was not enough. England had drawn from India twenty times as much as she had yet lent her. He did not claim that it should be returned, he simply asked for a loan of so much money as would enable India to supply herself with necessary public works, and it should all be repaid with a thousand thanks for England's good government. When India was lying in the dust, exhausted and helpless, only just reviving a little, it was no use saying to her, "You must help yourself." If no other feeling prompted such action—though he contended there could be no higher object of ambition than to raise up a nation of 200 million souls—selfishness alone should lead Britain not to drain India entirely dry. Many speakers had mistaken his views, but all had agreed that India required further help; and in replying to the charge which had been made against him in some quarters, of not doing justice to the good services which England had rendered to India, he had simply to submit a Dr. and Cr. account which he had sketched out, and to which he believed no exception could be taken.

Cr.—*In the cause of Humanity.*—Abolition of suttee and infanticide. Destruction of Dacoits, Thugs, Pindarees, and other such pests of Indian society. Remarriage of Hindoo widows, and charitable aid in times of famine. Glorious work all this, of which any nation may well be proud, and such as has not fallen to the lot of any people in the history of mankind.

In the cause of Civilisation.—Education, both male and female. Though yet only partial, an inestimable blessing as far as it has gone, and leading gradually to the destruction of superstition, and many moral and social evils. Resuscitation of India's own noble literature, modified and refined by the enlightenment of the West. The only pity is, that as much has not been done as might have been in this noble work; but still India must be, and is, deeply grateful.

Politically.—Peace and order. Freedom of speech and liberty of the press. Higher political knowledge and aspirations. Improvement of government in the native states. Security of life and property. Freedom from oppression caused by the caprice or avarice of despotic rulers, and from devastation by war. Equal justice between man and man, sometimes vitiated by partiality to Europeans. Services of highly educated administrators, who have achieved the above-mentioned good results.

Materially.—Loans for railways and irrigation. (I have been particularly charged with ignoring this, but I consider it one of the greatest benefits you have conferred upon India, inasmuch as it has enabled us to produce more than we could before, though there is not yet enough for all India's ordinary wants.) I cannot ascertain the exact amount of investments in irrigation works, but I take them to be about £10,000,000, making the total £110,000,000. The development of a few valuable products, such as indigo, tea, coffee, silk, &c. Increase of exports. Telegraphs.

Generally.—A slowly growing desire of late to treat India equitably, and as a country held in trust. Good intentions.

No nation on the face of the earth has ever had the opportunity of achieving such a glorious work as this. I hope in this credit side of the account I have done no injustice, and if I have omitted any item which anyone may think of importance, I shall have the greatest pleasure in inserting it. I appreciate, and so do my countrymen, what England has done for India, and I know that it is only in British hands that her regeneration can be accomplished. Now for the debit side.

Dr.—*In the cause of Humanity.*—Nothing. Everything, therefore, is in your favour under this head.

In the cause of Civilisation.—As I have said already there has been a failure to do as much as might have been done, but I put nothing to the debit. Much has been done, or I should not be standing here this evening.

Politically.—Repeated breach of pledges to give the natives a fair and reasonable share in the higher administration of their own country, which has much shaken confidence in the good faith of the British word. Political aspirations and the legitimate claim to have a reasonable voice in the legislation and the imposition and disbursement of taxes, met to a very slight degree, thus treating the natives of India not as British subjects, to whom representation is a birthright, but as something like British helots.

[I stop here a moment to say a word as to a mistake into which my friend, Mr. Hyde Clarke, fell, in supposing that I desired the government of India to be at once transferred to the natives. In my belief a greater calamity could not befall India than for England to go away and leave her to herself].

Consequent on the above, an utter disregard of the feelings and views of the natives. The great moral evil of the drain of the wisdom of practical administration and statesmanship, leaving none to guide the rising generation. (Here, again, have I been misunderstood. I complain not of Englishmen returning to their own country, but of the whole administration being kept entirely in English hands, so that none of the natives are brought up to and taught the responsibilities and duties of office, so that we have none amongst ourselves to guide us as our elders, and to teach us our duties as citizens and as moral beings. A foster-mother or nurse will never supply the place of the real mother, unless she shows more kindness and attention to her charge than the real mother, and the natives will therefore naturally follow their own leaders, unless you prove more kind, humane, and considerate. Draw these leaders on your side. True, the policy adopted during the last 15 years is a hopeful one, and, if persevered in, gratitude and contentment will follow.) The indifference to India even of a large portion of those who had Indian care and who are living on Indian pensions. The culpable indifference of a large portion of the people, the public press, and Parliament of this country to the interests of India; therefore, periodical committees of inquiry are absolutely necessary, for the knowledge that such will take place would be a check on careless administration. With regard to the native States, though their system is improving, it is most unjust that their cases should be decided in secret. The frequent change of officials is a constant source of disturbance in policy, and, though it may be unavoidable, it is none the less hard upon India.

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* Sir A. Cotton told me, after the meeting, that I was quite right, that about 1850 the poor people were very wretched.

Financially.—All attention is engrossed in devising new modes of taxation, without any adequate effort to increase the means of the people to pay; and the consequent vexation and oppressiveness of the taxes imposed, imperial and local. Inequitable financial relations between England and India, *i.e.*, the political debt of £100,000,000, clapped on India's shoulders, and all home charges also, though the British exchequer contributes £3,600,000 to the expenses of the colonies. The crushing and economically rude and unintelligent policy of making the present generation pay the whole cost of public works for the benefit of the future, instead of making the political like all other machinery, and distributing the weight so as to make a small power lift a large weight by the aid of time. The results of trying to produce something out of nothing, of the want of intelligent adaptation of financial machinery, and of much reckless expenditure; in financial embarrassments, and deep discontent of the people.

Materially.—The political drain up to this time, from India to England, of above £500,000,000, at the lowest computation, in principal alone, which with interest would be some thousands of millions. The further continuation of this drain at the rate, at present, of above £12,000,000, with a tendency to increase. (I do not mean this as a complaint; you must have a return for the services rendered to India, but let us have the means of paying. If I have a manager to whom I pay £1,000 a-year, and he only makes the business produce £400, so that £600 a-year must be paid him out of capital, any man of business can see what will be the result. Peace and order will soon be completely established by the closing of the concern.)

The consequent continuous impoverishment and exhaustion of the country, except so far as it has been very partially relieved and replenished by the railway and irrigation loans, and the windfall of the consequences of the American war, since 1850. Even with this relief, the material condition of India is such that the great mass of the poor people have hardly 2d. a day and a few rags, or a scanty subsistence. The famines that were in their power to prevent, if they had done their duty, as a good and intelligent government.

Contra.—Increase of exports; loss of manufacturing industry and skill. Here I end the debit side.

About Sir A. Cotton's remarks I would just say this. Suppose rice could be got at the shipping ports in India at 6s. a cwt., and transit to this country cost 2s. more, the price at which people here get it is only about 9s., and not that people here pay 24s. for which in India natives pay only 6s. If it were so, if English people would be kind enough to give us 24s. or 18s. for what in India fetches 6s., we shall be very thankful and rich in a very short time. Again, if an article costs 5s. here, and takes 1s. transit to India, the people in India have not to pay one-third (or 2s. only) of what you pay them, but have to pay with ordinary profit 7s. for the article. What I suppose Sir A. Cotton means is, that for certain necessities of existence here you require somewhat more material and therefore more money than in India. That is true, but what I maintain is, that comparatively less as the absolute wants of natives may be, they have not even then been sufficiently supplied. But to say that the natives of India would not like to enjoy as much the good things of this world as any other people is neither fact nor nature. See the manner in which the rich Hindoos and Mahommedans of Bombay live.

It is sometimes said that loans beget waste. I cannot see how money of loans can have waste in its character more than money from revenue. The right horse to saddle with about waste is the officer who wastes, and not that the money is a loan. A wasteful officer would as much waste money from revenue as from loans. The condemnation of waste must be in the administrative system and men, and not in the source from which money comes.

With regard to exports being merely surplus produce, there cannot be a greater mistake than that which was advanced by one speaker, that a country could not export anything until all her own people were fed. A country might not consume a farthing's worth of its own produce, but might send it all away, and, getting in return what was more valuable, become wealthy and happy. Surplus has nothing to do with it. England formerly tried by forcible means to keep her own produce at home, but now she got corn from all the world. To sum up the whole, the British rule has been—morally, a blessing; politically, peace and order on one hand, blunders on the other; materially, impoverishment (relieved as far as the railway and other loans go) by taxation, or, as the natives call it, "Sakar ki Churi," the knife of sugar. That is to say, there is no oppression, it is all smooth and sweet, but it is the knife, notwithstanding. I mention this that you should know these feelings. Our great misfortune is that you do not know our wants. The great problems before the English statesmen are two. 1. To make the foreign rule self-supporting, either by returning to India, in some shape or other, the wealth that has been, and is being, drawn from it, or by stopping that drain in some way till India is so far improved in its material condition as to be able to produce enough for its own ordinary wants, and the extraordinary ones of a costly distant rule. If you cannot feel yourself actuated by the high and noble ambition of the amelioration of 200,000,000 of human beings, let your self-interest suggest to you to take care of the bird that gives the golden egg of £12,000,000 a-year to your nation, and provisions to thousands of your people of all classes. In the name of humanity, I implore our rulers to make up their minds not to prevent the restoration of the equilibrium, after the continuous exhaustion by drain and by horrible famines. I do not in the least grudge any legitimate benefit England may derive for its rule in India. On the contrary, I am thankful for its invaluable moral benefits; but it is the further duty of England to give us such a government, and all the benefit of its power and credit, to enable us to pay, without starving or dying by famine, the tribute or price for the rule. 2. How to satisfy reasonably the growing political aspirations and just rights of a people called British subjects, to have a fair share in the administration and legislation of their own country. If the Select Committee solve these two problems, before which all other difficulties, financial or others, are as nothing, they will deserve the blessings of 200,000,000 of the human race.

The **Chairman** said he would not detain the meeting by any attempt to sum up the discussion, but there were one or two results which it might be useful to bear in mind. In the first place, there seemed a pretty general consent that, during the last few years, England had been trying to do her duty to India; that the way had been discovered by which India could be made such a part of the British empire as would strengthen both England and herself, and that the chief reasonable complaint was, that what was necessary to the end had not been done to the proper extent. When a large population like that of India began to be animated by one set of feelings and aspirations, they would feel, as all felt in England, that the performance of to-day was always insufficient for the hopes of to-morrow, and that you must continually endeavour to do more than your fathers have done if you would come up to the reasonable expectations of your children. For this reason there was no doubt room for a much greater demand upon England than she had hitherto been in the habit of considering she could be fairly called upon to meet. But what was the demand? Mr. Naoroji had said he believed the desire of Englishmen was to rule others as they would be ruled themselves, and he asked no more. But while such were the wishes and feelings of England, there was a material short-coming in her performances, owing, as he believed, in great measure, to the habit of measuring what had been done by the limited area of our own country. We ought to go farther in the same path we had recently been following. For every mile of railway there ought to be ten, and for every mile of canal a hundred, and then it might be hoped that India would begin to approach more nearly to the condition of America, and we should have as go-a-head a race in India as our cousins in the west. Nor was this an unreasonable expectation, as far as he could see. The development of India's commerce had hardly begun, and he felt every confidence that the younger members of his audience would see the day when what was thought the great performances of to-day would be looked back upon as something extremely small. Above all, it must be remembered that when England was asked to lend money to India, it was not in the way of charity, but in the way of business, and more than the average profit would be returned; so that the bargain was likely to be beneficial in a high degree to both parties. One great difficulty was, that we did not yet sufficiently know what was required, for we were but poorly informed of the wants of those whose voice was not heard in the council of the nation. He was glad to see, however, that the House of Commons was beginning to call upon the rulers of India to give an account of their stewardship, and the more of this there was the better. Another great want was, that the natives should have more voice in the passing of the laws by which they were governed; and he must say the experiment in this direction had been most successful so far as it went, though that was almost an infinitesimal distance. In conclusion, he proposed a cordial vote of thanks to Mr. Dadabhai Naoroji for his able and eloquent paper.

A vote of thanks was also passed to the Chairman for his kindness in presiding at the adjourned discssion, and the proceedings then terminated.

FOURTEENTH ORDINARY MEETING.

Wednesday, 8th March, 1871; JAMES CAIRD, Esq., C.B., in the chair.

The following candidates were proposed for election as members of the Society:—

Beanes, Edward, Avon-house, Dulwich-common, S.E.
Brunsdon, Richard, 92, St. Vincent-street, Glasgow.
Burra, Henry, Rye, Sussex.
Larsen, J. D., 1, The Avenue, Blackheath, S.E.
Phipson, Herbert M., 15, Delancey-street, Regent's-park, N.W.
Pratt, Daniel, Tentercroft, Cuckfield, Sussex.
Webster, William, 15, Highbury-hill, N.

AND AS HONORARY CORRESPONDING MEMBER.

Roberts, Samuel Hartley, 116, Swanston-street, Melbourne.

The following candidates were balloted for and duly elected members of the Society:—

Blencowe, J. G., the Hooke, Lewes.
Cunliffe, Roger, 6, Princes-street, Mansion-house, E.C.
Davis, Samuel, 14, Strand, W.C.
Ogle, John, St. Clere, Sevenoaks.
Pennington, Frederick, 17, Hyde-park-terrace, W.
Robinson, Thomas L., Union Bank, Croydon.
Spartali, Michael, 25, Old Broad-street, E.C.
Whiteman, John, 32, Hilldrop-road, N.

The Paper read was—

ON THE CULTIVATION AND USES OF SUGAR-BEET IN ENGLAND.

By Dr. Augustus Voelcker, F.R.S.

Scarcely a longer period than half a century lies behind us since the first beetroot-sugar manufactory was erected in Germany, and sugar was extracted from beet-root on a commercial scale. Like other new branches of industry, the production of beet-root sugar, at first, had to encounter the unreasoning opposition of men who look with suspicion upon anything bearing the stamp of novelty. Its development, moreover, was hampered by stupid and vexatious fiscal regulations, and the new industry had to struggle for nearly twenty-five years with all the difficulties which are common to all technical enterprises, which can only be carried on successfully after much experience has been gained, and men have been taught to avoid the shoals and quicksands impeding progress, and to carry into practice the scientific principles upon which success depends.

The difficulties which the manufacturer of beet-root sugar had to meet at the outset were indeed great, for he had not only to contend with his own inexperience as regards the plans of extracting sugar in the most profitable manner from beets, but he had likewise to acqaint himself with all the conditions as regards soil, climate, and manuring, favourable or opposed to the abundant development of sugar in the root; and finally he had to teach his own slowly-acquired experience in the field—and all agricultural experience of necessity is slow—to the agriculturist upon whom he had to depend for the supply of his raw materials. Time will not permit me, on the present occasion, to give a sketch of the rise and progress of the beet-root industry. Suffice it to say that, considering the difficulties under which it had to struggle at first, it made rapid progress on the Continent during the last twenty years. The cultivation of beet-root is still largely extending in France, the North of Germany, Belgium, and Austria. It has found its way into several districts of Russia, the soil and climate of which appear to be remarkably well suited for the production of roots rich in sugar, and it has been introduced more or less successfully into Sweden, and various parts of the United States. There are at present over 500 beet-root sugar factories and distilleries in France, nearly 200 in Belgium, about 300 in Prussia, and a goodly number in Austria, Russia, and other Continental States. Probably the number of Continental beetroot-factories and distilleries does not fall much short of 2,000, and, according to reliable reports, most of them do a lucrative business.

It may appear somewhat strange that, notwithstanding the favour with which beet-root is at present regarded abroad, and the great success which has led to the rapid extension of the beet-sugar industry on the Continent, comparatively few attempts have been made in this country to cultivate this useful crop, for the purpose of extracting from it sugar or spirits. It cannot be said with propriety that English farmers are more backward in intelligence or more slow to introduce improvements into farm practice than their Continental brethren, nor can the industrial classes in Britain be charged with apathy in pursuits likely to increase their material interests. There must then be, it strikes me, some good reason why the cultivation of beet-root and the manufacture of sugar from it in England has not kept pace here with the rapid development of the beet-root industry on the Continent. The principal reason of the disinclination of the British agricultural and industrial community to imitate the example of Continental growers and manufacturers of beet-root sugar, appears to me to have its foundation in the fact that, on the Continent, agricultural and industrial pursuits are more closely linked together, and are more mutually dependent for success on each other, than they are in England. In many of the Continental sugar-factories the proprietors are farmers as well as manufacturers, and raise, if not the whole crop, at least a large proportion of the raw material required in the factory. This gives the manufacturer the advantage of paying special attention to the cultivation of roots rich in sugar. His own interest has taught him carefully to study all those conditions as regards soil, manure, general treatment of the land, harvesting of the crop, and other circumstances, which all influence the yield of sugar in the root, and he has gained great experience in growing roots suitable for his purpose. The case is different in England. The interest of the farmer, who is not himself a manufacturer of sugar, is to produce heavy crops, irrespective of quality. Indeed, his interest not being directly concerned in producing roots rich in sugar, the British farmer as yet has paid little attention to the essential conditions which favour the development of sugar in beet-roots. The first step in a right direction that has to be taken in England, with a view to further the development of the beet-sugar industry in these islands, appears to me is to pay greater attention than has hitherto been given to the cultivation of beets distinguished for their sugar-yielding qualities. Everyone who has visited a horticultural show, and noticed the great variety of flowers, fruits, and garden produce in general, must be struck with the fact that all these varieties are the result of skilful cultivation. If we look at a carrot or parsnip in the wild state and compare them with the succulent and sweet cultivated roots, we clearly see what may be done by the skill and persevering care of the gardener. There can be no doubt that, within certain limits, the farmer has it in his power, as well as the gardener, greatly to improve the quality of the crops he raises, or to adapt them by skilful cultivation to the special purpose for which they are wanted.

Before proceeding further, I propose to offer some remarks on the selection of the seed, the character of good sugar-beets, the nature of the soil, the manures suitable for sugar-beet, and the general treatment it should receive from the hands of the farmer. In the next place I shall have to lay before you the results of our present experience on the growth of sugar-beets in England, and to compare it with that obtained on the Continent. We shall then be prepared to examine together the question whether the climate and soils of Great Britain are well adapted for sugar-beet, and which localities are most suitable for the establishment of beet-root sugar manufactories or distilleries; and, in conclusion, I shall have to speak of the uses to which the crop may be turned.

Cultivation of Beetroot.

The beet-root is a biennial plant, growing wild in the south of Europe. It was introduced into the Netherlands by the Spaniards, and thence brought into Germany. The common field beet, of which the German name is "mangelwurzel," has long been known in Germany, from whence it was introduced into England in the last century. The sugar-beet is a variety of the common mangel wurzel obtained by crossing and culture. Much attention has been given by Continental farmers to the selection of roots rich in sugar, and numerous varieties, which need not be mentioned, have been raised. Of all the principal sorts, the white Silesian root *(Beta alba)*, of which there are again more than one species, is the the most valued by sugar manufacturers, as it is particularly rich in sugar. The Silesian beet, when grown in perfection, is pear-shaped, white in the body, and shows very little above ground, penetrating about twelve inches into the soil, from which, by means of numerous radicles, it draws the necessary nourishment. It is light green on the top, has white flesh, and its leaves are green, with lighter coloured ribs, and strong long petioles. The Silesian beet is of a vigorous growth, and though it does not yield so large a per-centage of sugar as some other varieties, it yields a larger weight per acre, and in consequence produces more sugar per acre. There are two varieties of Silesian sugar-beets—the rose-coloured and the white. The former has a rose-coloured skin, and leaves marked by purple-coloured ribs, but the flesh of the root, like that of the latter, is white. Both the rose-coloured and white Silesian beet are frequently seen growing together in the same field. I have examined both, and do not find any marked difference in their respective sugar-yielding qualities.

The selection of seed deserves the greatest attention on the part of the beet-root grower. Experience has shown that roots rich in sugar transmit their richness to the next generation of roots, whilst all seed from ill-shaped, light roots, poor in sugar, as a rule, produce inferior roots. In France, great trouble has been taken by M. Vilmorin, the celebrated seedsman of Paris, to the selection and crossing of sugar-beet, and Vilmorin's improved beet, which by some is regarded as a specia variety of Silesian beet, is justly esteemed in France and Belgium for its sugar-yielding quality.

Great attention is also paid in the north of Germany, more particularly in the neighbourhood of Magdeburg, in Prussia, to the growing of true and superior beet-root seed. Owing to the fact that in Prussia the duty is levied on the roots, and not on the manufactured sugar, as in France, special care has been taken in Prussia to propagate roots rich in sugar, and speaking generally, beets grown in Germany yield from 3 to 4 per cent. more sugar than on an average in France. I would therefore strongly recommend English agriculturists, if possible, to procure beet-root seed from the neighbourhood of Magdeburg.

Good sugar beets possess the following characteristics:

1. They have a regular, pear-shaped form and smooth skin. Long, tapering, carrot-like roots, are considered inferior to pear-shaped Silesian beets.

2. They are symmetrical, and do not throw out forks, or fingers and toes.

3. Good beets have a white and firm flesh, a delicate and uniform structure, and clean sugary taste. Thick-skinned roots are frequently spongy, and always more watery than beets distinguished by a uniform firm and close texture.

4. They weigh, on an average, from $1\frac{1}{2}$ to $2\frac{1}{2}$lb. a-piece. Neither very large nor very small roots are profitable to the manufacturers of sugar. As a rule, beets weighing more than $3\frac{1}{2}$ lbs. are watery, and poor in sugar; and very small roots, weighing less than $\frac{3}{4}$lb., are either unripe or too woody, and in either case yield comparatively little sugar. As the soil and season have a great influence upon the composition of the crop, it is quite possible in a favourable season, and with proper cultivation, to produce beets weighing over 4 lbs., which, nevertheless, yield a good per-centage of sugar. Speaking, however, generally, good beet-roots in average seasons seldom exceed $2\frac{1}{2}$ lb. in weight.

5. Good sugar-beets show no tendency to become necky, and their tops are always smaller than those of inferior beets.

6. Good beet-roots are considerably denser than water, and rapidly sink to the bottom of a vessel filled with water. The specific gravity of the roots affords a pretty good test of their quality, for the greater their specific gravity the richer they will be found, as a rule, in sugar. A still better test than the gravity of the root itself is the specific weight of the expressed juice. The juice of

good beet-roots has usually a specific gravity varying from 1·06 to 1·07. When very rich in sugar, the gravity of the juice rises above 1·07, and in some English-grown beets I have found it as high as 1·078. These roots contained over 14 per cent. of crystallisable sugar. The juice of roots poor in sugar invariably falls below 1·060, and thus by taking the gravity of the juice of different beets, a pretty good idea may be formed of their comparative richness in sugar.

7. In a well-cultivated soil beet-roots grow entirely in the ground, and throw up leaves of moderate size. The tendency of the root to bury itself in the soil is characteristic of good sugar-beet. It has to be remarked, however, that in thin, stony, and in badly-prepared stiff clay soils, resting on an impervious subsoil, even good kinds meet with mechanical resistance too strong to be overcome, in consequence of which the top part of the bulbous root is thrown out of the soil, and on exposure to light turns greenish, and yields less sugar than roots completely buried in the soil. Manufacturers of sugar are well aware of this, and they therefore remove the greenish-coloured heads of the roots before passing them through the pulping machine. Much waste consequently is incurred when beet-roots, grown in a large measure above ground, are sent to the factory.

Character of the Soils Suitable or Ill-adapted for the Growth of Beets.

Although beets will grow in a great variety of soils, all are not equally well adapted to grow this crop to perfection. The best soils are those in which neither clay nor sand, nor lime greatly preponderate, but which contain these constituents, together with a fair proportion of organic matter, so mixed together that the land is neither too stiff nor too light, and crumbles down after being ploughed into a nice friable loam. There should be a sufficient depth of soil, for all soils incapable of being cultivated to a depth of at least sixteen inches are unsuited for the growth of sugar-beets, which, unlike the common yellow globe mangold, grows almost entirely underground, and therefore cannot be cultivated with advantage in any shallow soils. The subsoil should be thoroughly well drained, and be rendered friable by autumn-cultivation and free admission of air. A deep friable turnip-loam, containing a fair proportion of clay and lime, on the whole appears to be the most eligible description of land for sugar-beets. Lime is a very desirable element, for in land deficient in lime beets are liable to become fingered and toed. When well worked, clay-soils, especially calcareous clays, are well adapted for beet cultivation, provided they are properly drained and of sufficient depth. On such soils a succession of beet-roots may often be grown without manure, for many clays abound in all the elements of fertility. These, however, require to be rendered available for the use of plants. The most effectual means of thus providing plant-food are deep autumn ploughing, stirring of the subsoil, and similar mechanical operations, all of which tend to bring into action the fertilising materials which lie dormant in many clay-soils in practically inexhaustible store, and which, at the same time, improve the texture of the land, rendering it more friable and more readily penetrable by the roots.

Many persons entertain the mistaken notion that clay soils are not suited for the cultivation of beets, and that the crop will only flourish in light, sandy soils. Some of the finest crops of beets which I ever saw were grown on clay-soils, and some of the worst crops on light, sandy land. It is true, a badly-worked, half-drained clay-soil does not bring beets to perfection, but even stiff clays when well drained, may be brought into a fine, friable condition, when the land is broken up by the cultivator early in autumn, and left in ridges as roughly as possible during the winter, and not touched until the season of sowing the seed arrives, when it suffices to pass a pair of harrows over the land. The land in general is much improved by deep autumn cultivation and exposure to the air in a rough state; and, according to my own observation and the testimony of the most successful of the heavy-land farmers, it is far better never to touch the land after it has been put roughly into ridges than to give it a second ploughing in spring.

On light, sandy soils, beet-roots grow well, if the land is in a good agricultural condition; sandy soils, however, are poor in plant-food, and not well adapted for the cultivation of sugar-beets. It is true, such poor, sandy soils may be enriched by the application of dung or other suitable manures; but as it is not desirable to grow sugar-beets on newly-manured land; poor, sandy soils, which will not yield a moderate crop without manure, are not nearly so suitable for beets as soils which contain naturally a larger proportion of the mineral elements which enter into the composition of the ash of beet.

Peaty soils and moor-land produces watery, spongy roots, poor in saccharine matter, and ought to be avoided, as well as all soils which are either too dry, like the thin, gravelly soils resting on pure silicious gravel sub-soils, or too wet and cold, like many of the thin soils which are found in Cambridgeshire resting on impervious chalk marl.

Speaking generally, the best soils for sugar-beet are precisely those on which other root crops can be grown to perfection, that is, land which is neither too heavy nor too light, which has a good depth, is readily penetrated by the roots, and naturally contains lime as well as clay, and sand as well as organic matter, in such proportions as we find them in good friable clay-loams.

Manures for Beets.

If possible, sugar-beets should be grown with as little farm-yard manure as possible; and when dung has to be used, as in the case of very poor soils, care should be taken to apply the dung in autumn, or during the winter months as early as possible.

Heavy dressings of common farm-yard manure, such as are generally applied to land upon which mangel-wurzel is grown for feeding purposes, must not be employed if the land is intended for sugar-beets.

The effect of heavy dressings of dung, and, I may add, of all animal nitrogenous matters, as well as of ammoniacal salts, is to produce abundance of leaves and big but watery roots, which are not only comparatively poor in sugar, but also contain nitrogenous matters, which greatly interfere with the extraction of sugar in a crystallised state.

Common salt, and saline manures in general, although useful when used in moderate doses, say at the rate of 2 or 3 cwt. per acre on light soils, should be avoided on the majority of soils, for experience has shown that sugar-beets, grown on soils highly manured with common salt, produce roots the expressed juice of which is largely impregnated with salt, a constituent which is dreaded by the manufacturer of sugar even more than the albuminous or nitrogenous impurities of the juice.

Peruvian guano, sulphate of ammonia, and nitrate of soda require to be used with discrimination. If the land is in a good agricultural condition, in which it always contains a sufficient amount of available nitrogen to meet the requirements of the crop, neither guano nor sulphate of ammonia should be used as a manure for beets. It is true guano and sulphate of ammonia largely increase the weight of the produce per acre, but at the same time it has to be borne in mind that heavy crops, produced by the aid of guano and purely ammoniacal manures, generally are poor in sugar. Beets grown with an excess of guano or sulphate of ammonia, moreover, furnish a juice that presents much difficulty to the sugar manufacturer.

If the land is very poor naturally, it will be found necessary to manure it, and if farm-yard manure cannot be obtained in the required quantity, and be applied in autumn, it may be desirable to use some guano or sulphate of ammonia. In that case, I would recommend 3 to 4 cwt. of Peruvian guano, or 2 cwt. of sulphate of ammonia, mixed with 2 cwt. of superphosphate of lime, to be sown broadcast in autumn; and when the seed is sown in spring, to drill in with it at the same time 2 cwt. more of superphosphate.

Superphosphate of lime and bone-dust, or the refuse bones of glue makers, are excellent manures for sugar-beets, and other phosphate manures are suitable for every description of land; they never injure the quality of the beet crop, like the indiscriminate use of ammoniacal manures; on the contrary, superphosphate decidedly favours early maturity, and for this reason I would never sow a crop of beets without drilling in at the same time 2 to 3 cwt. of superphosphate.

On light soils, in which potash is often deficient, the judicious use of potash salts has been found serviceable. The salts of potash, however, should not be used by themselves, but always in conjunction with superphosphate and phosphatic guanos; for such soils I have found 3 cwt. of superphosphate, 2 cwt. of crude sulphate of potash, and 1 cwt. of sulphate of ammonia, or 1½ cwt. of Peruvian guano, very useful for common mangolds, and have no doubt this mixture would be equally useful to sugar-beets.

TIME OF SOWING AND DISTANCE OF PLANTING.

The best time for sowing beet-root is the beginning or middle of April. If sown too early in spring, the young plants may be partially injured by frost, and if sown later than the first week in May, the crop runs the risk of requiring to be taken up in autumn before it has had sufficient time to get ripe.

From 10 to 12 lbs. of seed, or about double the quantity of seed usually sown for common mangolds, is the quantity of seed required per English acre. Much more seed is sown, because sugar-beets are planted more closely than common mangolds. As regards the width between the plants, I may state that, generally speaking, the distance between the rows and from plant to plant should not be less than 12 inches, nor greater than 18 inches.

Should the young plants be caught in spring by a night's frost, and suffer ever so little, I would advise to plough up the crop at once and to re-sow, for plants attacked by frost are certain to run to seed, and beets that have run to seed are practically useless for the manufacture of sugar.

Like root-crops generally, sugar-beets require to be frequently horse and hand hoed. As long as the young plants are not injured by hand-hoeing, the repeated application of the hoe from time to time is attended with the greatest benefit to the crop. It is advisable to gather up the soil round each plant, in order that the head of each root may be completely covered with soil.

HARVESTING OF THE CROP.

Sugar-beets must be taken up from the soil before frost sets in, else they suffer. When the leaves begin to turn yellow and flabby, they arrive at the stage of maturity, and the crop should then be closely watched that it may not get over-ripe. If the autumn is cold and dry, the crop may be safely left in the ground for a week or ten days longer than is needful; but should the autumn be mild and wet, it is highly desirable to remove the roots as soon as possible after they arrive at maturity, for if left in the soil they are apt to throw up fresh leaves, and nothing does so much injury to beets as a second growth of tops after the roots have become ripe. Particular attention, therefore, should be paid by the grower of sugar-beets in watching the ripening of the crop. It is a good plan to test the gravity of the expressed juice. A root or two may be taken up at intervals, and be reduced to pulp, by grating it on an ordinary hand-grater. By pressing the pulp through calico, the juice is obtained, which is to be tested with an ordinary float, used for ascertaining the density of liquids heavier than water. As long as the gravity of the juice continues to increase, when the roots are tested from time to time, the crop should be left in the land. The juice of beets of good sugar-yielding qualities has a specific gravity of about 1·065, and when rich in sugar it rises to about 1·070.

Immature roots cut across with a knife rapidly change colour on the surface laid bare by the knife, turning first red, then brownish, and finally quite dark. If the newly-cut slices of beet turn colour on exposure to the air, the ripening process is not completed, but if they remain for some time unaltered, or turn only slightly reddish, it may be assumed that they are sufficiently ripe to be taken up. By this simple means, the state of maturity may be ascertained with sufficient accuracy for practical purposes. The crop should be harvested in fine, dry weather. In order that the roots recently removed from the ground may part with as much moisture as possible, they are best left exposed to the air on the land before they are stacked, but they should not be left longer exposed to the air than a few days, and guarded against the direct rays of sunlight. Perhaps the best plan is to cover them loosely with their tops in the field for a couple of days, and then to trim them, and at once to stack them. For storing roots, especial care should be taken to prevent their germinating and throwing out fresh tops, which is best done by selecting a dry place for the storage ground. The roots may conveniently be piled up in pyramidal stacks, about six feet broad at their base, and seven feet high. At first, the piles or stacks should be but thinly covered with earth, in order that the moisture may readily evaporate, and subsequently, when frosty weather sets in, another thicker layer of earth, not exceeding one foot in thickness, may be placed on the stacks.

QUALITY OF SUGAR-BEETS GROWN IN ENGLAND IN THE SEASONS 1868, 1869, AND 1870.

Having briefly described the mode of culture, and referred to the character of the soils and the manures best adapted to the growth of beets rich in sugar, it devolves upon me to bring under your notice the results of our present experience as regards the quality of sugar-beets, which, during the last three seasons, have been raised in various parts of Great Britain.

During the last three seasons, many samples of beets from different parts of England, Scotland, and Ireland, and grown on a variety of soils, and under different conditions, have been analysed by me, and I have thus been placed in a position to form a good idea of the quality of sugar-beets grown in Great Britain, and I may state at once that by far the majority of the numerous specimens examined by me were found fully equal to the average quality of good sugar-beets grown in the same seasons in France, Belgium, Holland, and Germany, and some I find as rich in sugar as the best specimens of French beets. It would be wearisome to you were I to lay before you the details of my investigations on the composition of sugar-beets, and I therefore select only a few examples by way of illustration of my subject, and beg to refer you for further details to a paper of mine which appeared two years ago in the pages of the *Journal of the Royal Agricultural Society*, and to a second paper on "Sugar-beets and Beet-root Distillation," which will shortly appear in the forthcoming volume of the same *Journal*. Many of my audience, no doubt, are aware that the beet-root culture in England has received a fresh impetus by the painstaking exertions of Mr. James Duncan, who has the merit of having established the first beet-root sugar manufactory in England. Three years ago, that gentleman put up works and machinery for the extraction of sugar from beet-roots, within a few yards of the railway-station at Lavenham, in Suffolk. When fully employed, the factory is capable of using up about sixty tons a-day, and at this rate 6,000 tons of roots—a quantity which Mr. Duncan hopes will be grown ere long by the neighbouring farmers—would keep the sugar manufactory fully employed for 100 days.

The beetroots for the manufacture of sugar as mentioned already, generally do not exceed 2 to 2½lbs.; as a rule, beets of a smaller size are richer in sugar than big ones, but at the same time, I would observe that small roots do not invariably contain more sugar than large and heavy beets, for in the course of my investigation I found frequently more sugar in beets weighing fully 3lbs. than in roots grown in the same season and weighing only 1lb. and under. Although no fixed rule can be given as to the size and weight of the roots which are most suitable for the manufacture of sugar, for much necessarily depends on the peculiar character of the season, and the agricultural condition of the land upon which the beets are grown, I believe, as a rule, it would neither be profitable for the farmer to grow roots less in weight than 2lb., nor pay the manufacturer to work up very small roots.

This leads me to refer briefly to the cost of cultivating a crop of sugar-beets. The cost is variously stated by agriculturists, but most men agree that it is rather more expensive to grow sugar-beets than a crop of swedes or common mangolds.

Mr. Wm. Biddell, of Lavenham-hall, Suffolk, one of our largest growers of sugar-beets, has recently given the following estimate of cost per acre:—

Common charges—rent, 33s.; tithe, 7s. 6d; rates, 3s. 6d.; interest on capital, 10s.	£2 14
Horse tillage and drilling	2 5
Hand hoeing and singling, 12s. 6d.; seed, 9lb., 4s. 6d.	0 17
Taking up and topping	0 11
Filling and carting, say 2 miles, 2s. per ton on 15 tons	1 10
Manure, 10 loads, 45s.; 3 cwt. superphosphate, at 5s. 6d., 16s. 6d.; guano 1 cwt., 14s.; labour to manure, 2s. 6d.	3 18

Making the total cost £11 15s. per acre.

This estimate, although it may appear high, it strikes me bears upon it the stamp of having been made by a man who takes care to avoid to mislead others either by over-rating or under-rating the actual cost that has to be incurred in the cultivation of this crop. It therefore deserves more credit than many of the estimates which are made by enthusiastic advocates for introducing sugar-beet culture into England, and by men on whose practical acquaintance with the details of farm-operations not much reliance can be placed. Upon the receipt side, Mr. Biddell gives £15 7s. as the total receipt of the produce from one acre, leaving an apparent clear profit of £3 12s. The conclusion to which Mr. Biddell arrived is, that where a farmer is situate within two miles of a sugar-beet factory, it will answer his purpose to grow from one-eighth to one-fourth of his arable land in sugar-beet, if he can obtain £1 per ton for them, and have the pulp returned at 12s. per ton (which amounts to about one-sixth of the weight of beet-root), and which, if fed liberally with corn and cake, will in a great measure replace the waste caused by removing so much produce from the farm.

The land in the neighbourhood of Lavenham, upon which the crop was grown, I may observe, is not particularly well adapted for beets, but I have no doubt in my own mind that, with deep autumn cultivation and attention to the mechanical condition of the soil, the produce of even such land may be materially increased, and that in good seasons 20 tons of beets, of good sugar-yielding quality, will prove a fair average crop in a fair season.

If, then, anything like eighteen or twenty tons of sugar beets can be raised—and the supposition is within the bounds of reality—the farmer will derive a very handsome profit from his crop, and have, moreover, the satisfaction of experiencing a general improvement in the agricultural capabilities of his land for growing heavier corn crops; for it has been realised, and universally been acknowledged, that wherever beet-root culture has been introduced on the Continent, the average yield of corn has materially increased, and a marked improvement in the general agricultural aspect of the country has taken place in localities where beet-root sugar-factories or distilleries have been established.

Composition of Sugar Beets.

All the sugar present in fairly ripe beets is crystallisable, and, when perfectly pure, identical in composition and properties with crystallised cane-sugar. Beet-roots do not contain any glucose, or grape-sugar, and the glucose in the molasses produced in beet-sugar manufactories is the result of the changes which cannot be entirely avoided in extracting the crystallisable sugar from the roots.

In addition to sugar, the principal solid constituent of beets, we find in them water, albuminous or nitrogenous compounds, vegetable fibre, pectinous compounds, and mineral constituents, which the crop has taken up from the soil on which it was grown.

The following selected analyses, made by me of roots grown in various parts of Great Britain in 1868-69-70, are well calculated to give us information as to the fitness of the English beet as a raw material from which sugar may be profitably extracted on a manufacturing scale:—

Composition of Sugar-beets (Silesian) grown in the neighbourhood of Lavenham, Suffolk.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Description of root	Green top white skin.	Red top, rose-coloured skin.	White pear shaped root	Long red root.	Long red root.	Pear-shape white root.	Small red top.	Pear-shape white root.
Weight of root	2¾lb.	2lb. 4½oz.	1½lb.	2lb.	1¾lb.	2lb. 5oz.	1lb. 4¾oz.	2lb. 12¼oz.
Specific gravity of juice	1·0637	1·0689	1·058	1·0612	1·0628	1·0589	1·0659	1·0643
At a temperature of	64° F.	64° F.	62° F.	62° F.	..	..	58° F.	58° F.
Moisture	83·11	82·72	83·03	83·43	82·70	82·27	81·76	83·34
Albuminous compounds*	1·25	1·44	1·71	1·53	1·23	1·08	2·13	2·12
Crude fibre (pulp)	3·43	3·38	4·31	3·49	3·60	3·73	3·77	3·04
Crystallizable sugar	10·51	10·94	9·31	10·04	10·72	11·14	10·55	9·74
Pectin, colouring matter, &c.	·63	·45	·60	·50	·68	·74	·70	·52
Mineral matter (ash)	1·07	1·07	1·04	1·01	1·07	1·04	1·09	1·24
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen	·200	·231	·275	·245	·197	·173	·341	·340

The preceding roots were all received for analysis on the 23rd October, 1868. Nos. 1 and 2 were grown by Mr. Hitchcock, Lavenham; Nos. 3 and 4 by Mr. C. Northcott, Thorpe; Nos. 5 and 6 by Mr. Mumford, Thorpe; Nos. 7 and 8 by Mr. W. Baker, Metford.

These analyses may be taken as fairly representing the composition of English sugar-beets of good quality. It will be noticed that these Suffolk roots, in 1868, contained from 9¾ to 11 per cent. of sugar, in round numbers. In the next table I have placed together the results of analyses made of Silesian beets grown, in 1868, in the counties of Norfolk, Berkshire, and Buckinghamshire:—

Composition of Silesian Sugar Beets grown in Norfolk, Berkshire, and Buckinghamshire.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Kind of root	Small white.	Large white.	Red.	White.	Red.	White.
Weight of root	1lb.	2lb.	1lb. 13oz.	2lb. 4oz.	2lb. 9oz.	2lb. 14¾oz.
Specific gravity of juice	1·059	1·0558	1·0558	1·0465	1·0659	1·0588
At a temperature of	60° F.	60° F.	64° F.	64° F.	62° F.	62° F.
Moisture	84·32	85·22	85·23	86·71	82·35	83·93
Albuminous compounds*	1·28	1·51	1·70	2·13	1·55	1·76
Crude fibre (pulp)	3·51	4·11	2·92	3·13	3·25	3·21
Crystallizable sugar	9·42	7·46	8·86	6·67	11·09	9·31
Pectin, &c.	·48	·55	·47	·50	·52	·63
Mineral matter (ash)	·99	1·15	·82	·86	1·24	1·16
	100·00	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen	·206	·243	·273	·341	·248	·283

Nos. 1 and 2 grown by the Rev. W. B. Hurnard, Bingham Rectory, Norfolk. Nos. 3 and 4 grown by Mr. James Kimber, Tubney Warren, Abingdon, Berkshire. Nos. 5 and 6 grown at Woolston.

The roots grown in Norfolk, Berkshire, and Buckinghamshire contained from 9 to 11 per cent. of sugar, and thus were well suited for the manufacture of sugar.

In my remarks on the manures suitable for sugar-beets, I have alluded to the injurious effects of a heavy spring dressing of dung, and in illustration of this point, I quote the following analysis giving the composition of two unusually large roots, both raised from true white Silesian beet-seed:—

Composition of Two very Large White Silesian Beets grown in 1868 in Suffolk.

Weight of root	11 lbs. 6oz.	6½ lbs.
Specific gravity of juice	1·0431	1·0553
At a temperature of	65°F.	65°F.
Moisture	92·58	88·13
*Albuminous compounds.	1·40	2·16
Crude fibre (pulp)	1·73	2·74
Crystallisable sugar	2·22	4·82
Pectin, &c.	·47	·44
Mineral matter (ash)	1·60	1·71
	100·00	100·00
*Containing nitrogen	·225	·347

The larger of the two beets contained only 7½ per cent. of solid matter, of which little more than 2 per cent. was sugar. Considering the large amount of water in this root, the per-centage of both albuminous compounds and saline mineral matter is very high. The smaller of the two roots was not so watery as the larger one, and was richer in sugar. It was, however, a poor root, even for feeding purposes, and, like all roots of low feeding quality, comparatively rich in albuminous compounds, and which constituents are poor in sugar. Very good sugar-beets, weighing from 2½ lbs. to 3 lbs., were sent to me, in 1868, from Scotland. They were grown in Ayrshire, and yielded from 8½ to 11 per cent. of crystallisable sugar.

It may interest some of my audience, that the highest per-centage of sugar in any of the numerous specimens which were sent to me for examination in 1868, I found in a rose-coloured Silesian beet, weighing little above 2lbs., which was grown at Barking with London sewage. In this beet I found as much as 13 per cent. of crystallisable sugar. At the same time, it is but right that I should mention the fact that, in another beet raised with London sewage in the same season, I found only 3 per cent. of sugar. The differences in the sugar-yielding qualities of the two beets are very striking; and I direct attention to them because the results of the two analyses show on one hand that excellent sugar-beets can, and have actually been, grown with London sewage, and, on the other, that the same fertilising agent, improperly used, may have a very injurious influence on the quality of the produce. As yet, we possess but a limited experience with regard to the most profitable mode of applying sewage to various farm-crops, and I cannot, therefore, venture to give distinct directions as to the quantities of sewage which may be profitably applied to sugar-beets. Used at the right time, and in proper quantities, I believe town-sewage is likely to become one of the most useful fertilisers for sugar-beets, and I would suggest to irrigate the beet-crop repeatedly during the first two or three months of its growth, and then to cut off completely the supply of sewage, for it is very essential to success to withhold all further supply of liquid plant food during the last two or three months of the growth of the crop. Thus used, sewage, I have no doubt, will encourage an early, luxuriant, and healthy development of leaves, by which sugar is afterwards elaborated from atmospheric food and stored up in the roots, whilst the continuous application of sewage up to a late period in the summer will have the effect of causing over-luxuriance in the leaves, and prevent the roots to ripen before frost sets in, and the crop has to be taken up.

Composition of Sugar-beets Grown in England in 1869.

The following analyses (see Table, next page) of roots grown in 1869, in the neighbourhood of Lavenham, in Suffolk, and in Berkshire, fairly represent the character of the beet crop in that year.

Passing by the details of analyses which I made in 1869 of sugar-beets grown in other localities, I may state in general terms that the quality of the crop was quite equal to that of the preceding year.

Composition of Beet-roots grown in 1869.—*Berkshire* (*No.* 1, 2, *and* 3), *and in Suffolk* (*No.* 4).

	1	2	3	4
Water....................	81·28	81·71	84·40	82·46
Albuminous compounds*..	1·24	·98	·91	·81
Crude fibre (pulp)........	4·01	4·02	3·04	3·87
Crystallisable sugar......	11·87	12·02	9·14	11·06
Pectinous matters........	·63	·45	·54	·66
Mineral matters (ash)....	·97	·82	·97	1·14
	100·00	100·00	100·00	100·00
* Containing nitrogen..............	·199	·157	·145	·128

Quality of the Beet Crop in 1870.

The cultivation of sugar-beet has been largely extended, in 1870, on Mr. Robert Campbell's estate at Buscott, Berkshire, as well as in the neighbourhood of Mr. Duncan's sugar-factory at Lavenham, in Suffolk.

In both localities the sugar-producing qualities of the roots have been most satisfactory. The beets, on an average, contained fully 12 per cent. of sugar, and Mr. Duncan informed me that he expects, as the result of this season's campaign, to obtain from the whole of the roots which were supplied to him in 1870, 8 per cent. of saleable crystallisable sugar of fine quality.

On a small scale, beets were grown last season in a good many places in England, Ireland and Scotland, and I had occasion to analyse many samples of excellent roots. Thus, in beets grown by Mr. De Morny, Cold Harbour, near Wallingford, Berkshire, I found from 12½ to 13 per cent. of sugar; in beets grown in Yorkshire, from 10½ to 13¼ per cent.; and in Surrey, 11¾ per cent. Again, in 10 lots of beets, grown on various farms in the county of Kilkenny, I found in

3 lots nearly 15 per cent. of sugar.
2 lots ,, 13½ per cent. of sugar on an average.
3 lots ,, 12 to 12¾ per cent,, and in
2 lots about 10 per cent. on an average.

I much question whether better sugar-beets have been grown this season in the most favoured beet-root districts of Belgium or France.

The summer and autumn of 1870, no doubt, were highly conducive to the development of much sugar in root-crops, and probably the beet-roots which were raised in England and Ireland, in 1870, were richer in sugar than they are likely to be in average seasons. Still, considering that we now have three years' recent experience on the cultivation of sugar-beets, I cannot see any reason why this crop should not be profitably cultivated in many parts of the United Kingdom. In a good season, I believe from 18 to 20 tons of beets, of as good a sugar-producing quality as in France or Belgium, may be grown without much difficulty.

The farmer will run very little risk by trying the experiment to grow sugar-beets instead of common mangolds, for if he cannot obtain a good price for his roots from the sugar-manufacturer he can use the beets for cattle-food, and although he may not grow so heavy a crop as he does when he plants common mangolds, it has to be borne in mind that 1 ton of sugar-beet is quite as valuable as cattle-food as at least 1½ tons of good common mangolds.

Although great success has attended the growth of sugar in the north of Europe, many people in this country question whether an equally satisfactory result would characterise its introduction into England. Indeed, the notion is a very common one that our English summers are not warm enough to ripen sugar-beets sufficiently. This idea is based on the supposition that sugar-beets require a great amount of heat for coming to perfection. It is, however, altogether erroneous, for experience has proved that our English summers are quite warm enough to produce beets as rich in sugar as those grown in the North of France or Belgium; moreover, sugar-beets are actually not cultivated with advantage in a country possessing a high summer temperature.

The average temperature of the Continental beet-growing countries, and of the localities in England where beets may be grown with advantage, is pretty much the same, and ranges from 62° to 65° Fahr. It is not so much heat as a dry and unclouded sky during the autumnal months, which makes the sugar in the beet, and hence the crop succeeds far better in the North of France and of Germany than in Central France or the South of Germany, where the summers are very much longer and warmer than in the northern districts. It has been justly observed that a bright and dry August influences the per-centage of sugar in roots to a far greater extent than the summer's heat. Experience has further shown that nothing is so conducive to all heavy crops than abundance of rain distributed over the first two months of its growth. Keeping in view the climatological condition which regulates the healthy growth of beets, which is eminently a plant suited to countries having a comparatively low average temperature, I have come to the conclusion that the eastern, south-eastern, and northern counties of England, and even many localities in Scotland, as well as a part of Ireland, as far as climate is concerned, are well adapted for the cultivation of sugar-roots.

The Uses of Sugar-Beet.

Having dwelt at considerable length on the cultivation of the crop, because it is a matter of primary importance, on which, moreover, I can speak with greater authority than on the industrial application which is made of the crop, no time is left to me to enter fully on the subject of the manufacture of beet-root sugar, or the distillation of spirits from beets. Perhaps it is hardly desirable that I should give, on the present occasion, anything more than the briefest outline of the process of manufacturing sugar and obtaining spirits from beets, for I notice that a gentleman is going to read a paper on a subject connected with the beet-root industry, in which he no doubt will bring before the Society questions which can only be profitably raised or discussed by those who possess more technical or engineering knowledge and practical experience than I can boast of to possess.

Manufacture of Beet-root Sugar.

The first process to which the roots, are submitted as they are brought from the farm to the factory, is to cut off the greenish coloured upper part of the roots. They are then passed through the washing machine, and cleaned from all adhering dirt.

On leaving the root washer, or rather, the incline below it, the beets are pitched into the jaws of the pulper, where they are seized between revolving cylinders, armed with spikes or knife-blades, which rapidly reduce them to fragments. These fragments pass into the pulper proper, which consists of a double revolving drum, driven by belting. It is constructed by tightly fitting into two circular iron-end plates alternate series of small saw blades, with projecting straight teeth, and carefully-made wooden rulers 0·39 of an inch broad, and 0·78 of an inch high. The saw blades are toothed on both edges, so that by reversing them, one side can be employed after the other has been worn off. Immediately in front of the revolving drum, whose speed must be from 600 to 700 revolutions per minute, is placed a stout, finely-attached blade of steel, facing the points of the saw teeth, and adjusted so nicely as to leave no holes or intervals through which any fragments of beet-root would find their way. A small stream of water, regulated by a tap, is allowed to run constantly on the top of the drum, and to mix with the pulp. By this means, the pulp is more perfectly exhausted than without the addition of a small quantity of water.

The pulp thus produced is received into bags made of coarse woollen sacks, each about 33 inches deep by 22 inches broad, and holding a shovelful as a quantity, which, when slightly flattened, will not exceed the thickness of a finger.

The bags are piled up one over the other, separated by sheet-iron trays, and at first submitted to gentle pressure, and finally they are exposed to the powerful hydraulic presses, which squeeze out the juice so perfectly that scarcely more than ¾ per cent. of sugar is retained in the expressed cake pulp. The pulp thus obtained, when properly prepared, amounts to about one-sixth part of the roots.

The expressed juice flows into an iron reservoir, united by means of a valve or tap with an upright boiler called a monte-jus, and is next subjected to the process of defecation in a batch of open, circular, round-bottomed pans, provided with an outer steam-tight jacket, or false bottom, into which steam is admitted. The juice is rapidly heated, until it reaches a temperature of from 174° to 185° F., when milk of lime is poured into the warm juice, and well mixed with it by an agitator.

Steam is allowed to continue entering the space between the double bottom with full force until a layer of scum, of the thickness of a finger, has formed on the surface of the juice.

The object of adding lime is to remove the greater part of the nitrogenous constituents of the raw juice. The operation of defecating the juice, simple as it may appear, has to be conducted by an experienced man, on whose practical judgment much depends. The scums formed during the process of defecation of the beet-root juice are rich in saccharine matter, which is removed as much as possible by pressing the scum in sacks made of a strong, close-woven tissue of raw flax.

The expressed scum constitutes a useful manure, and is readily bought by the farmers in the neighbourhood of the factory.

The beet-root juice, freed from the greater part of albuminous and other organic matters which interfere with the crystallisation of the sugar contained in it, contains an excess of caustic lime, which has to be removed before it can be profitably evaporated or crystallised.

Formerly, the defecated juice was passed through filters, charged with a large quantity of animal charcoal; but although this plan effectually removed from the defecated juice the excess of lime and other impurities, the loss in sugar and the waste in animal charcoal were considerable, and the plan of carbonation is now generally adopted in every beet-root sugar manufactory instead of the old method of filtration through chemical filters.

Carbonation consists simply in the saturation of the defecated beet-root juice by means of carbonic acid gas, which removes the excess of lime. The carbonated juice is run into large receivers, where it is allowed to settle, after which the juice is generally submitted to a second carbonation, and finally is passed through filters, from which it issues perfectly bright, and of a pale yellow colour; it is then ready to go into the vacuum pans, which are now always employed in all beet-root sugar factories, and evaporated and concentrated sufficiently to deposit a crop of crystals when set aside in the crystallising pans or receptacles.

I have attempted to give a rough outline of the method commonly followed in beet-sugar manufactories for obtaining raw or moist sugar; but I may state that there are other plans in use for extracting the juice from beet-roots than that described.

Without entering on this occasion on the relative merits of the various methods of extracting saccharine juice from beet-roots, I may observe that the diffusion process, invented and patented by Mr. Roberts, of Seelowitz, in Austria, is highly spoken of by Continental beet-root sugar manufacturers, who have introduced it into their works, and that the adoption of the diffusion process is rapidly extending on the Continent.

Beet-root Distillation.

Another profitable use which may be made of beet-roots is the production of spirit from it by fermentation. It is maintained by the advocates of beet-root distilleries that the distillation of spirit is a more profitable business than the manufacture of beet-root sugar, and, in consequence of this prevailing opinion in France, a good many sugar-manufactories in that country have of late years been entirely converted into distilleries. There are in France alone about 500 beet-root distilleries, and in Belgium and Germany also distilleries are frequently found attached to sugar-manufactories. The combination of these two branches of industry has the advantage that, in a season when the proportion of sugar in the roots is too poor to yield much profit to the manufacturer, if he extracts the sugar in such poor beets, he may, with greater profit, employ the crop in fermenting the sliced roots, or their saccharine juice, and obtain by distillation from the fermented materials the spirit which has been produced by the act of fermentation. At any rate, it is in the power of the proprietors of sugar factories to which distilleries are attached, to take advantage of the fluctuations in the market price of sugar and spirit, and to produce spirit, when the price of spirit is high, and that of sugar low, and *vice versa.*

Beet-roots containing less than eight per cent. of sugar cannot be profitably employed for sugar making. Such roots are not only comparatively poor in sugar, but they also contain a more considerable proportion of albuminous and saline constituents, which sadly interfere with the production of sugar crystals, but which have no injurious influence whatever on fermentation, and therefore do not diminish the amount of alcohol which can be obtained from the sugar in the roots. It thus happens that spirit can be produced from roots which are utterly unsuitable for sugar-making. Whilst beet-roots must contain certainly not less than eight to nine per cent. of sugar in order to render the manufacture of beet-root sugar profitable, the distillation of spirits is said to be still remunerative if it is carried on with roots containing only five or six per cent. of sugar.

In comparison with the manufacture of sugar, the operations that have to be carried out in a beet-root distillery are simple, and the capital required for the necessary distilling and rectifying apparatus much less than the capital which has to be invested in the establishment of a sugar factory.

Time does not permit me to speak of the relative merits of the methods most frequently adopted in Continental beet-root distilleries of fermenting the expressed juice, and of Leplay's or Champonais' system of converting the sugar of the roots into alcohol. Whatever system may be followed, the spirit which is produced by simple distillation is not saleable, as it is neither sufficiently strong nor pure enough to be employed for the purpose for which alcohol is used.

In addition to water, the product of the first distillation of the fermented beet-roots contains certain by-products of fermentation which are poisonous, and have a very unpleasant taste and smell. They are volatile, and are popularly known under the name of fusel oils. From these volatile impurities, the weak, crude spirit has to be separated by rectification. The more perfectly fusel oil is removed from alcohol in the process of rectification, the greater is the commercial value of the rectified spirit, apart from its strength, which, of course, affects the value of alcoholic liquids. Of late years, the production of clean spirits from beet-roots has been much simplified by the employment of improved rectifying stills, and very pure spirit indeed is at present produced in France from beets. Most of this spirit is used by the makers of French cognac, who, by the addition of 25 to 50 per cent. of real cognac to rectified beet-root spirit, for the better qualities, and about 20 per cent. for the cheaper sorts, produce, it must be confessed, very fair French brandy.

I have here a specimen of rectified beet-root spirit, which was made at Mr. Robert Campbell's distillery, at Buscott, in Berkshire, and also a sample of beet-root spirit produced about twelve years ago at a beet-root distillery, then in existence at Minety, a village some miles distant from Cirencester, in Gloucestershire. The difference in the quality of the two samples is most marked, for, although Mr. Campbell's beet-root spirit is new, it makes very fair brandy, when about 30 per cent. of real cognac and a little burned sugar, for the sake of colour, are added to it. It may also be used for the making of perfumes, as will be seen by the specimen which I have the pleasure of exhibiting to-night. The second sample also—it is now about 12 years old—you will find on examination, has still a nasty, burning, earthy taste, and an abominably bad smell, and is only fit for the manufacture of varnish, French polish, and similar preparations, for which impure alcohol, selling at the lowest market price, is as well adapted as properly rectified and much more expensive spirit.

Mr. Campbell, who farms about 5,000 acres of his own land, expects to grow yearly not less than 10,000 to 12,000 tons of sugar-beets for distilling purposes, which will give him sufficient refuse pulp to feed about 12,000 sheep and 2,500 oxen.

On the strength of the best information obtainable in France and elsewhere, Mr Campbell decided in favour of Messrs. Savalle and Co.'s rectifying stills. These stills are held in high esteem, not only in France, but likewise in Germany, Holland, Belgium, and other parts of the Continent.

Messrs. Savalle's stills, which received a gold medal at the Great International Exhibition held at Paris in 1867, include a boiler, a distilling column, separating condenser, cooler, and a special reservoir for the reception of fusel oils, and a steam regulator.

The distilling column consists of a metallic cylinder, fitted in the interior with a number of diaphragms, which are placed one above the other. On leaving the distilling column the impure alcoholic vapours enter the analysing condenser, in which the densest constituents are liquefied and thrown back into the distilling column, and the more valuable escape. The condenser communicates with the refrigerator, which receives the valuable vapours, and rapidly condenses them. Both the condenser and refrigerator are tubular. The regulator is a novel and ingenious contrivance, introduced by Mr. Savalle, for maintaining a uniform temperature and pressure, conditions essential for producing a rapid flow of good alcohol. The operation, consequently, is never interrupted by excessive heat, over which there is no control in ordinary stills.

It will probably be recollected by some of my audience that beet-root distilleries were established about twelve or fifteen years ago in various parts of England, and that, after a languid existence for a few years, had to be closed. It may, perhaps, be supposed that the renewal of the attempt to manufacture alcohol from beets is not likely to succeed better than in former years. There are, however, good reasons for the utter failure of the beet-root distilleries, from which much was expected at a former period. At that time I lived at Cirencester, in the neighbourhood of which town the Minety beet-distillery had been established, and I had thus every opportunity of becoming acquainted with the manner in which the distillery was managed, and was fully convinced then that it, and similar equally badly-managed distilleries, could not carry on operations for many years. I remember perfectly well that the manager of the farm attached to the Cirencester College, with which I was connected at that time, sold common mangold, containing not more than 4½ per cent. of sugar, to the Minety Distillery at 20s. a ton, and I need hardly say that at that price such beets could not possibly be remunerative to the distiller.

The failure of the Minety distillery finds a ready explanation in the fact that common mangolds, and not Silesian sugar-beets, were employed as the raw material from which alcohol was produced, and that the same price was paid for roots containing not much more than 4 per cent. of sugar as for beets more than twice as rich in sugar. Furthermore, many of the managers of former beet distilleries did not understand how to carry out properly the process of fermentation, nor had they much knowledge of the rectification of impure spirit. The consequence was, that the spirit then produced was of a very inferior quality, which had to be sold at the lowest market price of impure spirit, full of fusel oil.

Of late years much attention has been bestowed by scientific men upon the theory of rectification, and their labours have borne good fruit in the improved apparatus, such as Coffey's or Savalle's stills, by means of which pure spirit may be obtained with comparative ease and certainty.

In conclusion, I offer a few remarks on

BEET-ROOT PULP.

The refuse pulp which is produced in beet-root sugar manufactories or distilleries is a valuable feeding material. When obtained by submitting the grated beets to strong hydraulic pressure, it appears in the form of thin cakes, which can be readily broken in pieces, and mixed without difficulty with straw chaff, meal, and such like feeding materials.

In its natural state, the pulp contains from 70 to 72 per cent. of water, and consequently it embodies a much larger proportion of solid feeding matter than the roots from which it is obtained, and still more than ordinary mangold, in which the proportion of water amounts on an average from 88 to 89 per cent.

The composition as well as the feeding value of beet-root pulp naturally varies in accordance with the plan that is in use in the factory for extracting the sugar from the roots. The pulp produced in distilleries generally contains a good deal more water than that from beet-sugar manufactories, in which the juice is obtained by pressure of the grated roots. In round numbers, the refuse pulp of sugar-factories where presses are used contains, in 100 parts—

Water	70·0
Sugar	1·5
Albuminous compounds (flesh-forming matters)	2·5
Crude fibre and a little lactic acid	24·0
Mineral matter (ash)	2·0
	100·0

In 100 parts of pulp, it will be noticed, there are 30 per cent of dry matter, whereas 100 of sugar-beet from which it is obtained contain only 15½ parts of dry substance on an average, and common mangolds but 11 parts.

A ton of beet-root pulp accordingly contains 672 lbs. of dry matter, or 325 lbs. more than a corresponding weight of the roots, and 425½ more dry matter than a ton of common mangolds. In other words, a ton of pulp contains not quite, but nearly, the same amount of solid food as two tons of Silesian sugar-beets, or three tons of common mangolds. Nobody probably will dispute the fact that the dry substance of sugar-beet or a mangold is more valuable for feeding purposes than the dry substance of the pulp. The question, however, which requires to be settled is, not whether the perfectly dry pulp is less valuable than perfectly dry roots from which it is made, but whether the 672 lbs. of solid matter contained in a ton of pulp are worth more or less than the 347 lb. of solid matter present in a ton of sugar-beets, or 246½ lbs of the solid matter of which common mangolds consist. I find, moreover, that, weight for weight, the pulp contains more albuminous (flesh-forming) matter, much more fibre, and but little sugar. On the one hand, we have in sugar-beets an excess of 8 per cent. of sugar, and in common mangolds an excess of 4 per cent., over the amount of sugar in the pulp; and on the other hand, we have 24 per cent. of fibre in the pulp, against $3\frac{1}{2}$ in beets, or 3 per cent. in common mangolds, besides an excess of 1 per cent. of albuminous matter in the pulp.

The question thus resolves itself into this, are 4 lbs. of sugar (the excess in 100 lbs. of common mangolds), or 8 lbs. of sugar (the excess in 100 lbs. of sugar-beets), worth more or less than 1 lb. of albuminous or flesh-forming matter, and 21 lbs. of the finely-grated fibre, which constitutes the excess in 100 lbs. of the pulp? As the difference in the amount of nitrogenous matter in the pulp and in the roots is comparatively small, we may, for simplicity's sake, throw it together with the excess of fibre.

Taking into consideration the probable difference in the feeding value of sugar and vegetable fibre, I am inclined to think that a ton of fresh beet-root pulp, as it comes from the presses, or old pulp, not containing more water than fresh, is worth fully as much for feeding purposes as $1\frac{1}{2}$ tons of the beet-roots from which it is obtained, or as much as 2 tons of common mangolds.

Beet-root selling at 12s. a ton is, unquestionably, a cheap and valuable food, which may be used as a good substitute for roots. It is, in fact, worth more than 12s. a ton to the farmer, and there can be no doubt that the refuse pulp of sugar manufactories or distilleries will always command a ready sale in England.

I have seen in Belgium large numbers of beasts fed upon nothing else but the refuse pulp of sugar manufactories. This, however, in my opinion, is not a good plan, and I would advise it to be mixed with some bean-meal, or Indian-corn, or, better still, cotton-cake.

A mixture of refuse pulp and cotton-cake is an excellent food for milch cows, for it produces abundance of milk, and milk of good quality.

A few more remarks, and I have done. If we consider the actual success and wonderfully rapid development of the beet-root industry on the Continent, and the satisfactory experiments in the growth of sugar-beets which have been tried in England during the last three years, I think there is every probability that ultimately a considerable breadth of land will be applied to the cultivation of sugar-beets, and that, ere many years have passed away, beet-root sugar manufactories and distilleries will spring up in various parts of England and Ireland.

DISCUSSION.

Mr. Botly begged leave to move a cordial vote of thanks to Professor Voelcker for his able paper, which he had been much interested in, and the more so as he knew something of beet-root culture in the localities mentioned in his essay in the *Royal Agricultural Journal*. There were many who pooh-poohed the idea of growing sugar beet in the United Kingdom; but to any such he would say that it was not so many years ago since the first turnips were grown in England; and Swedes and mangolds were now constantly cultivated where at one time it was predicted they never could be grown at a profit. Some 30 years ago, for instance, he purchased a small farm in Wiltshire, and he was then told he could not grow Swedes there, but, so far from that, he produced some of the finest in the country, and not only so, but in a short time doubled his yield of corn, which he could not have done but for artificial manures and the growing of root crops. He believed that any land which would grow other roots would grow the sugar beet. Only the previous day he had seen some mangold wurzel at Upper Norwood, of which he was assured the yield was 40 tons to the acre, and if that were so he was certain the cultivation of sugar beet would be profitable. It must also be borne in mind that the additional growth of root crops was of immense importance to the poor man, on account of the great amount of labour required for hoeing, &c. On his own ground, he had estimated the cost of hand labour at 10s. per acre on root crops, and as there were upwards of three million acres of this kind of cultivation in the kingdom, it was obvious how important it was. He was, therefore, a strong advocate for the introduction of the beet-root culture, not only on account of the increased amount of employment it would afford, but also because wherever it was introduced the production of wheat increased also.

Mr. Barron inquired if the revenue laws interfered in any way with the manufacture of beet-root sugar, or rendered it less advantageous to make it in England than to import it from abroad.

Mr. Newell V. Squarey said there was one important question which had not yet been touched upon, viz., whether, when the crop of beet was produced, it would not be more advantageously employed in feeding cattle than in being converted into sugar, seeing that there were other countries, such as the West Indies, where saccharine matter could be produced in enormous quantities, whilst the supply of animal food in England was anything but adequate to the requirements of the population. He suggested, therefore, the question whether the sugar contained in the roots might not be as advantageously employed in feeding cattle as in any other way, particularly as he understood it was now becoming a common practice to feed cattle upon refuse sugar obtained from other countries, treacle, &c.

The Rev. Mr. Langhorne said there were one or two points of the question which he did not think had been cleared up. Some years ago he spent some time in the south of Russia, where the land was almost entirely given up to the cultivation of the beet for the purpose of sugar manufacture, the price of wheat being very low, and the object of the proprietors being to grow such a crop as could most readily turned into money. For this purpose many of them had gone to great expense in importing machinery from France, England, and Belgium, for the purpose of the manufacture, and on the estate on which he was staying, nearly every field was given up to the cultivation of the sugar-beet. The result, however, was, that many of the proprietors were ruined, not being able to produce sugar cheap enough to meet the market, although the price there was about 2s. a lb. If therefore, in such a locality, with every advantage, cheap labour, good soil, and favourable climate, sugar could not be produced at less than 2s. or 2s. 2d. a lb., it was evident the thing must fail, as fail it had. The particular proprietor to whom he referred—a man of great eminence and great influence—had gone so largely into it as to borrow about a quarter of a million from the government for the purpose, but the result was he had to mortgage his estates so heavily and got into such embarrassments that he had to sell a large portion in order to free himself. If, therefore, sugar could be imported from the West Indies at 4d. per lb. or less, he did not think it would prove very profitable to attempt making it at home.

The Chairman said Mr. Langhorne had referred to the growth of sugar in Russia; he might say that Mr. Duncan, whose name had been mentioned several times, and whose absence he much regretted, had travelled through the part of Russia to which allusion had been made, and described it as extraordinarily rich in quality, and apparently calculated for the most successful beet cultivation, and the facts did not quite correspond with the statement which had just been made. A return given to him by Mr. Duncan showed that during the last four years, the production of beet-root sugar had risen from 112,000 tons to 155,000 tons, so that notwithstanding a failure in the particular instance mentioned

—and such failures happened to everybody, in every country, and under every circumstance—it was quite evident that the cultivation was on the whole successful. It had been stated that the gentleman referred to had entered into speculations, and that his estates were heavily mortgaged, and that might lead to the conclusion that there were other reasons besides those alleged for the failure of the enterprise. The question raised by Mr. Squarey was, no doubt, one of great importance, viz., whether it would be more profitable to convert the root at once into sugar or at once into meat, and this was a consideration which must weigh greatly with those who took an interest in the subject. The price of meat was gradually rising because the number of consumers were increasing more rapidly than the production of meat to satisfy their wants, and that, it might be said, was a good reason why in this country sugar cultivation, which might flourish on the Continent, might not be successful. The answer, however, was this, that the price of butchers' meat on the Continent was also rapidly increasing; but, notwithstanding that, the manufacture of beet-root sugar was also constantly increasing, and wherever it was adopted it had been uniformly followed by an increased production, not only of wheat, but also of fat cattle, in a similar ratio; and with regard to the question of duties, Mr. Duncan had assured him that he found no difficulty whatever, the duty on the sugar being collected by the officers of the Inland Revenue at exactly the same rate as on imported sugar of any kind. The consumption of sugar in this country was very vast, as some figures which he had before him would show, and it was not only vast, but increasing. Last year the consumption was equal to 44 lbs. per head of the whole population, which was higher than in any other country in the world, and this year it had increased to 47 lbs. per head, while the total quantity imported was 700,000 tons, the total consumption being 643,000 tons. It was rather difficult to attach any definite meaning to such large figures. It amounted simply to this, that the quantity of sugar imported into this country was equal to one-eighth of the entire consumption of wheat in this country, both foreign and native grown, while the foreign sugar imported was equal to one-fourth of the import of foreign wheat. With this vast and increasing consumption of sugar, it was of great importance to look out for increased sources of supply, for although Mr. Langborne seemed to think that there was no occasion for looking for other sources of supply so long as there was plenty of cane-sugar to be obtained from tropical countries, there were serious considerations attaching to that side of the question. The greatest sugar-producing country was Cuba, in which slavery was still prevalent, and the probability was altogether in favour of its disappearance in a few years, either gradually or suddenly, but, in either case, the first consequence would be a serious diminution in the production of sugar for some years, although it might not affect the question eventually. Now Cuba produced something like 700,000 tons—nearly as much as the total consumption in England—and in other colonies the production of sugar was very much dependent on Coolie labour, and that was becoming more scarce and expensive. Therefore, in whatever direction one turned, it would be found that there were increasing difficulties to be apprehended if the supply of sugar were to be solely drawn from these tropical countries. On the Continent the production of beet-root sugar had now become a vast industry, having grown up really from nothing. In 1868, the production was about 664,000 tons; the next year, 658,000; in 1869, 841,000; and, in 1870, 925,000 tons; and of this vast quantity England had imported 76,000, or nearly one-twelfth of the whole. Now, it so happened that it was not the hotter parts of Europe which were best adapted for this cultivation, but the northern parts of France, and the cooler districts of Belgium and Germany, or, in other words, in those districts whose climate most approximated in its character to the eastern, south-midland, and south-eastern counties of England, and to the south-eastern counties of Ireland. It was a very important question as regarded Ireland, and he regretted that Mr. Agar Ellis, who had paid much attention to its cultivation there, was not present, but he had placed in his hands the result of experiments he had made; and the analysis spoken of in the paper by Professor Voelcker showed an extraordinary amount of sugar as the result of the growth of beet-root in Ireland. There seemed, therefore, a very good prospect for the introduction of this industry into those particular counties in the neighbourhood of Kilkenny, which was one of the dry, corn-producing counties, and those adjacent to it, for it was generally allowed that the moistier parts of the kingdom, such as Devonshire, were not favourable to this cultivation. One important consideration as to the introduction of this industry into England was the cost of production, but in every point of view, he thought England could compete successfully with the Continent. Coal, which was one large item of cost, nine hundred tons having been used at Lavenham last year, was cheaper, labour was quite as cheap, if not cheaper, land in that part of Suffolk where the beet-roots had been grown was cheaper than generally on the Continent, and only the roots themselves were dearer, and that was in favour of the farmers. If most of the items in the cost of cultivation were lower here, certainly there was a higher value for the sugar produced, or the Continentals would not send us so much here, and as the pulp, so far as it was used for food, for which it was very useful, yielded a high price, it would be evident that every advantage was in favour of the English cultivator. There only remained one or two practical points upon which he would touch. Mr. Duncan said, from his experience in his own case, and from what he had learned on the Continent, that nobody should enter into this enterprise unless he were in a position to complete the process of sugar manufacture, because if he confined himself to the manufacture of syrup he could not always be sure of a market, and the syrup could not be kept any considerable time. At the same time, the smallest factory which, in his opinion, would pay, involved a capital expenditure of about £9,000. In his case, in consequence of the crop being small, and the supply of roots not being equal to his power of machinery, his machinery had not been in full work, and therefore operations had been carried on at a disadvantage. Last year he had only used about 4,500 tons, but he reckoned that if he had had 6,000 tons he should have made a profit of 6s. a ton, 7s. if he had used 7,000 tons, or 8s. if he had had 8,000 tons, simply because with the larger amount he should only have been able to fully employ his machinery. With regard to the locality where the sugar factory should be placed, it was not absolutely necessary it should be a railway, for the roots would not bear carriage above a few miles, and the shifting of them from the cart to the trucks, and from the trucks back again to the carts, added greatly to the cost of the raw material. The factory, therefore, should be placed so that it could be easily supplied by the neighbouring farmers carting their roots themselves. In France, it had been found that this labour of cartage was so heavy where the manufacture was carried on to a great extent, that in one place a system had been devised, by which no less than thirty-seven miles of iron pipe had been laid out from a central factory to farms in the neighbourhood. The roots were pressed at these outlying farms, and the juice was sent through the pipes to the central factory, and there the finishing process was carried on. In this way the expenditure of a small capital of £2,000 on the outlying farms was sufficient for preparing the juice, which was then transferred to the central factory, where both capital and skill could be concentrated upon it. It was, in fact, the cheese-factory system carried out in a sugar-factory, the cost and trouble of carting both the roots and the residuary pulp being saved.

With regard to the profits on his capital of £12,000, embarked at Lavenham, Mr. Duncan had this year, even with his inadequate supply of roots, made a clear return of 15 per cent, after writing off an equal sum for interest and depreciation, and with that return he was quite satisfied, as also with the quality of the roots, as compared with those he had seen on the Continent. He was decidedly of opinion that, with proper skill and economy, with sufficient capital, the enterprise might be entered upon with every hope of success. With regard to the farmers themselves, the crop this year had been rather a light one, but he had recently had the pleasure of meeting most of the beetroot growers of the neighbourhood of Lavenham, and although they were not particularly enthusiastic, and spoke about the difficulties attendant on the cultivation of roots of a proper average size, and so on, yet they were all willing to contract, and did contract, to continue the supplies in future years at the same price. This was quite enough to show that in their opinion it was an agricultural success. Then it must be borne in mind that they got back the pulp, one ton of which was worth, for feeding purposes, one and a-half tons of the roots themselves at 12s. a ton, while they sold the ton and a-half of roots for 30s., which was not by any means an unprofitable transaction. There was something no doubt to be said as to its being an exhausting crop, and this was a point which both farmers and landlords would have to consider. But the same might be said of other things, potatoe culture, for instance, which for the last twenty years had been carried on very largely, especially in the East Lothians. In that case, nothing whatever was returned to the land, whereas in the case of the beet, where between one-third and one-fourth of the entire weight of roots sent off the ground could be returned in the form of pulp, and the balance could be easily made up if there were a profitable business, as was done by potato growers, by the purchase of such manures as were necessary to keep the land in good condition. Upon the whole, his own impression was that, whilst the value of meat, as compared with the value of sugar, was a serious question to consider, the most successful plan of operations would be to combine the production of the two. If the production of sugar realised a profit, and supplied an article in immense demand, it would afford the means of purchasing those articles which would produce the meat, which was also so much required. The last question of all, which was perhaps the most important, was, How did this branch of industry affect the labourer? Anyone acquainted with the south-midland and southern counties of England knew that one of the greatest difficulties in those districts was how to tide over the winter months, when labour was slack, when there was little outdoor work to be done, and when any kind of employment was an immense boon to a vast number of people. Now, this particular kind of industry seemed especially adapted for the object. At Lavenham, in the hundred days during which the manufacture was going on, there was an expenditure for labour of about £1,900; for coal, gas, oil, tallow, &c., about £400; £500 in railway transport; a certain amount in local rates, and a large sum contributed to the public revenue. There was, therefore, a large infusion of capital spread over the whole of this agricultural village which it had never had before, and if these roots had been applied directly in the feeding of cattle, instead of converting them into sugar, not one-tenth of the amount of labour would have been employed. In conclusion, he had much pleasure in tendering the cordial thanks of the meeting to Professor Voelcker for his interesting and exhaustive paper.

Tea.—Messrs. Graham and Macdonald have failed to find a practicable route from the Cachar tea district to Chittagong.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

As already announced, the Council in aid of this object will give six concerts in the Albert Hall, and a guarantee fund for assuring the Society against loss has been commenced, and the amount guaranteed is £2,548.

Members willing to have their names placed on the list of guarantors, or to become subscribers for tickets, are requested to signify their wishes by letter, addressed to "The Secretary of the Society of Arts, John-street, Adelphi, London, W.C."

A subscription of one guinea entitles a member of the Society of Arts to a transferable numbered and reserved seat at each of the six concerts.

The prices to be charged to the public for admission to reserved seats at the concerts will be as follows:—

Arena for one concert	£0	7	0
Or subscription for the six concerts	2	2	0
Balcony for one concert	0	7	0
Or subscription for the six concerts	2	2	0
Amphitheatre for one concert	0	10	6
Or subscription for the six concerts	3	3	0
A box holding five persons for one concert	3	3	0
Or for the six concerts	15	15	0

In letting, preference will be given to a subscription for the six concerts.

Members of the Society of Arts will have the privilege of subscribing for a set of six tickets (transferable), admitting the bearer to a reserved seat, at each of the six concerts, as follows:—

Arena	£1	1	0
Balcony	1	1	0
Amphitheatre	2	2	0
Box holding five	10	10	0
Ditto „ for one concert (if vacant)	1	15	0

Special Notice to Members of the Society of Arts.

The price to members subscribing for sets of tickets for the six concerts at the Royal Albert Hall is 1*l.* 1*s.* up to the **15th MARCH**, after which date the price will be 2*l.* 2*s.*; and the above privilege to members can on no account whatever be extended.

OPENING OF THE ALBERT HALL.

Tickets to admit to the ceremonial at the opening of the Royal Albert Hall by the Queen, on the 29th March, can be obtained of Mr. Samuel Thomas Davenport, the financial officer of the Society of Arts:—Arena, 3*l.* 3*s.*; Balcony, 2*l.* 2*s.*; Picture Gallery, 1*l.* 1*s.* each.

INDIA COMMITTEE.

This evening (Friday) a Conference on the subject of "The Claims of India Cotton" will be opened by Sir Thomas Bazley, Bart., M.P. The chair will be taken at eight o'clock, by John Cheetham, Esq.

POSTAL REFORM.

A meeting of the Society, for the discussion of this subject, will be held in the Society's rooms on Monday morning, the 13th of March, at 12 o'clock, when the chair will be taken by Lord Henry G. Lennox, M.P., the Chairman of the Council.

CANTOR LECTURES.

The third course of Cantor Lectures for the Session will be delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will consist of Five Lectures, commencing on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. W. Fothergill Cooke and Professor Charles Wheatstone, F.R.S., in recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Council invite members of the Society to forward to the Secretary, on or before the 22nd of April, the names of such men of high distinction as they may think worthy of this honour.

THE LIBRARY.

The following works have been presented to the Library:—

List of Members of the National Association for the Promotion of Social Science.

The Forty-sixth Annual Report of the Directors of the Liverpool Institute.

Transactions of the National Association for the Promotion of Social Science for 1870. Presented by the Association.

A Pamphlet, entitled, "An Ode to England."

Recueil de Documents sur les Exactions, Vols, et Cruautés des Armées Prussiennes en France. Presented by Messrs. Johnson and Sons.

Catalogue of the Victorian Exhibits to the Sydney International Exhibition of 1870.

Statistics of New Zealand for 1869.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

Royal Albert Hall.—The Queen has appointed Wednesday, 29th March, 1871, when Her Majesty will open the Royal Albert Hall of Arts and Sciences, erected as a memorial of the Prince Consort; and the following is the

Programme of the State Opening.

The doors will open at 11 a.m and close at noon. Whilst the assembling of the public takes place, military bands will play.

1. His Royal Highness the Prince of Wales, President of the Provisional Committee for the Hall, will be received by the Provisional Committee at 12 o'clock.
2. On the notification of the Queen's arrival near the building, his Royal Highness and the Provisional Committee will proceed to the entrance to receive her Majesty.
3. Upon the Queen's entrance into the Hall the orchestra will play one verse of "God Save the Queen."
4. An address will be read by His Royal Highness the Prince of Wales.
5. Her Majesty will make a reply, and will hand a written answer to the Prince of Wales.
6. A prayer will be said.
7. Her Majesty the Queen will then formally open the Hall, which will be announced by trumpets and a royal salute in the park.
8. Her Majesty will be conducted to the Royal box, and a cantata, with words from the Bible, composed ex-

pressly by Sir Michael Costa, will be performed by full orchestra and chorus of 1,000 performers.

9. Her Majesty will then quit the Hall.

10. An interval of ten minutes.

After which a grand miscellaneous concert will be given, to be conducted by Sir Michael Costa.

The Exhibition.—The committees of selection in the various classes have been sitting during the week, and as soon as they have finished their work the arrangement of the exhibits will begin. The owners of rejected articles are requested to fetch them away as quickly as possible. The labours of the committees have been all the more arduous because nearly all of the articles sent in have displayed considerable merit; the restriction placed by a limited area of exhibition on the judges have compelled them only to admit the works possessed of the highest excellence.

United States of Columbia.—A circular has been addressed to the secretaries of the governments of the States, which is an energetic appeal to them to use every means to get together a collection which shall enable foreigners to form a just estimate of the progress of the country in works of art and industry, urging them, as a point of honour, to answer to the call of England, by taking such measures as shall lead to the most ample and detailed representation of such objects. Appended to the circular is a list of such matters as the London Exhibition will be confined to, to serve as a guide to parties who wish to exhibit. The circular modestly states—"Truly we have not many things to send, but we shall not absolutely fail. Portraits, and drawings, and oil paintings, small carved articles and sculptures in wood, representing animals, costumes; some specimens of native pottery; a few photographs and lithographs; educational works, in which perhaps our exhibition may count a hundred volumes; scientific inventions and new discoveries, in which might figure certain processes employed in exploring mines; tapers of vegetable wax; the application of kaolin to stucco work. In all these matters something may be exhibited, not to show our advancement, but our aspirations and our efforts."

THE PATENT LAWS.

In the House of Commons on Tuesday night, March 7,

Mr. Samuelson, in moving for a committee to inquire into the law, practice, and effects of grants of letters-patent for inventions, declared himself in favour of patents if the system were properly administered; but it would be better to abolish it altogether than keep it as it was at present. What was chiefly required was a more efficient examination of applications for grants and a check on the multiplication of frivolous patents. Inventors required protection because they were almost invariably poor men, and not in a condition to carry out their inventions without the assistance of capitalists, who, of course, if they advanced money, expected to be recouped. The self-acting mule, for example, swallowed upwards of £30,000. Bessemer's improvements in the manufacture of steel cost £100,000 in seven years before any return was obtained.

Mr. Macfie, who seconded the motion, condemned patents altogether. Mr. Samuda also questioned the advantage of retaining patents. Mr. Mundella, Mr. Hinde Palmer, and Mr. Platt argued in favour of patents for inventions.

Mr. Chichester Fortescue assented to the motion without committing himself to any opinion, but the Attorney-General pronounced against the abolition of patents. If there were no Patent-law, inventors would, he said, be of two classes. The first class would consist of purely scientific men, who made discoveries for the love of truth. The second class would consist of manufacturers, who invented for their own benefit and kept their inventions secret. But the Patent-law called into existence a third-class, whom he might call professional inventors, who invented in order to make a profit by publishing their inventions. These were the creatures of the patent law, and to them was due the greater part of the discoveries which were made. He thought the tribunal for the trial of patents might be amended by abolishing the jury and substituting assessors, and perhaps a special court might be established for the purpose.

The motion for a Select Committee was then agreed to.

Leave was also given to Mr. Hinde Palmer to bring in a bill to amend the law relating to patents for inventions.

EDUCATIONAL NOTES.

The London School Board and the Religious Question.—At the meeting on Wednesday last, the motion of Mr. W. H. Smith, M.P., which had occupied several meetings in discussion, was passed, in an amended form, by a majority of 38 to 3. The first clause, as agreed to, read as follows:—"That in the schools provided by the Board, the Bible shall be read, and there shall be given therefrom such explanations and such instruction in the principles of religion and morality as are suitable to the capacities of children." The second clause gives power to the Board to except particular schools from the operation of the resolution, upon adequate cause shown by the managers, parents, or ratepayers of the district.

British Teachers and the New Code.—At a recent meeting of the London British Teachers' Association, at which most of the metropolitan teachers, both masters and mistresses, were present, together with many country teachers, resolutions were adopted approving of the new code upon the whole, but asking for the following changes in the pupil-teachers' system:—1. That the teacher of the school for the time being shall be a party to the agreement made with the pupil-teacher. 2. That a direct payment be made for the instruction of pupil-teachers. 3. That the old hours of work, six per diem, should be restored. 4. That the "six months' notice" clause should be modified. They also ask for some revision of the schedules of examinations, the syllabus of instruction for the higher standards being now higher in several ways than the pupil teachers' syllabus, and for some modifications of the conditions required for honorary certificates.

Music in Elementary Schools.—The Rev. John Curwen writes to remonstrate against the new Revised Code, which excludes drawing and music from the list of extra subjects for which grants are given by the Committee of Council. He apprehends that music will cease to be taught in the schools directly the government discourages it. He believes the real difficulty lies in the fact that probably not more than one-tenth of the inspectors know how to examine in music. This difficulty might, he suggests, be met by extending to schools that system of ear exercises which has for some years past been introduced at the Christmas examinations of the training colleges, the examinations of the Society of Arts, and the local examinations of the universities, the only difference being that the exercises must be more graduated and better adapted to their purpose. The inspector would then, he says, have only to see the exercises done, in the course of ten or fifteen minutes, and send them to London for correction, a great advantage of this plan being that the examination would be uniform throughout the country. In reference to the teaching of singing, the Rev. J. M. Capes, in a recent letter, urges that "there is but one way to create a love for music in the people, and that is to teach them, while still boys and girls, to sing part-music and to sing with ease by note. If the members of the school boards content themselves with imparting some sort of modification of that miserable teaching which prevails in many of their own families, the attempt can only result in utter failure. From the earliest years, children should be accustomed to the sight of the five lines of the musical staff, and should be taught to sing all possible intervals in the chromatic scale." He thinks, however, that it will not do to intrust this teaching to the master or mistress, and recommends the school boards to call to their aid "a certain number of professional or half-professional men and women, who have made the teaching of part-singing to children their special study;" an art of which many of the professionals who are now painfully struggling to obtain a living by teaching in schools and private families are quite ignorant. He thinks young teachers would generally be the most suitable, and that thus the cost would not be very considerable, probably about £20 to £30 a-year for each school. On this subject the *Daily News*, while expressing regret that in the Revised Code the teaching of music in elementary schools has not been considered requisite or practicable, points out that if it is to be taught, it will be necessary to render it a non-compulsory branch of tuition, in which only those should be taught who would care to learn; but it suggests that their industry might be stimulated by prizes. "When music is taught in the schools," says the same journal, "we shall hear no more of the buffoon ditties, and our people will find their enjoyment only in the works of masters and of accomplished artists. Certainly some stronger objection must be made to the teaching of music than a statement of the incapacity of the inspectors to examine or to report on the matter. It might be suggested that sooner than have musical instruction omitted from the school course, an inspector properly qualified might be added to the present unmusical corps of gentlemen who discharge supervising duties in the Educational Department."

The Debates in School Boards.—The editor of the *School Board Chronicle* defends the boards from the attacks now beginning to be made upon them—that they are disputing when they ought to be at work. It thinks that "the masterly and exhaustive manner in which such questions as religious instruction, the maintenance of denominational schools, and compulsory attendance, are being discussed throughout the country, under the influence of every shade of local feeling and predilection, will be estimated as worth a good deal among a people like ourselves, who consider all things well before we make up our minds. In this manner, in the very face of the task which lies before them, and by the very men who are most familiar with the work, it may be said that the difficulties which have hitherto barred the way to education, and the problems which have so long demanded a solution, should be met and disposed of for the time; not alike in city, and rural parish, and manufacturing town, but in all places according to the feeling which predominates among the people, and in harmony with their habits and associations."

The Games of Children.—In a beautiful chapter by Jean Paul Richter, which Mr. Blanchard Jerrold says should be posted in the meeting-room of every School Board, the author, after pointing out that that which produces and maintains cheerfulness is nothing but activity, says—"The usual games of children, unlike ours, are only the expressions of earnest activity, clothed in lightest wings." And he goes on to divide them into two classes:—"First, into games or exertions of the receiving, apprehending, learning faculties; and secondly, into games of the acting, forming powers. The first class would embrace activity from without working inwardly, like the nerves of sense; the other, activity from within working outwardly, like the nerves of motion." The first class, which he calls the theoretic, would include "games which are properly only a child's experimental physics, optics, mechanics. Children have great pleasure, for instance, in turning or raising anything—putting keys into locks, and, in general, one thing into another—opening and shutting doors; to which is added, moreover, the dramatic fancy of seeing the room now large, now small, and themselves alone one moment, in company the next;—watching the employment of their parents is to them a game of this kind, as is also listening to conversation." In the second, or practical division, would be included "all those games in which the child seeks to relieve himself of his superabundant mental activity by dramatic fancies, and of his bodily, by movements."

CORRESPONDENCE.

THE COMMERCE OF INDIA.

Sir,—I am one of the last of those, who have served in India, who would wish to throw cold water upon the natives of India freely expressing their opinions, both in India and in England, upon topics which so nearly concern the welfare of their fellow-countrymen as the subject of the debate last night; at the same time I should be sorry to let some of the remarks in the paper which was read at your former meeting go forth to the world, without taking some means to express my dissent from the views of the writer on certain points.

While I think that discussions of this nature are calculated to be of very great benefit to India, where the government of the country is non-representative, I cannot compliment the writer so highly as some of the speakers have done, on the ability with which he has treated the subject. To begin with, the title of the essay is a misnomer. It is not a treatise on the commerce of India, but something very different; whereas so many false issues are raised in the paper, that, in the absence of that summary of the results of the whole debate which Sir Bartle Frere, from want of time, was prevented from making, the good that, on the eve of the assembly of the Select Committee of the House of Commons on Indian finance, a debate of this nature might be expected to accomplish may be lost.

It is quite beside the question to enter into statistics gathered from trade returns dating half a century ago. In a history of the trade and commerce of India, these figures would be in their proper place; but in an essay, however misnamed, which purports to deal with the present, they are not only not in their proper place, but as the public are prone to assume that a treatise bristling with figures, which may or may not be accurate, is something very profound, they may do a great deal of mischief.

The false issue raised by these figures is, that the trade of India is to India a losing business, to the extent of £60,000,000 or £70,000,000 in fifteen years of the times gone by, and £30,000,000 in some six or eight years later (I write from memory). And that I do not by any means wish to be unfair to the lecturer, I appeal to the twice or thrice repeated phrase that these millions of produce have been sent to England without India receiving any equivalent whatever in goods, or money, or anything else. To make this seem more clear, moreover, the lecturer, in treating of imports, has twice or thrice italicised the words "including treasure." Now, any person unacquainted with the subject would be induced to believe from such statements that the merchants who imported these goods did not pay for them, or that, by some juggling on the part of government or other persons, India was done out of its share in the profits of the transaction; and the only conclusion that could logically follow from such an argument is, that the government of India would do a good service to the country by placing all the merchants in Calcutta, Bombay, and other Indian ports, on board the merchantmen in these ports, sending them to England, and putting a stop at once to all trade with foreign countries. And that such a conclusion does follow, or rather, I should say is made to follow, by the lecturer himself, from the false premises from which he started, I may instance the subsequent passages in his paper, in which he details how, whilst hundreds of thousands of the people of India were dying of starvation in Orissa, the merchants of Calcutta were sending home millions of hundredweights of rice in ships across the seas. And he adds, with, no doubt, unfeigned horror—a horror apparently shared in by my respected friend Sir Arthur Cotton — "Good God! how long are such things to last?"

Let me add parenthetically here, for the information of those who have not paid particular attention to economic questions, that these things will last until such time as India has a Viceroy or a government who know that it is the first duty of a good government to save the Queen's subjects alive; who have the intelligence to understand that in all crises the ordinary laws of political and economic science are paralysed, and refuse to act; and who have the humanity to feel for the suffering fellow-creatures whom Providence has committed to their charge; and England has a Secretary of State who, like Lord Salisbury, has the courage to do his duty, though the heavens fall.

The duty of a government in such circumstances is not, however, to seize ships laden with rice, but to adopt the very much simpler and more constitutional course of creating such a demand as will raise the price of rice, or any other commodity, for home consumption to a price higher than that at which the merchant will purchase it for export to a foreign market.

So much for the false issue raised by the array of figures resuscitated from ancient trade returns by the lecturer, which indeed have nothing on earth to do with the questions subsequently discussed in this paper. The writer has, in short, mixed up two entirely distinct questions, a mode of procedure which must be fatal to the right understanding or discussion of either of them, and has so involved and inverted his arguments that the important subjects he has attempted to discuss appear in a shape which I can only describe as one of unutterable confusion. It is for this reason that I say I cannot compliment the author on the ability with which he has handled the subject, for to do so I should be compelled to doubt his sincerity, which I should be very sorry indeed to do. Mr. Naoroji has very probably read in other places a good deal of such matter as he has submitted for discussion, and no doubt thinks that India is suffering under some monstrous oppression and injustice. But there is nothing very new in these ideas, except his very extraordinary mode of treating the subject. Indeed, it is only a few weeks ago that I received a letter from Bombay, calling my attention to a pamphlet by Sir George Wingate, regarding the "tribute of India to England."

The real issue raised by the paper under discussion by the Society is, "The government of India by Great Britain, as now administered, costs the country very much more than if we Indians governed it ourselves; has the result shown a profit or a loss?" The extra cost the writer loosely calculates at £12,000,000 annually, and states this result to be the impoverishment of the country, and a grinding and oppressive system of taxation upon a people whose food is a handful of rice, whose clothing is a rag round their loins, and who live in hovels.

Now, everyone knows that there is a charge on the revenues of India for the maintenance of the home government of the country. What that charge is I cannot off-hand say. It may be £1,000,000; it may be £3,500,000, as was mentioned to me in the room last night. The equitable distribution of this charge between England and India is a fit, a very fit, and proper subject for the careful consideration of the Select Committee of the House of Commons about to sit. But when Mr. Naoroji mixes up charges for stores purchased in England, payments for guaranteed interest (if he has done so) the remittances of officers, soldiers, and civilians serving in India, and the pensions of retired public servants, he imports into the argument matter which has quite as little to do with the subject as the results he has evolved from a comparison of ancient returns of exports and imports. Had he devoted all the time and attention he has no doubt bestowed upon these valueless figured statements, to carefully analysing the details of the past year's home charges, especially he charges for military purposes, and distributing them equitably according to his lights as a native of India, he would have discharged a very valuable service to his country. But as it is, he has simply diverted public attention from what possibly may be a real injustice, to what certainly is no injustice at all.

It is a serious misfortune for India, circumstanced as she is, that her climate is not suitable as a residence for Europeans, and one that should not be allowed to pass unconsidered; but this misfortune borne in mind, that a portion of her revenue will be spent out of the country must be a recognised fact. It is a misfortune she shares similarly with a nation that "whips creation"—America. As well might the pay and expenses of all the English ambassadors and consular agents at foreign courts, the interest of all the foreign loans contracted in England, and the money remitted from England to all Englishmen, pensioners, and others residing abroad, be set down in our trade returns to the loss of England, and to the profit of those foreign countries, as the charges Mr. Naoroji has included in his creditor and debtor account of England with India. In short, these charges have, as I said before, no earthly concern with the subject-matter under discussion, and merely serve to confuse and confound the few Englishmen of influence in this country who, from upright, honourable, and conscientious motives, really and truly wish to study the extremely difficult problem Great Britain has set herself to solve, viz., How to govern India to the best of its ability for the welfare of the country and the good of its people.

Nothing would be more simple than to refute almost all Mr. Naoroji's arguments—if, indeed, conclusions drawn from false premises can be called arguments at all — from his own paper; but it is hardly worth while to devote serious attention to subjects of such paramount importance to India upon an indictment, as some of the speakers termed it, framed upon issues so false as those which this gentleman has raised. The very alpha and omega of his arguments are a contradiction of all the reasoning he has been at the pains to bring to his aid, for, while starting with an assertion which he has demonstrated by figures, that the commerce or trade of India with England has been a ruinous concern for India, and has led to the impoverishment of his country he sums up the remedies he would propose for the evils he has commented upon by adopting as his definite conclusion a dictum of Lord Lawrence's, to the effect that if exports be increased the regeneration of the country will follow.

Nothing would be simpler for me, or for any intelligent person with a very superficial knowledge of India, to show that the wealth—the actual and positive wealth—of India has increased enormously under British rule, since bloody and expensive wars have ceased to be the rule; and nothing would give me greater pleasure than to do so, if the government of the country would pay more careful attention to those national statistics which are the backbone of all comprehensive treatises upon a country's progress. Suffice it to say that, in one province of India alone, within the present century, there has been an actual creation of wealth, leaving roads, bridges, and public works out of the question, representing an annual income of from £4,000,000 to £5,000,000, every shilling of which goes into the pockets of the people of India, and contributes, I may say, almost nothing to the maintenance of that machinery which every government is bound to keep up for the protection of the lives and properties of its subjects. In other provinces of India similar results have been obtained, though perhaps not quite in an equal degree, and with this distinction, that the increased wealth contributes its quota to the general fund for the public benefit and the material and moral progress of the country and the people.

It would be impossible for me, in a letter of this nature, to go into details on this portion of the subject, both from want of space and reliable data. Nor is it at all necessary. All I need ask any sensible person is—Allowing for the increase of territory represented by the Punjaub, Oude, Burmah, the Central Provinces, &c., and taking into consideration the bad management—another term for bad government—which is said to have prevailed, could the annual revenues of India have doubled within the last quarter of a century without the most monstrous oppression, if there had not been, if not a proportionate, at least a very considerable, increase in the wealth of the nation. I adduce this as a general argument, for I write *currente calamo*, without book or references of any kind. It is, nevertheless, a sufficiently conclusive one. I pass over the salt-tax, which must be taken in the light of a poll-tax. The grievance, as far as my experience of India goes, is a philanthropic one. But I cannot pass over the income-tax. Its imposition in a country like India is in the highest degree censurable, and lays the government of the country open to execration, and with some reason. In regard to the taxation of the country, the very greatest care is necessary, in consequence of the ignorance of the government of the real capabilities of the people to pay, and, I fear I must with reluctance add, the disregard that is too often shown for their feelings, wishes, and prejudices. But a financial equilibrium *was* obtained by Mr. Laing, without incurring the hostility of the people, or raising any public outcry. The account branch of the Financial Department *was* reorganised, and put on a tolerably sound footing by Sir Charles Trevelyan; and with an increasing revenue and profound peace, there ought to have been no reason for the confusion which has since arisen. But the reforms of Mr. Laing were not maintained, and the account branch of the government was allowed to get into such disorder that, in one year, the Public Works Department spent nearly a million more than was included in their estimates, or was sanctioned by the government, and half a million more than the Department itself was aware of. Lord Lawrence again getting alarmed at the plan which had previously been approved of, of separating the capital and revenue charges on the State, made a redistribution of these charges after many of the works had been begun and large sums of money had been expended, thus throwing on to the annual revenues of the State charges it never was intended they should bear when the reorganisation of the finances was completed by Mr. Laing; and finally, the government of the day has lately given out to the world that the deficits announced in 1868-69 were fallacious, thus establishing that they were at the time wholly and totally ignorant of what was the real financial position of the country. But these are evils which may be cured.

Now all this furnishes good grounds for inquiry, but what in the name of common sense has it to do with the trade and commerce of the country from a general point of view? Nothing. The opium trade with China, which produces a revenue of from £7,000,000 to £8,000,000 annually, is a creation of the British government, and might be expected to figure in the accounts of Mr. Naoroji's essay upon the trade and commerce of India; but I find no mention of it, though it might well be set against the home charges, as it is pure gain, whilst it cannot be said that the home charges are pure loss. The government of India has much no doubt to answer for; but for that very reason surely, if justice and truth are to be the basis of the account, let the indictment be framed with ability, caution, judgment, care, and discretion, so that from a true bill true issues may be framed, and a just verdict be the result.

If any one wants to know what India was under the best of Mahommedan sovereigns, let him read Abu Fuzl's eulogium, and the counter-statements of the historian Abd-al-Kadir, of Baduon, and the revenue accounts to be found in the Institutes of Akbar, and history of Nizam Oddeen, the most carefully revised estimates from which are at this moment going through the press in a work by Mr. E. Thomas, the numismatist. If he wants to know what the greater part of India was in the earlier years of British rule, let him read the Perpetual Settlement Act of Lord Cornwallis' government and the minutes of Sir John Shore; and if he wants to know what it is, let him read the progress reports of the India Board or Council for the last few years, and afterwards go and travel for one cold season through the country.

I would desire to point out, moreover, that the remedies which Mr. Naoroji suggests, viz., the borrowing of some hundreds of millions sterling for the prosecution of public works, would, unless the interest due for many of them for years were debited to capital account, intensify the evil he so bitterly complains of, viz., the annual drain of the sale proceeds of India's produce into the pockets of English bond-holders, thus involving an increased necessity to tax the people of the rag and handful of rice beyond their ability to pay.

The question, however, of how far it is safe for the government of India to borrow for the prosecution of public works, is a legitimate one to discuss, but certainly not after the fashion it is treated of in this paper; for if India has been so impoverished since the country has come under British rule, and now has a national debt of £200,000,000, whereas before she owed nothing, surely it must be clear that no capitalists ought to trust her, or no government ought to take the undoubted risks which must attend the execution of all public works carried out with borrowed money. If to borrow money in the London market is the aim of that section of the people whom Mr. Naoroji represents, I do not think they have chosen a judicious advocate.

It is certainly disagreeable to me to point out what I consider the fallacies of Mr. Naoroji's arguments, for I rejoice above all things to see natives of India come to England and state their own cases—if they think they have cases—against English rulers; but the subject is of such paramount importance to India, that I do not think I would be serving the people amongst whom I have so long lived if I remained silent.

Mr. Naoroji, in his replies, corrected some of his statements, explained others, and read a list of public works which he set down to the credit side of the government account. But I have dealt only with the broad and clear statements of facts and assertions made in the essay which are unmistakeable, and which may be summed up in these words—The government of Great Britain, as at present carried on, involves a loss, and not a gain, to the people of India.

I heard, with very great pleasure, the practical and sensible remarks of Kazi Shahabudin, and I sincerely trust that more Indian gentlemen will express themselves frankly and fearlessly, regardless of any opposition they may meet with to their views. I have always been myself a consistent advocate for the progress, both material and moral, of the country and people of India, and that I do not wish to see that cause, for which I have myself laboured very hard, damaged, is the best excuse I can give for having been drawn into writing this long letter.—I am, &c.,

W. Nassau Lees.

March 4, 1871.

PATENT LAWS.

Sir,—I fancied that, in the course of my remarks at the Society of Arts last Wednesday evening, I had said sufficient to indicate my views upon those points of Mr. Newton's paper upon which they obviously bore. As, however, the chairman regretted that I had not summed up my remarks by clearly stating the conclusions to which my experience as a patentee had led me, I see that I must have assumed too much. I will therefore ask you to allow me by letter to state precisely the points in which I think my experiences tended to confirm the correctness of Mr. Newton's views:—

1. Mr. Newton, while considering a preliminary examination to be of use, deprecated the notion of obliging an intending patentee to submit unconditionally to the decisions of the examiners. In illustration of the injustice which might arise from decisions without appeal, I mentioned that, in an invention of my own, which I may term a chemical one, even so distinguished a chemist as Dr. Faraday misunderstood the nature of the phenomenon which led me to the discovery, and, after the process had actually been in operation for a year or two on a manufacturing scale, the editor of the *Chemical News* scoffed at it as a roundabout and expensive way of making an ordinary article of commerce. What chance of favourable consideration would my proposal have had at the hands of any examining body while still in its crudest form? Here was manifestly a case in which the necessary knowledge to judge of claims to a patent did not exist. The phenomena, indeed, on which my patent is based are still, after a lapse of sixteen years, unexplained.

2. Mr. Newton endeavoured to show that inventors needed the stimulus of the reward which, as patentees, they hoped to reap, to induce them to push their inventions to a successful issue. I described, in support of this, the difficulties which I had encountered in introducing a new system of firing pottery ovens, which is now an admitted success, and which effects a large annual saving in fuel for some of the most eminent firms in this country. I also stated the opposition which workmen had in every case raised to the introduction of both my firing system and my plan for using limes, though, in the latter case, I had at last succeeded even in overcoming *their* objections to novelty. Sixteen years of unremitting endeavours had, in fact, been necessary to put me into the position of placing this latter invention before the public, in a shape in which it was equally approved by the master, the man, and the employer. Giving me credit for the purest desire of benefiting my fellows, was it probable that, during the best years of my life, I should have devoted all my spare time and energy to pushing an invention against which so many objections were raised, but for the hope of reward beyond that which virtue always, of course, confers on those who follow her paths?

3. Mr. Newton showed that it was often wrongly assumed that lapsed patents contained valueless information. I explained that I had taken out no less than ten patents for successive improvements in a process, each one of which led up to my final discovery of a mode of using lime which, in the minds of architects, builders, and workmen, must lead to a revolution of the methods which have been practised since the first building in bricks and mortar was erected, and each one of which, on its lapse, might have enabled a careful observer to rob me of my reward, by anticipating the results which I had at last attained to. On many of these patents I did not pay up the heavy taxes exacted by the government, because, before the successive taxes became due, I had gone beyond what they aimed at; but this did not, as I conceived, render them valueless, if I had relinquished my researches.

4. In more than one case I had wished, on the other hand, to get a renewal of the term; but Mr. Newton had always told me that my chances of success depended entirely on the state of the digestive organs of the law officers who grant such renewals, and that I had better save the £500, which I should certainly have to pay, whether I succeeded or failed. On this point it was evident that I coincided with Mr. Newton's views as to the necessity of some revision of the Patent-law.

5. The chairman failed to see the moral of my experiences, excepting it was this—that persons about to patent should act on *Mr. Punch's* advice to persons about to marry, and abstain. I should admit this if I had not plainly stated that I believed I was at last on the eve of a large reward. Dr. Johnson observed, when he heard of a man who, having twice been unfortunate in his wives, ventured a third time to put his neck into the hymeneal noose, that the gentleman was a remarkable instance of the triumph of hope over experience. I may be another example of such triumph, but I have, in the opinion of others, good grounds for being sanguine; and since I left your rooms last night, it has occurred to me, that as a member of the Society of Arts, and an old Member of Council, I ought to offer to explain to the Society, whose express object is the encouragement of Arts, Manufactures, and Commerce, my mortar process, before imparting it to any other body. I beg, therefore, that you will mention my offer to your Council, and in the meantime I shall be most happy to convince any of your members that my invention is not an unsubstantial dream of improvement, by giving them an opportunity of inspecting the works at Kensington, where the material has been largely used.—I am, &c.,

Henry Y. D. Scott.

Kensington, March 2nd, 1871.

Sir,—On reading over Mr. Macfie's book, as well as articles written by other opponents of the Patent-law, one feature is specially noticeable, viz., that the statements made are generally exceedingly vague and indefinite. Most of the writers have such a loose way of discussing the matter; they make large assertions, but rarely condescend to give us proofs or illustrations in support. A considerable portion of the public press, unfortunately, take these assertions for facts, and write accordingly, so that much mischief is caused by the practice. Take the following illustrations:—It is frequently asserted by these writers that scientific men do not patent their discoveries, but give them freely to the world. At page 170 of Mr. Macfie's book, M. Chevalier says:—"The *savants*, who are the greatest discoverers, are satisfied with these immaterial rewards—honour, glory, and reputation." It is difficult to find a name coupled with assertions of this character, but I have found two, those of Dr. A. W. Hofmann and Sir David Brewster. At page 177, it is said, "Hofmann, after Perkins, discovered a magnificent dye made from aniline. Hofmann took no patent; it seemed as if he wanted to present gratuitously to tintorial industry a new and beautiful produce." Now, here we have a distinct and plain statement with which we can deal. The fact, however, is, that Dr. A. W. Hofmann did take out a patent, and it is No. 1,291, A.D. 1863; he also took out a patent in the United States for the same dye, the number of which is 43,066.

A writer in the *Illustrated London News* of Feb. 15th, 1868, when alluding to the recent death of Sir David Brewster, says of him, at page 155:—"He invented the kaleidoscope. Had he patented it in 1816 he would have made a handsome fortune." Here, again, the statement is incorrect. Sir David Brewster did take out a patent for the kaleidoscope, it is dated July 10, 1817, and the number is 4,136 (O.L.) Sir David Brewster appears also to have met with the usual fate of inventors and patentees, for he suffered grievously from infringements of his patent rights; and in a book which he published on the subject in 1819, he complains bitterly of his troubles and annoyances on this score.

A third illustration on this point is the case of the illustrious chemists, Chevreul and Gay-Lussac, the originators of the stearine candle. These chemists took out patents for its manufacture, both in England and France. The English patent is numbered 5,183 (O.L.), and dated June 9, 1825.

With regard to the word "patent," when used in advertisements, and affixed to manufactured articles, I observed that it was time some restriction was put upon its employment, as the public is daily victimised by the unwarranted use of it made by unscrupulous tradesmen and manufacturers. The Act of Parliament which unsuccessfully attempted to deal with this matter is Willim IV., cap. 83-84, sec. 7, 1835, commonly known as Lord Brougham's Act.—I am, &c.,

JOHN FORDRED.

Granville-park, Blackheath, S.E.

SIR.—Many of the most clever inventors that have hitherto been born in this country have, it is well known, become, one after another, ruined and broken-hearted, and solely because they have ventured to go to the expense of procuring a patent for their inventions, hoping to benefit thereby.

My case at the present time will possibly explain why this is.

In March, 1870, I took out a patent for improvements in double-furrow ploughs. In April and in June following, two of the most eminent plough-manufacturing firms did so likewise. Through long illness, I was unable to get into the field, with my principles fully carried out as soon as these two firms, but immediately I saw their new implements I was convinced, and openly declared, that, if there was any truth in patents, they were both using my patented inventions. Despite all friendly notice from me, the two firms continued, and still continue, making. Government has taken the money to procure me a patent, but does not afford me the slighest assistance afterwards to protect it. As soon as the blue-books of the two celebrated makers, with mine, were published by government, it was clearly seen how near they were to my principles. I should have been happy to have gone to the expense myself of paying qualified persons to decide in the matter, but such was not the law; all must be decided alone by the High Court of Chancery, at my own cost, if I intended to attempt to save the money already paid, and maintain my patent so as to stop the above two firms manufacturing. Into that court, at any risk, I was obliged to go, or lose the whole of the money paid, and all the true value of my invention.

In that court the case has been for six months, hundreds of pounds are now depending on the result; I know not when that will be settled, which, from the first, any three qualified engineers could, in three hours, have decided.

If at the conclusion of the case there should turn up any unforeseen technical hitch, so that I cannot safely maintain my patent right, I shall be indebted, far beyond what I can possibly pay, in a ruinous sum to solicitors and counsel.

From the best authority I have been able to get, the invention is in every respect now either my property or that of the public. If I have not sufficiently described the principle to enable me to keep the patent, I have so far shown that neither of the above two firms can possibly keep theirs. I, or the agricultural public, are severe losers; I through the said firms going on manufacturing, or, if my patent is in any way not valid, the agriculturists; because, if the invention be public property, a number of other leading firms would at once take up the manufacture, and the implements would be supplied equally perfect throughout the country at full 20 per cent. less cost than they are now.

In the patent laws, as they now are, there are perplexities and disappointments enough to ruin and break the heart of many a clever and persevering man. But very little opportunity exists in reality, with but very little hope for patentees as the law now stands, unless they possess a sum of money ready to be ventured in the High Court of Chancery, for hap-hazard success.

Through your columns I would respectfully ask those at the head of affairs, Why such vexatious delay and danger of entire ruin is allowed in this our wide, world-free, independent, ever generous England? It is unquestionably a great impediment to the general progress of the country.—I am, &c.,

WILLIAM WOOFE.

Bedford, March 7th, 1871.

SIR,—On the occasion of Mr. Newton's paper, read before the Society on the 1st inst., I ventured to suggest, in furtherance of the improvement of the Patent-laws (which I think nearly all agree to be the proper course of legislation), the adoption of the certificate of addition enactment in the French law, for the protection of improvements on a first or mother patent.

Under the French law, the right to improvements is secured exclusively to the original patentee for the first twelve months of the grant, and is open to him in common with the public for the remainder of the term. Such an enactment in the English law would have a tendency to avoid multiplicity of patents, one of the great complaints to the present Patent-law, and would save the expense of repeated patents for alterations or improvements, often found necessary after the first patent is taken to perfect the invention. Here would be found the cure for the many patents taken by Colonel Scott to bring his improvements to a successful issue. It might, with judicious supervision (as suggested by Mr. Newton), also be used, in a great measure, to exclude outsiders from invading the occupied territories of the patent domain.

This addition, with preliminary investigation as to novelty, conducted on the basis of the American system advocated by Mr. Webster, Mr. Aston, and others, *i.e.*, confined to printed matter in this country, carefully collected, and aided by models, would no doubt render duplicate and useless patents much more scarce. To enable such an examination to be effective, a more detailed provisional specification than at present would be required, which might be published after the certificate of provisional protection was issued, provided the force of a provisional patent were given to such provisional protection imparting the right of anteriority.

The present right to entering objections could also be utilised, not only to protect individual rights, but also to complete the weeding-out system, instead of remaining a dead letter, as at present.

The preliminary examination would doubtless prove a substitute for the present money check to the multiplicity of patents, and thus would safely permit of a reduction in the tax on patents, to a scale corresponding somewhat to the expenses for keeping up the Patent-office and accessories, with a liberal margin for contingencies. The tax, as it now stands, frequently proves an obstacle to the poor inventors obtaining the protection of the law, and gives rise to an objection often raised to the patent system, *i.e.*, that it serves to give his reward to another, instead of fulfilling its intended object of enriching him, or at least of stimulating his inventive faculties with this expectation. Other reliefs to the poor inventor, such as a longer time than three years for payment of the £50 tax, and allowing an extension of the term, in case of default through accident, on payment of a fine, as advocated by Mr. Newton, I think desirable. A preliminary examination of cases for litigation, as a means of simplifying and cheapening patent suits, would, I think, be a great boon to this country.

I would also beg to suggest to our noble and learned chairman, Lord Henry Lennox, that he would be rendering a great service to many French inventors who, having commenced their applications for patents in England before the war (of whom I have several instances), were prevented from finishing them by the duties it imposed, or by being shut off from communication with England by the siege of their respective towns of habitation, and who have, consequently, lost their inventions through the publicity given thereto, by bringing forward a measure to relieve them from the effects of such publicity, and enable them to renew their applications.

The Government of Defence, by their decree of 10th September, 1870, postponing the time for payment of annuities on French patents falling due and unpaid on and from the 25th August last, initiated a policy which it should be a pleasure and a duty for our legislature to reciprocate, if legally practicable.—I am, &c.,

4, South-street, Finsbury. W. A. GILBEE.

ORNAMENTATION CONSIDERED AS HIGH ART.

Sir,—I have just returned to town, after an absence of some days in the north of England, and find in the two numbers of your *Journal*, which have been delivered at my house, letters having reference to the paper which I read before the Society on the 10th of February, on "Ornamentation Considered as High Art." The first of these letters is entitled "Ethics and Ornamentation;" the second, "True and False Ornamentation;" the third, Ornamentation and Religion;" and the fourth, which appeared in your last issue, "Truth in Ornamental Art." The first letter is worthy of a respectful reply; the second is amusing, and may be taken for what it is worth; the third is unworthy of notice, as it employs no argument, but is a mere expression of feeling; and the fourth is shallow and illogical. I will, nevertheless, answer each, so far as I think necessary.

The first letter sets out with this position, that moral guilt cannot attach to the false in art; but the writer agrees with me that there can be no "little sins" wilfully committed, and that the love of truth can be satisfied with nothing short of the best and most perfect to which the mind can attain in thought, word, and deed. I argued in my paper that a truthful art could become the teacher of truth, and this position I consider has not been shaken. All impressions which the mind receives from the outer world are conveyed to it through the medium of the senses. I *touch* an object, and the sensation which results from my body coming in contact with it is conveyed through the nerves to the brain, where the character of the body touched is judged of by the nature of the sensation which has been conveyed to the mind. I *see* an object, and the image depicted on the retina of the eye induces a sensation which is carried to the brain, and here the nature of the object which produced the sensation by acting on the retina is judged of. In like manner, a sound produces a sensation on nerves which convey it to the brain; and taste and smell are sensations produced in particular nerves, which convey these sensations to the brain, as a centre, where the nature of the object producing any particular sensation is determined. The nerves we will compare to the wires of an electric telegraph, and the object at one end and the brain at the other shall each represent an operator. The sender of the message wishes to inform the receiver at the other end of the nature of some new substance, but owing to the words employed not being familiar to the receiver, or owing to the new substance having qualities altogether unheard of by the receiver, he does not get a true conception of the nature of the object described. He therefore asks a series of questions, and it is only after repeated answers have been given that he understands the nature of the substance, which was new to him. Mark this, that it was the mind in which the picture of the new substance was formed, and this picture was at first indistinct, and in part wrong, and it only became distinct and right by an inquiry after truth.

These illustrations are given of natural deception. "Speaking loosely, I may say that my sight deceives me when I see the sun going round the earth; or that on the railway my eye constantly deceives me, leading me to believe that I am moving when stationary, or the reverse." True, but surely the writer of these statements would not have us rest satisfied with the conclusions drawn from the momentary impression caused by some moving object, or indeed from any impression, if that impression can by further inquiry be shown to be false. It is our duty to seek after truth, and if truth can only be arrived at by making many inquiries, and after much thought, it is yet our duty to strive to attain it. The child grasps at the moon, but that does not prove that the moon is within reach. One person says, "What a warm day it is?" while another says, "Very cold, is it not?" but these assertions neither prove that the day is warmer nor colder than the average of days. After conducting all legitimate inquiries, we form in the brain an image as truthful as our knowledge enables us to do.

The writer of this first letter now goes to pictorial art, and speaks of "Turner's wonderful distances," but all that he says about them only proves my statement, that a true work of pictorial art is a hieroglyph of beauty, which, like a banker's cheque, is in one man's hands a pile of gold, in another a mere bit of paper. A picture is, to an extent, a work of deception, inasmuch as in its most exalted form it is "symbolised imagination or emotion, representing idealised reality," but just in proportion as the mental thought or "symbolism" predominates over the imitative, so is the work exalted, and in all noble pictures the ideal does predominate. What reconciles us to the imitative is the frankness with which we are informed by the artist that we are not looking at a reality. Were a picture painted in a purely imitative way, and were the sashes of a window drawn on the canvas, while the picture was set in a window opening and hung with drapery, we should be altogether displeased with it. Nothing is more detestable than waxwork figures, and nothing more amusing than the tricks of the conjuror; in the first case you mistake a deception for a truth, in the other you *feel* that you are being deceived. So with a picture; its very treatment, if the work of a true artist, and its very frame, tell you that it is not a reality, and it is the perfect knowledge which we have of the fact that all the realistic element of the work is fictitious that makes the work tolerable.

The next position advanced is false, for it supposes a room minus a pillar which architectural truth demands, and the same building with a sham or painted representative pillar, and the argument is this—that in the one case we have a want of truth, owing to the absence of the pillar, and in the other owing to the untruthfulness of the representation, and then we have this remarkable passage:—"In one sense it may be said that the work is false, not because it is, materially speaking, illusive, but because the illusion is not sufficiently complete." All I will add to this statement is this, had the illusion been perfect, it would have given the same repugnant sensation that we derive from beholding a waxwork figure.

The next argument is based on the nature of pigments. Blue is a receding colour, yellow is advancing, and so on. Whatever colours nature employs, she, nevertheless, always causes those things which are distant to appear as distant, and those things which are near to appear as near to those of ordinarily intelligent judgment, and this the true ornamentist will also do. By a judicious mixture of colours he will achieve this end. Then, as to the representation of figures, no one will say that an outline drawing of a figure is false, as it does not represent the rotundity of that which is pourtrayed. It is a symbol of an idea or of reality, and as such it may be applied to the decoration of a wall, and that without violating any sense of truth or propriety.

My remarks bring me to this conclusion, a conclusion in which I remain unshaken, that if we wish to train a child in the way of truth, that its surroundings must be truthful so far as we know. Let the child live in a room where sham pillars are painted around it, which pillars are imitative of marble; let the walls have a pattern upon them which simulates relief; let the carpet be as an inverted groined roof, and the ceiling as a beclouded sky, and I cannot but think that its sense of moral truth will be materially impaired; and of this I feel assured, that by constantly striving to achieve truth to the best of our knowledge, our moral perceptions become sensibly improved.

The second letter needs no reply beyond that which I have made to the first, and the third is so absurd and shallow that a simple word or two is all that I need say respecting it. The writer complains that I did not devote the evening to the laying down of certain canons for the guidance of the public in matters of art. My object was that of showing that "ornamentation was high art," and it appears that I convinced him of the truth of my position, for he even agrees that ornamentation is "the highest art possible." Then he makes a series of dogmatic remarks which any person who could write a few words could as well do, for he does not bring forward a single argument to support them; indeed, he reminds me of the mode in which certain street boys argue, where the one who cannot answer simply turns up his nose at the other.

I come now to notice the fourth letter, and this I will do very briefly, because there is very little in it that needs answering. First, throughout this letter there is a strange confusion of the principles of pictorial art with those of ornamental art; but this is a thing of general occurrence with the public, and is due to the fact that the character of pictorial art is much more generally understood than the principles of ornamental art. The first part of this letter is answered by my paper itself; but a word must be said upon this wonderful doctrine, that "Truth in ornamental art is the accomplishment of its purpose or promise." Surely, then, that is truest which brings about the accomplishment of the end of the vicious, as well as of the good, as it gives him pleasure. The rogue uses true words if he thereby induces the widow to place her little money in a "bubble" company. "That is the truest music which affords the greatest amount of pleasant emotion to the most cultured mind." Certain "ornamentation is true in the accomplishment of its purpose, as the aim of the arrow is true which reaches its mark." "Truth in both music and decorative art is a harmony which the mind recognises and enjoys." I agree with the writer perfectly, but he must know that the truth of which he speaks has nothing to do with the truth of which I speak. I may write about a Christmas-box, and he may say the box is a kind of arborescent plant, or that it is a small room in the opera, or a seat on a coach. Mark this fine passage: "If any natural objects are introduced" with ornament "they are so many words mingling with the music." I need not explain this passage, it is lucid and clear, and yet the writer complains of my mysticism. "Some feel quite sure that it would be an outrage against the truth of ornamental art to represent a rose, a sunflower, a tulip, and a convolvulus all springing from one root. But true ornamental art is perfectly independent of the laws of botanical nature." It certainly is, because it is wholly ideal, but if ornamental art is to be an absurd association of natural forms, I, for one, would rather be without it.

I will not reply further to this letter, for there is nothing in it worthy of serious consideration; and this one fact cannot fail to manifest itself to all who read this discussion, that not one word has been written or said to controvert my statement, that ornamentation is a high art, and that it is even the highest of the arts, which it was the aim of my paper to show. Whatever has been said or written pertains to incidental remarks or corollary statements only. I can but consider, then, that I have succeeded in demonstrating that "ornamentation is a high art."—I am, &c.,

Chr. Dresser.

Tower Cressy, Notting-hill, W.

P.S.—Since writing the above, other letters have appeared in your *Journal*, to which I will, with your permission, reply next week.

DR. DRESSER'S PAPER.

Sir,—Whatever may be the value from an art point of view of the ideas and theories of Dr. Dresser, I do not think that his paper has been discussed with that fairness and impartiality it deserves. I do not know whether he is right or wrong, but I do know that what he says on high art is very much the same sort of matter I find in the pages of Mr. Ruskin and other art writers; and but a few days ago I read the address of a distinguished artist, Mr. Poynter, to the members of the Midland Institute, which takes up exactly the same strain. Dr. Dresser may, for all I know, not be able to draw a line correctly, or combine the simplest colours harmoniously, but his opponents do not discuss this point, which is a legitimate one for them to take up; but they condemn his ideas, and his manner of stating them, forgetful of the fact that to be consistent they must cry down Ruskin and all his followers. With regard to Mr. Moody's letter, I think, Mr. Editor, you were lacking in your usual discretion when you consented to let it appear; there were some sentences in it which should never have been written, and certainly were out of place in the *Journal of the Society of Arts*. Mr. Moody must learn that, besides showing a want of that courtesy to an opponent which is so important in a discussion, the best interests of art are not likely to be advanced by calling him arrogant and conceited.—I am, &c.,

Amicus.

PRESERVATION OF MARBLE STATUES.—ORNAMENT AS A FINE ART.

Sir,—In last week's *Journal*, Mr. Henry W. Reveley writes, that Canova gave statues several coats of white wax, which he sank in with a gentle heat, and that this process was a perfect success in respect to white marble statues required to stand in the open air. Through the medium of your *Journal*, I would desire to convey my hopes for further information from Mr. Reveley as to the names and whereabouts of these statues.

In reference to the subject of ornament, I would submit, with some divergence from the very clever, and in great measure true, remarks of one of your correspondents of last week, that the Society of Arts has done very well to lend its lecture-room and open its *Journal* to papers and discussion on ornamental art, for ornament is not accorded in this country a sufficiently high place. Painting, sculpture, architecture, and ornament should, in my opinion, be spoken of as "four sisters," although not, perhaps, of equal stature.—I am, &c.,

Epsilon.

THE TEACHING OF HIGHER SUBJECTS IN PRIMARY SCHOOLS.

Sir,—By the kindness of the editor, I have been enabled, on several occasions, to call the attention of the readers of the *Journal of the Society of Arts* to the means by which, in my opinion, the teaching of higher subjects in primary schools might be effected, without increased cost, and without prejudice to any principle or interest.

As your correspondent, Mr. Rundell, does not seem to have clearly apprehended the purport of my remarks, and as I am anxious to bring the matter to a test on a definite issue, seeing the immense importance of removing every possible obstruction to the progress of learning in our elementary schools, I may be permitted to state a proposal I have made to the committee of the Teachers' Benevolent Institution. I have offered to pay to the funds of that excellent institution £50, if the following proposition should be negatived after discussion, according to conditions and by umpires mutually agreed upon, provided an opponent is found willing to pay £10 to the same fund in case the propositions should be affirmed.

The propositions in substance are as follows:—

1. Half the time now spent in teaching what is called orthography in primary schools, would suffice to teach the elements of music, drill, the outlines of science, and a large amount of general knowledge, useful and interesting to children.

2. Do what you will in teaching orthography, a very small proportion only of children of the labouring population, who leave school at or before the age of thirteen, will ever "spell correctly," in the present fashion, in after life, while the knowledge of general subjects which might be taught in the time would be of immense value through life.

3. A large portion of the time of teachers is spent in teaching (and of inspectors in testing) as "correcting spelling" what is in reality nothing less than the "errata

of printers, and the blunders of copyists," while modes of spelling used by the best authors are treated as "bad spelling."

4. By selecting simple modes of spelling from the works of standard authors, present and past, the "spelling difficulty in education" would to a large extent be overcome.

Such are the propositions I have submitted, after careful consideration and a long study of the question in its various bearings. If they are substantially true, then it is a "wicked waste" of public money, and a cruel wrong to the children of the country, when they are asking for the bread of knowledge, to cause them to feed upon the mere husks of an orthography falsely so called.

My object is to bring this vexed question to a point on a definite issue; and if Mr. Rundell, or any other gentleman desirous to improve education, will discuss this important question in a friendly contest, not for victory, but for truth, I shall be glad to meet him. Little good can result from a vague discussion on paper. —I am, &c., E. Jones.

Hibernian Schools, Liverpool, 28th February.

PRESERVATION OF VEGETABLES.

Sir,—In reply to your correspondent, Prof. Rodgers, I have simply to remark that *Jatropha manihot* is a vegetable, and that it is not by any means the only instance of the necessity existing for the removal of acrid matter. Among euphorbiaceous plants, we have *Cuidosculus herbaceous.* Among aroids we have our own common *Areum*, and many others; and in *Terustromiaceæa* we have (as I endeavoured to show) tea.

If these, or any other vegetables, are not modified by heat, why, then I cannot see why people do not eat them raw, the more as we are told "that for years the value of the whole constituents" have been fully recognised, raw vegetables, that is to say, are fit to eat.

I fancy if Prof. Rodgers will take the trouble to have any vegetable analysed, both before and after cooking by steam, he will find that a very great deal has been lost.

Nobody could have been more interested than myself in Mr. Buchanan's paper, but when he proposed to introduce his system generally to coffee-leaves, tea-leaves, &c., I felt that he could not do so economically, or (as he put it) practically.—I am, &c.,

J. McPherson.

49, Hereford-road, Bayswater.

PREPARED COFFEE LEAVES.

Sir,—In reply to your correspondent of the 1st inst., I beg to supplement my former remarks on prepared coffee leaves being the basis of a cheap, palatable, healthful, and nutritious beverage, with the following facts:—

During the International Exhibition in London, in 1851, a commission of Chaszees declared that coffee-tea resembled the infusion obtained from China congou or souchong. Admitting that there are many qualities of souchong, and that the price of this tea may range, say from 1s. 3d. to 1s. 10d. per-lb. in ordinary states of the market, there can be no doubt, if it is shown that coffee-tea equals the least expensive in quality, it must be a cheaper article, as it can be produced on the spot at one-third the cost of China and one-fifth that of Indian tea. In 1856, Professor Johnston, author of "The Chemistry of Common Life," states that "the price of prepared coffee leaves in the island of Sumatra at that time was about 1½d. per lb., and that they could be packed, of good quality, for the European market, for 2d. per-lb." The estimated cost of China tea on the spot is about 6d., and Indian tea about 10d. per lb., which, taken in connection with other circumstances, will bear out my axiom.

Taking the one chemical ingredient of theine as a test of value, I find, from the analyses of Mulder, Peligot, Robiquet, Boutron, Stenhouse, Graham, Campbell, and others, the following to be the results of their researches:—

China	hyson	contains	0·43	to	2·56	per cent	of theine.
,,	twankay	,,	0·90	,,	0·98	,,	,,
,,	gunpowder	,,	4·00	,,	4·10	,,	,,
,,	souchong	,,	1·50	,,	2·55	,,	,,
,,	congou	,,	0·46	,,	2·13	,,	,,
,,	bohea	,,	0·60	,,	0·70	,,	,,
Java	hyson	,,	0·55	,,	0·60	,,	,,
,,	congou	,,	0·60	,,	0·65	,,	,,
Indian, from Kumâon			1·97			,,	,,
Paraguay tea			0·13	,,	1·25	,,	,,
Prepared coffee leaves			1·15	,,	1·25	,,	caffeine.

Thus compared, it is evident that prepared coffee leaves are superior in value to common black and green tea, as good as the far-famed "maté" of the Brazils, and not much inferior to China congou and souchong, or a choice sample from the Himalayas. Viewed in juxtaposition with coffee beans, the difference is still more striking. Stenhouse, Graham, and Campbell give the per centages thus:—Prepared coffee leaves contain 0·80 to 1 per cent. of caffeine; another analysis, 1·15 to 1·250; and Roubiquet and Boutron state that Martinique coffee yields 0·360 per cent. of caffeine, Mocha 0·206, and Cayenne 0·200. These figures, allied with those representing the cost of production, are surely sufficient to establish a claim to cheapness and quality for coffee-tea; and when it is mentioned that the taste of the infusion resembles a mixture of strong coffee and tea, little can be said against its palatability.

To the extensive use of coffee in France is imputed the comparative immunity enjoyed there from the painful sufferings resulting from gravel, and it is found that in most places where it forms the chief beverage, this torturing disease and gout are scarcely known. At page 330, vol. xiii of the *Pharmaceutical Journal*, an instance is quoted of a gentleman whose sufferings from gout commenced at twenty-five years of age, and continued with severity till he was upwards of fifty, the joints of whose feet and hands were disfigured with chalk stones; but the use of coffee gradually and completely banished the complaint. Recollecting the greater richness of the coffee leaf in the subtle agent to which no doubt such remedial virtues were owing, I think I am justified in claiming for coffee-tea the position of being likewise an healthful beverage.

Regarding the essential volatile oil in prepared coffee leaves, to which your correspondent objects, I would hint that it has long ago been generally settled that most articles of food and drink are almost as much dependent on their flavour for their value as on any other qualities they may possess. To this nearly universal rule coffee beans and leaves are no exception. When the products of the coffee and tea plants are gathered, they emit but little smell, and only yield a very slight astringency; it is during the subsequent treatment that the desiderated aroma and characteristic taste are perfected. In tea, the proportion of essential volatile oil which produces this aroma is, according to some of the eminent analysts already alluded to, usually under one per cent.,; but in coffee beans (according to Payen) it does not exceed 1 lb. in 50,000, and in the leaves the per thousandth is not much greater. To destroy this delicate flavouring oil, then, is to ruin the value of any sample, as it is well-known a more concentrated or stronger aroma in Ceylon, Jamaica, or East India coffee, obtained by long keeping and careful roasting, enables them occasionally to almost equal the value and command the price of the finest Mocha. In short, Payen settles the question by stating "that if this essential oil could be bought, it would be worth £100 an ounce."

I do not contend that the essential volatile oil in prepared coffee leaves exercises any direct influence in nourishing the human frame, but it seems evident, from the valuable experiments of Julius Lehmann, that it has an effect of retarding waste in the tissues quite equal to the extraordinary power evinced by theine and caffeine, thus rendering less food, when accompanied by the beverage, necessary. If it is not a flesh-former, it certainly is a potent conservator of muscular substance, and must, therefore, be of vast importance to a busy population like ours, dependent on constant activity of body and clearness of intellect.—I am, &c., William Cochran.

289, Kennington-road, S.E.

Sir,—The question of making tea from coffee-tree leaves seems to be exciting some attention in the readers of your *Journal*, and Mr. McPherson, in his letter last week, alludes to some intention to give a medal for the manufacture of this substitute for ordinary tea. If such an intention has been published by the Society, it has escaped my notice; had I seen it, I should have felt as Mr. McPherson feels, that it is desirable to think twice before doing so. First, because the thing has been tried without success; for although a good substitute for tea has frequently been prepared from coffee leaves, it has always been to the injury of the coffee crop, and of the shrub itself; at the same time, the tea produced has been decidedly inferior to ordinary, nay, very ordinary, tea; and, secondly, because should this substitute ever be introduced, we shall require special training before we can learn to drink the infusion, for although it tastes like a good congou, its smell is so exactly like the sickly odour of senna-tea that it would require a strong mind and an indifference to a bad smell, which few possess, before its use can become general.

The large seeds of the tea plant, if roasted, would make a better substitute for coffee than some of those now used, but it is better to have our tea from the *Thea bohea*, and our coffee from *Coffea Arabica*, than to try and reverse these natural sources.—I am, &c.,

Thomas C. Archer.

Edinburgh Museum of Science and Art,
March 6th, 1871.

Sir,—In reference to what is advanced by your correspondent James McPherson, in the last issue of your *Journal*, March 3rd, allow me to remark that he is in error in supposing that "coffee-tea has been recognised by no one but the natives of Sumatra," as it is very commonly used by the coolies on the coffee estates in Southern India, and to be purchased at four annas per lb. in the native bazaars on the Neilgherry Hills.

The beverage made from these leaves, though not so pleasant to the taste as tea, is decidedly most refreshing and invigorating, and many is the time I have felt much refreshed by a draught of it when out shooting on the Neilgherry Hills.

As to its being "cheaply produced for the purpose of adulteration," no harm could well accrue from this description of admixture with ordinary tea, considering that much more objectionable leaves are now supposed to be largely used for this purpose.

In my estimation much credit is due to the Society of Arts for endeavouring to further the introduction of this decidedly wholesome article of food, which I consider will be brought within the reach of the poorer classes at a much more moderate rate than the present highly-adulterated tea now but too often supplied to them as a genuine article.—I am, &c.,

G. T. Haly, Colonel.

Shepherd's-bush, March 7th, 1871.

GENERAL NOTES.

Society for the Encouragement of the Fine Arts.—On Thursday last, a lecture was given in the Society's rooms, 9, Conduit-street, on the "Common Elements of Beauty in Race in Georgia, Circassia, the Holy Land, and Britain," by Hyde Clarke, Esq., in which the author brought forward a new theory of the principle on which a general standard of beauty in art has been accepted in classic times and in the modern age.

New Arctic Explorations.—Captain Hall is going to make another attempt to reach the North Pole. He will set out in about three months, winter in the Arctic regions, and he hopes to reach the North Pole, on a sledge drawn by dogs, before the summer of 1872 is over.

The Duration of a Flash of Lightning.—*Silliman's Journal* contains the result of an experiment made by Mr. Rood to ascertain the duration of a flash of lightning, and which he reckons lasts about 1-500th of a second. The duration of the flash was measured by cutting slits in a rapidly-revolving disc, which, with a certain speed, showed the slits to be of unaltered form, but with another speed showed them to be elongated, and the duration of the flash was inferred from the known velocity of the disc.

Galvanised Iron. — A method of estimating the quantity of zinc existing in the plating of galvanised iron has been communicated to the *Philosophical Magazine* by Mr. T. Warren. The principle of this method consists in the use of mercury to dissolve the zinc, when the loss of weight can be easily ascertained. But a thin coating of an amalgam of iron and zinc will remain, which will take up a certain quantity of mercury, and the amount of this amalgam present is measurable by the quantity of mercury it will take up. To determine this quantity of mercury, the iron is weighed, then heated to drive the mercury off, and then weighed again, when the weight of mercury which has mixed with the amalgam will be at once ascertained.

Beet-root.—The Secretary of the Wisbeach District Chamber of Agriculture has received a letter from Mr. James Duncan, who thus refers to his experimental farm at Lavenham:—"I am very glad to say that I have been successful at Lavenham this year, and I have no doubt that the beet sugar industry will soon take root in this country. There is nothing to prevent it. Land is cheaper in England than in France, Holland, or Belgium. We can grow quite as good roots as on the Continent, and, by means of deep steam cultivation, very much better. The cost of growing the roots at Lavenham, and delivery to the factory, ranges from £9 to £11 per acre, including rent, taxes, manure, labour, and cartage. Part of the manure, however, should be debited to the wheat crop which follows. With fair cultivation, an average crop of fifteen tons per acre is what may be expected. The price I pay for the roots is 20s. per ton, free of earth and leaves. The farmers get the refuse pulp for feeding the cattle at 12s. per ton. Three tons of pulp are equal to one ton of hay."

Centrifugal Pumps.—On Tuesday, February 14, a paper on centrifugal pumps was read before the Institution of Civil Engineers, by Mr. David Thomson, who stated that the first really successful centrifugal pump was that contributed by Appold to the Exhibition of 1851, in which the vanes were bent backward, which mode of construction is still followed in the best pumps. Mr. Thomson says that the depth of the revolving fan or radiating arms should be one-fourth of the diameter, and that the central opening for the admission of the water should be about nine-sixteenths of the diameter over the blades. The fan revolves in a case, which should be of much larger diameter than the fan itself. The best duty of the pump is given when the speed of the periphery of the fan exceeds the velocity of a body falling through the height of the lift by from 6 ft. to 8 ft. per second. A fan 12 in. in diameter, and proportioned as described, will discharge 1,200 gallons of water per minute, and the delivery, the speed of the periphery of the fan remaining the same, will increase as the square of the diameter. In small pumps, the duty is about 55 per cent., and in large, about 70 per cent. of the indicator power of the engine from which the motion is derived.

Russia and China.—Indian papers state that a Russian line of steamers is to be put on the Odessa and China line, *viâ* the Suez Canal, for the transport of tea and other merchandise to and from southern Russia.

Trade Marks.—Mr. C. Fortescue, in the House of Commons, in answer to Mr. Taylor, could not deny that great inconvenience was sometimes caused by the innocent infringement of trade marks, and the whole matter deserved the serious consideration of the government. But the question of the hon. member was put in a very abstract form, and was not easy to answer; and he would remind him that a bill with respect to registration of trade marks was introduced two years ago, and met with a very cool reception from the House.

Curious Property of Gun-cotton.—Dr. L. Bleekrode' in a paper published in the *Philosophical Magazine*' gives some account of experiments in which he tried to ignite gun-cotton with the electric spark. He thought to facilitate its explosion by wetting it with a highly inflammable liquid, as, for example, the bisulphide of carbon. But it was only this latter substance that was immediately set on fire by the spark—while the gun-cotton did not explode, but remained apparently intact amidst the burning bisulphide, presenting almost the aspect of a mass of snow slowly melting away; the same effect is produced by moistening gun-cotton with bisulphide of carbon, ether, benzine, or alcohol, and igniting it afterwards with some flame or other; all these liquids yield the same results and is without danger, even if great quantities are used; the explanation of this, Dr. Bleekrode finds in the researches of Professor Abel, "On the Combustion of Gun-cotton and Gunpowder." These results indicate that if, even for the briefest space of time, the gases resulting from the first action of heat on gun-cotton upon its ignition in open air are impeded, from completely enveloping the burning extremity of the gun-cotton twist, their ignition is prevented; and as it is the comparatively high temperature produced by their combustion which effects the rapid and more complete combustion of the gun-cotton, the momentary extinction of the gases, and the continuous abstraction of heat by them as they escape from the point of combustion, render it impossible for the gun-cotton to continue to burn otherwise than in the slow and imperfect manner, undergoing a transformation similar in character to destructive distillation."

Trade with Holland.—The trade accounts that have recently appeared in a parliamentary paper show that, up to the 30th of September, we had imported into that country from the United Kingdom, last year, 6,988,000 kilogrammes of potashes, 10,435,000 kilos. of cement, chemicals of all kinds valued at 912,000 guilders, 318,500 tons of coals, 10,364,000 kilos. of coffee, 16,909,000 kilos. of raw cotton, drugs of all kinds to the value of 684,000 guilders, 1,120,000 kilos. of dyewoods, 231,000 kilos. of campeachy, 1,688,000 kilos. of grease, undressed, and dried hides valued at 1,526,000 guilders, machinery valued at 875,000 guilders, 3,249,000 kilos. of corrugated copper, cast-iron valued at 4,276,000 guilders, wrought-iron at 2,019,000 guilders, and iron rails valued at 1,000,000 guilders, iron wares at 328,000 guilders, unwrought lead 103,000 kilos., 1,702,000 kilos. of steel bars, 251,000 kilos. of unwrought tin, cocoa-nut oil valued at 490,000 guilders, 7,643,000 kilos. of palm, and 142,000 kilos. of mineral oil, 1,177,000 kilos. of rice, 20,740,000 kilos. of unrefined salt, bleached or unbleached cotton to the value of 2,028,000 guilders, dried or printed cotton valued at 2,963,000 guilders, bleached or unbleached linen at 223,000 guilders, woollen cloths at 540,000 guilders, and other kinds of woollen goods at 1,970,000 guilders; 1,007,000 kilos. of raw wool, hemp, flax, and tow, valued at 2,014,000 guilders; 9,763,000 kilos. of untwisted cotton, 1,809,000 kilos. of unbleached cotton, and 2,306,000 kilos. of woollen and worsted. On the other hand, Holland exported to this country 50,670 horned cattle, 274,290 sheep and lambs, 23,170 pigs, 334,000 kilos. pit ashes, 1,288,000 kilos. of unground bark for tanning, wax candles valued at 2,630,000 guilders, chemicals at 527,000 guilders, 76,000 kilos. of undressed and 6,595,000 of dressed flax, 2,140,000 kilos. of potato flax, fresh fruit valued at 342,000 guilders, undressed hides at 437,000 guilders, and salted hides at 549,000 guilders, 394,000 kilos. of madder, 1,637,000 kilos. of unwrought lead, 1,209,000 kilos. of raw spelter, 2,864,000 kilos. of steel in bars, 1,132,000 kilos. of raw tin, 2,090,000 kilos. of seed oil, 15,970,000 kilos. of butter, 13,723,000 kilos. of cheese, 192,000 kilos. of meat, 712,000 kilos. of rags, 962,000 kilos. of rice, 30,000 hectolitres of linseed, 52,730 hectolitres of spirits, 26,000 hectolitres of liqueurs, 34,036,000 kilos. of refined sugar, 769,000 kilos. of raw sulphur, 425,000 kilos. of tobacco in roll or leaf, inland produce, bleached or unbleached cotton, valued at 3,297,000 guilders, 1,614,000 kilos. of raw wool, 562,000 kilos. of single cotton, and 4,549,000 kilos of yeast.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

March 15.—On "The Different Methods of Extracting Sugar from Beet-root and Cane." By Ferdinand Kohn, Esq., C.E.

March 22.—On "Drill, the Complement of the Present School Teaching." By Major General Eardley-Wilmot, R.A.

March 29.—On "Woman's Work, with Special Reference to Industrial Employments." By Miss Emily Faithfull.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Social Science Association, 8. Commander Dawson, R.N., "On the Social Condition of Merchant Seamen."
Royal Geographical, 8½. Dr. R. J. Mann, "Mr. Thos. Baines' Exploration of the Gold Region between the Limpopo and the Zambesi."
Medical, 8.
London Institution, 4. Mr. R. A. Proctor, B.A., F.R.A.S., "On Astronomy." (Educational Course.)

Tues. ...Civil Engineers, 8. Mr. Alexander Beazeley, "On Phonic Coast Fog Signals."
Social Science Association, 12. Right Hon. Sir Walter Crofton, C.B., "Is Our Treatment of Criminals Satisfactory."
Royal Institution, 3. Dr. Foster, "Nutrition of Animals."
Medical and Chirurgical, 8½.
Photographic, 8.
Anthropological, 8.

Wed. ...**SOCIETY OF ARTS, 8.** Mr. F. Kohn, "On the Different Methods of Extracting Sugar from Beet-root and Cane."
London Institution, 6½. Conversazione. Mr. Henry Holliday, on "Stained Glass æsthetically considered with reference to Modern Art."
Royal Society of Literature, 8½.

Thurs...Royal, 8½.
Antiquaries 8½.
Linnæan, 8.
Chemical, 8.
Numismatic, 7.
Royal Society Club, 6.
Society for the Encouragement of Fine Arts, 8. Mr. Ernest Edwards, "Heliotopy, its Applications and Mode of Working fully illustrated."
Royal Institution, 3. Dr. Odling, "Davy's Discoveries."

Fri.......Philological, 8.
Royal Institution, 9. Mr. J. Norman Lockyer, "On the Eclipse."

Sat ......Associated Arts Institute. Mr. A. H. Wall, "That the Aim of the Painter and of the Sculptor should be to Represent Thoughts rather than Things."
Royal Institution, 3. Mr. O'Neil, "Spirit of the Age."
Royal School of Mines, 8. Dr. Cobbold, F.R.S., Swiney Lecture on "Geology."

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FRIDAY, MARCH 17, 1871.

PROCEEDINGS OF THE SOCIETY.

POSTAL REFORM.

A Conference on the subject of "Postal Reform," was held on Monday, the 13th inst. Lord Henry Lennox, M.P., in the Chair. It was attended by a large number of gentlemen interested in learned societies, commerce, and trades affected by the recent alterations in the postal system.

The Chairman, in introducing the business of the meeting, said that since the new regulations of the Post-office came into force, the Society of Arts had taken a very active interest in their working, and had exerted itself very energetically to try and procure what they considered a reform of the new system. It had placed itself in communication with some of the largest houses in the City and elsewhere, and it was found that, although in some particulars a public boon had been effected by the new regulations, still they took away with one hand what was given with the other. To give one instance of the complication now introduced, he might mention that, whereas the leading and principal characteristic of the old Post-office regulations was its extreme simplicity, and the ease with which the public could understand what they might, and what they might not do, it had now been replaced by a complicated and lengthened series of regulations, which puzzled even the clearest heads to understand. The Society of Arts had therefore appointed a Postal Committee, which had been sitting since October last, and which had at length come to a conclusion as to what ought to be done with regard to the recent changes, and their views they had embodied in a petition to the House of Commons, which he should shortly call upon the Secretary to read. First, however, he would make one or two remarks on what were considered the most salient points calling for attention. First, with regard to the postal card. These, he understood now circulated to the extent of upwards of one million a week, and no doubt that was a great advantage to the public; but, in connection with their use were several grave anomalies which ought at once to be remedied. For example, a card could be sent for one halfpenny on which was printed or written whatever the sender desired. If, however, to the back was affixed a slip of printed matter, it would be surcharged on going through the Post-office. On the other hand, if the sender chose to buy a plain card, and affix the printed matter to it, although this might be to the extent of a column of the *Times*, it would then go through the Post-office for a halfpenny. That was one absurdity of the present regulations. What was proposed was, that one halfpenny should be the lowest sum at which all letters should be sent, for it was held by the Society of Arts, and he could not understand how anybody could deny the principle, that the postal-card was, to all intents and purposes, a letter; and if the Postmaster-General could afford to provide these cards, and allow the public to send a letter upon it, for one halfpenny, he did not see how he could object to the public providing its own material and affixing its own stamp, when envelope and all should be lighter in weight than that which the postal authorities were willing to carry for one halfpenny. It was quite unnecessary to point out that, in itself, there were grave objections to the system of sending open letters; and since these postal cards had been in use, frequent instances had been brought before the attention of the public, in which the most insulting communications had been sent through the post. A defamatory statement, if enclosed in an envelope, might be treated with the most sovereign contempt, and thrown at once into the fire, but if allowed to be sent on an open card, liable to lie on the table, and be read by every member of the household, it became a very serious matter. He had been told, on very good authority, that the suggestion of having a uniform rate of one halfpenny for letters of a minimum weight would be anything but detrimental to the public revenue; and it must be understood that there was no attempt whatever to dictate to the Post-office what weight should be sent for one halfpenny, but simply that, whatever weight was adopted, it should be open to the sender to send it in an enclosed envelope. As he had already stated, the weekly circulation of postal cards was upwards of a million, but it was calculated that the diminution of postage on letters in consequence was only about three per cent., so that the amount of cards sent more than counterbalanced the loss on the letters. If this were the case with the postal-cards, which were open to so many objections, how much more probability was there of the success of the experiment when these cheap letters were deprived of that which was such a great drawback, the possiblity of their being used by evil-disposed persons for improper purposes. The second point he desired to mention was, with regard to the transmission of newspapers and other printed matter. He had no wish to say a word in favour of restricting the privileges of newspapers. No one would wish to do so in these days, and still less anyone in his position before the public, when it was certainly not desirable for him to be on bad terms with these influential organs of public opinion. Still, there was no reason why the anomalies with regard to the transmission of newspapers and printed matter should not be remedied, and the whole system put into plain and intelligible shape. When Sir Rowland Hill introduced the great revolution of the penny postage, two or three rules, occupying a quarter of a page of the "Postal Guide," was sufficient to convey his meaning to the public, but now no less than five pages were required of the same size in order to contain the regulations, and even with that the meaning was, in many instances, far from being intelligible. One great hardship was this:—The definition of a newspaper was, that it should be something which was not stitched, and which appeared at intervals not greater than every week. Now, it was thought that periodicals of all kinds should be placed on the same footing as newspapers. For instance, if the Society of Arts' *Journal*, weighing more than two ounces, were sent forth stitched, it could not be sent for one halfpenny, and there were many other journals in the same condition. They desired to press upon the government that this anomaly should be removed, and that various fortnightly journals, representing different trades, which were to all intents and purposes newspapers, should not be mulcted in double postage, simply because they did not appear so often as once a week. It was also desired that all printed matter, without dictating in any way what should be the minimum weight, should be put on the same footing as all other parcels and samples. Again, as he had said before, the rules ought to be simplified, for at the present moment, amongst other great evils, one which had caused an enormous increase of labour to the Post-office officials, and that of a kind which ought not to devolve upon them at all, was that an immense deal of time was taken up in examining the printed matter which came through the post, in order to see whether it was published once a week or once a fortnight, and whether, in other respects, it complied with the regulations. The result was, that the public had to pay for the confused nature of the regulations issued by the Post-office. His friend, Mr. Graves, member for Liverpool, was going to bring this subject forward in the House of Commons on the following evening, and it would be his duty and pleasure to assist him in every way he could in pressing these views on the attention of the Postmaster-General. He would here say, however, that sitting, as he did, on the opposite side of the House of Commons to that hon. gentleman, he should be very sorry to say a word which should appear to partake of the character of factious opposition. He had no such desire, and, on the contrary, at an interview with Mr. Monsell, some short time ago, that gentleman, knowing that he represented the Society of Arts, had told him he should be very much obliged if, before the debate came on, he would inform him what was the view entertained by the Postal Committee of the Society of Arts, whose labours he knew had been very energetic. He would add, that he believed Mr. Monsell was perfectly well disposed and anxious to meet the wishes of the Society of Arts, as far as the Post-office authorities and the state of the revenue would allow. The most important point of all, however, was, to restore to the trade of this country that which they lost under the new regulations —the great convenience of a small parcels post. He was not going to ask the government for anything unreasonable, which some of the regulations in force on the Continent, by which you might send almost anything through the post, might be considered. All they asked was, that the invidious distinction between parcels and samples should be removed. As he had already said, there was no wish to lay down what the limit of weight should be, all this would be left entirely to the Post-office; but as the authorities were now able and willing to carry a sample of 12 ozs., he was unable to see why the same weight could not be carried at the same rate if the article was in execution of an order. If it were possible, as it was now, for the Post-office to carry by book-post a weight of 12 or 14 lbs., he could not see why parcels of 12 ozs. might not be easily carried. Without, therefore, wishing to curtail any privileges enjoyed by those who benefited by the book-post, it was desired to extend to the general trade and commerce of this country the advantage of being able to execute small orders by parcel-post to their customers. In this respect the new regulations had pressed very hardly on several mercantile interests of the country; and amongst others, there was one to which it was a most severe blow indeed, viz., the seed trade. At present there were no less than 65 regulations as to what could be sent as a parcel; whereas, if samples and other matters were all included in the same category, a great simplification might be introduced, to the benefit of all parties concerned. It might be said by the Post-office authorities, that by sending parcels the delivery of letters in the morning would be delayed; but to that his answer was plain and simple, that nothing of the kind need occur. The authorities had now the right, which they used when necessary, of delaying the delivery of book-post and other parcels, and he would suggest that there should be for all parcels a late and an early delivery. If any tradesman or merchant wished a parcel which he sent to be delivered by the early post, he should affix a double, or an extra stamp, whilst all other orders not so pressing might be delivered at a time when the letter carriers were not so busily engaged with the delivery of letters. If he were not detaining the meeting too long, he would produce from a box which he had present some few specimens, showing the anomalies which sprang up under the present regulations. The noble chairman then produced, to the considerable amusement of the meeting, various articles in pairs, differing slightly, if in any degree, from each other, one of which, however, had gone through the post at the sample rate, whilst the other had been surcharged—*e.g.*, bunches of flowers, pairs of slippers, decorations for churches, boxes of pills, and other matters. He concluded by calling upon the secretary to read the petition which had been prepared, embodying the views of the Society; after which, certain resolutions would be proposed for the adoption of the meeting.

The Secretary then read the petition as follows:—

To the Honourable the Commons of Great Britain and Ireland in Parliament Assembled.

The Humble Petition of the Society for the Encouragement of Arts, Manufactures, and Commerce, Incorporated by Royal Charter.

Sheweth,

I.—That this Society, in common with kindred associations, and with persons engaged in Arts, Manufactures, and Commerce, is largely interested in all that concerns the interchange of communication, whether by letter, printed matter, parcel, sample, or otherwise, inasmuch as such interchange of communication greatly affects the development of industry, both at home and abroad.

II.—That in the North German Confederation, Switzerland, and Belgium, such interchange of communication is carried on by the postal administration of those countries, to the great convenience and advantage of the inhabitants, both in a social as well as in an industrial point of view.

III.—That, in this country, the Post-office has a public agency of some twenty-six thousand officers, and of upwards of twelve thousand postal stations for the collection and distribution of letters, small book and sample parcels, and for the collection and distribution of money —which agency acts by upwards of forty-nine thousand miles of daily railway conveyance, and beyond this of thirty-three thousand miles of daily conveyance by coach, omnibus, and mail-cart, and also by upwards of seventy-two thousand miles of daily conveyance by foot messengers from the twelve thousand postal stations.

IV.—That the postal establishments, with such service of collection and distribution, cover nearly the whole country, and constitute a public agency capable, as your petitioners believe, of rendering service with profit, for the distribution of not only letters, samples, and printed matter, but of small parcels generally. That no private, and therefore separate, establishment can render such service except at a loss, unless under exceptional circumstances in crowded town districts.

V.—That if such a service can be carried on with advantage and with profit to the office in the countries above named, it may be confidently predicated, from the relative greater activity of business in this country, that a considerable further successful result, in a pecuniary point of view, may be anticipated by any improved systems of intercommunication adopted here.

VI.—Your petitioners submit that Continental experience has shown that not only printed matter but other matter, with the limitations as to size and weight which are placed upon the transmission of samples by post, may be carried at the rate of a halfpenny for every two ounces.

VII.—That your petitioners repudiate the notion, as false in political economy, that the public should abstain from utilising its own establishments to any extent for its own service—and that it should do so for the maintenance of separate and private establishments at extra and wasteful expense, to the detriment of the great elements of free trade, cheap, uniform, convenient, safe, and free transit.

VIII.—That the more the public distributing agency has to do, under a competent administration, the better it may do all parts of its work, producing the greater net revenue; that to limit the reduced charge to merely one sort of printed matter, or to any one sort of matter now comprehended in the sample post, would be to augment the proportion of the establishment charges on that one sort of printed or other matter, and diminish thereby the return of profit, in service or of revenue to the public.

IX.—That, where the augmented traffic may become too heavy for foot messengers, it will pay for delivery by horse or mail cart, and thus speed the general delivery of other matters.

X.—That your petitioners are of opinion that all extra service on the part of the highest officers, as well as the lowest foot messengers, should be accompanied by extra remuneration, your petitioners fully recognising the value of the opinion expressed by Sir Rowland Hill on this subject, that the introduction of a proper system of parcel postage would afford a means of augmenting the payment and improving the condition of the inferior officers of the post, and of inducing a higher and better class of persons to enter that branch of the public service.

XI.—That the recent alterations in the postage system, though in many respects advantageous, have encumbered the service with numerous rules and distinctions, which your petitioners submit are not only unnecessary, and restrict its usefulness, but give unnecessary trouble to the officers, in many instances impose duties upon them which, from their very nature, can only be imperfectly performed, leading to evasion on the part of the public, and delay in the circulation and other departments, thus limiting the usefulness of the Post-office.

XII.—That relief would be given to the office, as well as great benefit to the public, from a simplification of such rules; and that, in the opinion of your petitioners, such benefit might be obtained by dividing the service into three categories, thus—

1. Letters at rates commencing with one halfpenny, all distinctions of closed and open letters being abolished.
2. Newspapers, but without reference to period of publication, and, whether stitched or unstitched, to retain their privilege of passing for one half-penny.
3. All other matter, whether printed or otherwise, samples or merchandise, under the general head of parcels, at rates commencing at one halfpenny for two ounces, with such limit as to weight and bulk as may be found convenient.

XIII.—That as regards the parcel-post, as above-named, great convenience might be given to the Post-office without detriment to the public, if it were divided into a quick and slow delivery, *i.e.*, that for the ordinary rates of charge the Post-office should be at liberty to delay the delivery of such parcels for a given time, thus enabling the delivery to be distributed over those periods of the day when the postman is not burdened with the main delivery of the letters.

XIV.—That any parcels requiring the delivery by quick post should be paid for at a higher rate of tariff.

XV.—Your petitioners recommend for consideration as a principle, that the Post-office and the railway companies should share the receipts of the parcel transit, as for a joint service; the railways as regards the service for bulk transit, the Post-office as regards the service of collection and distribution.

XVI.—Your petitioners further recommend that the reforms in the postal transit of parcels should be extended to India and the colonies.

Submitting these views,

Your Petitioners therefore humbly pray that your Honourable House will take the premises into your consideration, and make such alterations as in your wisdom you may deem meet for bringing up the action of the postal department on the matters in question to the administration of other countries, and to the increased freedom of transit which is needed for the progress of the Arts, the Manufactures, and the Commerce of this country.

Sealed with the Seal of this Society for the
Encouragement of Arts, Manufactures, and
Commerce, this fourteenth day of March, One
thousand eight hundred and seventy-one, in
the presence of (L.S.)

P. Le Neve Foster, Secretary.

Mr. **John Symonds** moved the first resolution, as follows:—"It is desirable that simplicity should be introduced into the Post-office regulations, which should be as few as possible, and of a character which it is the interest of the public to obey." He said the only point in the petition which he thought likely to occasion any difficulty was, that he did not see clearly how a distinction could be drawn between a letter and a parcel. The petition indicated that a letter of a certain weight was to be conveyed for one halfpenny, and a parcel of another weight, say two ounces, was also to be conveyed for one halfpenny, but how was the distinction to be drawn. For his own part, he could see no material difference, in a commercial point of view, between one and the other. It was simply a commercial question—Did it pay to convey a parcel of a certain weight and size for one halfpenny, and if it did, why should not all parcels be so conveyed? Why should the privilege be restricted to certain kinds of parcels, with respect to which there must be a system of espionage in order to ascertain what the contents were? For his own part, he was very anxious to see all that kind of thing done away with, and he thought there should be no question at all as to the contents of a parcel, provided always they were not dangerous, as to which there were sufficient regulations already existing.

Mr. **Asprey** said he was very glad, as a man of business, to take any step which at all tended to improve the present system of the Post-office, especially as he had personally felt great inconvenience from the alterations recently introduced. He had no doubt the difficulty pointed out by Mr. Symonds could easily be got over, and that the distinction would be whether the parcels or letters were enclosed. He had much pleasure in seconding the resolution.

The resolution was put, and carried unanimously.

Mr. **Deane** (secretary of the Seed Trade Association) moved the next resolution as follows:—"That there should be three different principles or rates of charging, one for letters, one for all periodicals, without reference to the length of the period of publication, and whether stitched or unstitched, and one for parcels of all kinds of matter not dangerous, with such limit of bulk and weight as may be found convenient." There was no necessity for dwelling upon the first point of the resolution, viz., that there should be three different principles or rates for charging, inasmuch as this had been fully gone into by the chairman. But upon the third point—that there should be one rate for parcels of all kinds, not dangerous—he had a word or two to say, representing, as he did, a body upon whom the regulations which came into force on the 1st of October last had fallen with very great weight, viz., the seed trade. Previously, they had enjoyed the great privilege of sending to all parts of the country and abroad parcels of seeds at sample rates, although they were goods in execution of an order. In the case of the colonies, the East Indies, and the United States, that privilege had tended to develop to a great extent a valuable source of industry, for as seedsmen they found, year by year, that the orders received from those places were being considerably augmented. There were difficulties connected with the climate and other matters which interfered with the production of new and choice varieties of seeds and plants in the countries he had referred to, and it was an inestimable advantage to their correspondents in these localities that they should be able to receive, as quickly as possible, from England the contributions of the most talented horticulturists. Orders for seeds from these places, therefore, were being constantly received, and the great advantage of being able to send them by post consisted in this, that they were easily and quickly delivered. The fact that they were prepaid prevented any delay when they reached their destination. There was no Custom-house examination necessary, and no occasion for their being laid by in damp warehouses, to await orders being sent up the country, but they were delivered immediately, and in good condition, and this was of considerable importance, for many valuable kinds of seeds were speedily injured if allowed to lie about subject to atmospheric influences. The Post-office authorities had now set up this kind of barrier, that samples might be sent, but not seeds of value; but he should like to ask the Postmaster-General, or any official, how he was able to decide what were seeds of value, and what were samples. Even seedsmen themselves would very often find it exceedingly difficult to decide such a question, and he might state that, notwithstanding the recent regulations, the seed trade had continued to send their parcels through the post, and very seldom indeed were they challenged or interfered with, notwithstanding the regulations were constantly violated. Probably the Post-office authorities felt what a difficulty there was in deciding the point. Now and then a parcel was surcharged, but very seldom.

Mr. Edwin Chadwick, C.B., observed, on the question raised as to the distinction between letters and parcels, that it was a distinction not worth the trouble of maintaining. One great administrative discovery involving a new principle, made by Sir Rowland Hill, was that the carriage of a letter was only some thirty-seventh part of the cost, whether it was carried four hundred miles or to the next street. It was not, therefore, worth while to impose upon the sender the labour of looking out difference of charges, or of the Post-office authorities the time and labour of discriminating or taxing the letters according to the different distances they were carried. In the instance of parcels, it was not worth while putting the Post-office authorities to the labour of opening all to detect a penny evasion in some, and at the same time putting the sender of the parcel to the trouble of the separate enclosure of a letter which might contain instructions in relation to the contents of the parcel, and which convenience would require to have kept with them. The postal deliveries by the established agency were so cheap that there need be no fear of any material evasions of the revenue, even by bundles of letters being enclosed in parcels to be delivered by hand from any place, as the expense of a private distribution by hand would generally be greater, and it would be as cheap and more convenient to send them direct. The great administrative principle was uniformity, simplicity, and a public service cheaper than a private separate service, on the economic ground embodied in the petition.

Mr. T. Webster, Q.C., having taken a part in the early postal reform movement, had much pleasure in seconding the resolution, feeling assured, as he did, that the result of this conference would be to carry out to completion the greatest measure that probably ever resulted from the efforts of any one man. He quite agreed with what had been said by Mr. Chadwick, as to the principles which regulated this question. The Post-office was undeniably the cheapest carrier, and the great principle was to get rid of any waste of labour in examination of parcels. No doubt there must be an occasional examination, to detect any dangerous matters, but with that limit for the protection of the public it ought to be got rid of. With regard to the question of letters being distinguished from printed matters or parcels, he had always looked upon the question of extra payment for letters as a sort of insurance for extra speed and delivery. He had been much struck with the observation made by the chaiman, as to the answer to be given to the objection that parcels might be delayed. Of course, the bulk of matter to be delivered was so great that some alteration of that kind might become necessary, but if it were worth the while of persons to pay an extra half-penny or penny, whether on a letter, a parcel, or printed matter, either for extra security or extra speed, they ought to receive that extra advantage. With regard to the great proportion of printed matters or letters, he believed it would be wholly immaterial whether they were delivered an hour or two earlier or later; and, looking to the great accumulation of letters ordinarily distributed, he was quite satisfied that a distinction might easily be made between parcels and letters which might be delayed and those which could not, but the senders must be the persons to judge. If they thought it worth while to pay the high rate of postage, they ought to have every facility which the Post-office could give them. That distinction was already introduced to a certain extent, for newspapers and book parcels were not received up to so late an hour as letters; but he must insist upon this point, that the election must rest with the sender, and that election would be made known by the amount of stamps which he affixed to the letter or parcel. He had much pleasure in seconding the resolution, believing, as he did, that the Society would have the satisfaction of carrying out this great system of commercial reform to its most complete perfection.

Mr. Hogg said the chairman had disclaimed any idea of dictating to the Postmaster-General or to the government what weight they should or should not carry, but inasmuch as the primary object of the Post-office in introducing the halfpenny card was, that they should carry a minimum weight for a minimum amount, he thought, if it were insisted upon that there should be but one rate, consisting of a halfpenny for closed and open letters, it would, in some degree, be dictating to the government as to what they should carry for a halfpenny. He desired to suggest that the word "newspapers" should be substituted for "periodicals" in the resolution, which would render it more in accordance with the petition; and unless this were done, he thought they would be unwittingly committing themselves to a principle which could not very well be carried out, viz., that all kinds of publications, whether novels or other books, in volumes, issued at stated periods, would be enabled to avail themselves of the newspaper regulations. There seemed to be some difference of opinion in the Post-office, as to what might be contained in a newspaper; for instance, he had been recently connected with the bringing out of a newspaper with which a supplement had been issued, which supplement was nothing more or less than a form of subscription. Now, in the "Post-office Guide" there was no regulation with regard to a supplement, except that it should bear the date at the top, but he had been informed by a Post-office official that the supplement which he had referred to, inasmuch as it did not contain news or advertisements, would not be allowed to go as a supplement. With regard to parcels being sent open or closed, he thought that, except in case of seeds, and such matters as could not be sent open, that parcels should be sent unenclosed. Those which were sent enclosed might, of course, be opened by the authorities, and if the sender had put inside anything which ought not to have gone, such as a communication in the nature of a letter, he considered no fine would be too heavy. He had received a parcel of pens from the country, which came as a sample, and was charged one halfpenny; he had also received a large stereotyped plate, sample rate, although, as he believed, such a thing could not by any possibility be considered as a pattern or sample. There was no doubt, therefore, that the present regulations loudly called for alteration and simplification.

Mr. T. Webster suggested, in order to meet any difficulty, that the resolution should read:—"One rate for all newspapers, without reference to length or period of publication, and whether stitched or unstitched." As to any other kind of printed matter, that would go under the head of parcels.

Mr. Deane expressed his readiness to adopt this amendment.

Mr. Jeffreys thought the proposed amendment was no improvement. The three classes of matter to go by post were clearly marked out by the original resolution; but under the amendment there would still be the difficulty of ascertaining what constitutes a newspaper, and the anomaly would remain, that you could send 6 ozs. or more of matter by post if it were called a newspaper, whilst you would be confined to 2 ozs. for the same rate if it were ordinary printed matter. This anomaly would give rise to no end of contention at the Post-office, as it always had done, and he was sorry to find that a sounder principle was not proceeded upon. The Society would have been going in the right direction if they had contended for putting all printed matter, including newspapers, on the same footing. It was one of the most anomalous things in the present arrangements that the *Times*, the *Graphic*, or the *Saturday Review*, weighing 6 ozs. or more, might go for one halfpenny, whilst three numbers of the *Echo*, weighing less than 4 ozs., would be charged one penny. One good reason for placing printed matter on a different footing to all other things was that the State was now called upon to contribute to the education of the people; and it was well understood that it was a proper matter for the consideration of the government, that the diffusion of the means of knowledge by means of the press, which contributed to the education of the people, should have advantages given to it. That principle had been recognised, but the carrying of it out would, in his opinion, be more thorough by adhering to the wording of the original resolution.

Mr. Edwin Chadwick said one reason for drawing a distinction between newspapers and other printed matter was this—that it had been already proposed that the Post-office should have the right to delay parcels a certain time; but in the case of newspapers it was often of the greatest importance that they should be delivered at the same time as letters.

Mr. John Symonds thought that disposed of the question with regard to newspapers. The only exception he desired to advocate was in favour of newspapers. He had ventilated his views in print on that ground—viz., that it was of great importance to the State that a knowledge of contemporaneous history should be widely diffused, and therefore he thought the State might take upon itself to favour the delivery of newspapers as compared with ordinary parcels or other printed matter. His friend, Mr. Jeffreys, wished to place printed matter on the same footing; but there was no difficulty in ascertaining what was a newspaper, inasmuch as it had to be registered, and the name and title, &c., affixed to it. If printed matter had to be conveyed at the same rates, the parcels must be detained and examined to see whether it was really printed matter or not; but he rather concurred in Mr. Chadwick's view, that printed matter generally should be placed on the same footing as other parcels. As he understood, the view of Mr. Webster was, that a parcel up to a certain weight should be considered as a letter, and delivered accordingly by the earliest delivery, whilst one of a heavier weight would be detained for delivery at a later period, unless an extra postage were paid upon it.

Mr. T. Webster said that was his view, but with this qualification—that the sender should in every case elect whether it should be a letter or a parcel.

Mr. A. J. Ellis, F.R.S., said there were one or two points of difficulty which had occurred to him during the discussion. For instance, printed matter only had been referred to; but he had often to send manuscript matter through the post. His printer lived in the country, and he often had to send manuscript and printed proofs; and the question had sometimes occurred to him whether he was transgressing the regulations when he had written upon the proof directions to the printer, such as "Send so many copies of the next revise," or "Go to press." He had also desired to know whether he might send a bundle of letters which had already passed through the post by book parcel as manuscript matter, but the answer he had received was, he could not do so unless they were intended for publication. Now, he certainly could not see how the Post-office authorities were able to discover whether a bundle of such letters were intended for publication or not. With regard to newspapers, they enjoyed certain privileges which could only be obtained by those who registered their publications, and affixed to them the title of registered newspapers. With respect to book parcels, there were several difficulties at present, amongst the principal of which was, that they were required to be sent open or openable. Now, in sending two or three enclosures under one cover, there was often a great difficulty in so securing them as to prevent loss, and, at the same time, not to commit a breach of the Post-office regulations. This point, he thought, ought to be referred to in the memorial or resolution, particularly as the word "parcel" would, no doubt, be understood by Post-office authorities in a sense already affixed to it, viz., that of a parcel open at the ends, or openable.

Mr. Edwin Chadwick, with reference to the question of messages and parcels, said it would be a great convenience if the letter and parcel could go together. For instance, that morning he had sent back to a tradesman an article which required altering, and attached to it was a letter stating what he required. As it happened, this had been sent by the parcels delivery, but if he had sent it by post, it was doubtful whether he would not have been liable to a penalty.

Mr. G. F. Wilson, F.R.S., on behalf of the Royal Horticultural Society, desired heartily to support the resolution, inasmuch as the society which he represented had frequently had communications made to them, both from the seed trade and the public, of the great difficulties under which they now laboured.

Mr. Unwin said the great difficulty was to determine what was a newspaper, and until that was settled it was rather difficult to determine upon a uniform postage for newspapers. Two periodicals had recently come under his notice, both being trade reviews, one of which passed as a newspaper, but the other, it was decided, could not; and the difficulty was only evaded by adding a few advertisements in the shape of a supplement, to make it look more like a newspaper.

Mr. T. Webster said the law had defined what was a newspaper, and those who wished to take advantage of the newspaper privilege must comply with it. He did not say that if the matter were to be done *de novo*, he could argue there was any ground for giving greater privileges to newspapers than to other printed matter, or that if it were essential that newspapers should be speedily delivered the purchaser should not pay for that privilege on the same principle as he had always indicated. But, at the same time, they could not go backwards, and try to alter the present law in this respect. Therefore, though he agreed with what had fallen from Mr. Jeffery, he did not see how they could interfere in the matter.

Mr. E. Chadwick said the Belgian government collected the subscriptions for newspapers.

Mr. G. J. Symons said that Mr. Jeffreys had spoken of the interest taken in educational questions by the House of Commons, and had given that as a reason why newspapers were allowed certain privileges. Mr. Jeffreys, however, looked upon the parcel-post as connected rather with commercial matters; but representing, as he (Mr. Symons) did, the Royal Botanical Society, he must say that they, in common with others engaged in horticulture, had been much annoyed by the restrictions lately introduced with respect to seeds. There was, however, another section of society which had suffered quite as much, viz., microscopists. Formerly, it had been the custom to send microscopic specimens all over the country, and investigators had constantly exchanged their slides. This had gone on to a great extent, particularly between gentlemen in the country and Londoners. The whole of this was now stopped; and although they had heard that in defiance of the regulations seeds were constantly sent at sample rates through the post, he might say that this could not be done in the case of microscopic slides one time in twenty. Now, he considered there was almost as much progress in educational matters due to the circulation of these microscopic specimens as to newspapers; at any rate, they must be looked upon as connected with education. He desired, therefore, to support the resolution, firstly, on account of its bearing on the transmission of seeds; secondly, with regard to its commercial aspect generally; and thirdly, he did so on behalf of the Fellows and members of the Microscopical Society, who had been very severe sufferers by the late changes.

Mr. Soper did not think it would be very easy to abolish the distinction between newspapers and other printed matter, although, as a publisher, he should be very glad to avail himself of the same privilege for books as were now enjoyed by newspapers. It was proposed not to limit the weight with respect to newspapers, it being very necessary that there should be a limit to other printed matter; this, of itself, would cause a distinction. In order to avoid, as far as possible, the danger of parties sending large bundles of letters under the parcels-post, he thought the distinction should be as slight as possible between parcels and letters; for instance, whilst two ounces for one halfpenny might go as a parcel, provided it were left open at the ends, one ounce for one halfpenny might be the limit if the parcel were closed. It would then hardly be worth while to send letters in that way, and thus the revenue would be adequately protected.

The Chairman, before putting the resolution, said Mr. Hogg had fallen into a slight mistake in supposing that the first resolution was in any sense a dictation to the Postmaster-General. They simply said that it was only fair that the public should be allowed to send the same rate for one halfpenny, if they found the material and closed it, as the Post-office allowed them to do when the material was found by the government and sent open. They simply desired to remove the inconvenience which had arisen from the use of the post-card in the hands of evil-disposed persons. The greater part of the same gentleman's speech had really confirmed the general view of the hopeless confusion and uncertainty that prevailed in the present Post-office regulations. He was, however, as he had been informed, under a mistake in saying that a stereo-plate could not be a sample, as they were sometimes sent as samples of shawl patterns. He entirely agreed with Mr. Jeffreys that there was an anomaly in the case of newspapers, but at the same time they were most valuable as educational agents, and this privilege having been conferred upon them, there was no individual or society that would be powerful enough to breast the influence of the whole newspaper press, and try to take away from them those privileges which they now enjoyed.

The resolution, as amended, was then put and carried unanimously, viz:—"That there should be only three different principles of rates of charging, one for letters, one for all newspapers, without reference to length of publication, and whether stitched or unstitched, and one for parcels of *all kinds of matter* (not dangerous), with such limit of bulk and weight as may be found convenient."

Mr. J. Symonds proposed, and **Mr. Ware** seconded, a vote of thanks to the Chairman for his kindness in taking the chair, and the ability with which he had conducted the proceedings, which was carried unanimously.

The Chairman said it had given him much pleasure to be present, and he hoped his services would always be made use of in any other matter in which the best interests of the community were concerned.

The petition of the Society was presented in the House of Commons, on Tuesday, the 14th inst., by Lord Henry Lennox, when—

Mr. Graves rose to move the resolution of which he had given notice, and which was as follows:—"(1) That it is desirable to restore and extend those facilities for the tranmission of small parcels by post which the public enjoyed prior to the 1st day of October, 1870; and (2) that it is desirable to increase the number of money-order offices, especially in the rural districts, and to amend the rates charged for the transmission of money-orders, by establishing a scale of charge which shall press less heavily on the poorer classes of remitters." Having pointed out some of the anomalies existing in the present postal arrangements relative to the parcels post, and moved that it was desirable to restore and extend those facilities for the transmission of small parcels by post which the public enjoyed prior to the 1st of October, 1870; to increase the number of money-order offices, especially in the rural districts; and to amend the rates charged for the transmission of money-orders, by establishing a scale of charge which shall fall less heavily on the poorer classes of remitters, referring to money-orders, the hon. gentleman explained that, in the first year of issue, the amount transmitted through the post was £300,000, while in 1870 there were ten million orders, representing £20,000,000 sterling, two-thirds of which were sent in orders of less than £2. In consequence of the amount to be paid for money-orders, the poorer classes of the community had resorted to other means—such as sending money or stamps in letters—to avoid expense, the result of which was an enormous amount of crime among the Post-office *employés*, many of whom were ruined by the temptations to which they were exposed. The Post-office ought to be looked upon as a whole, and not departmentally, and if the result were advantageous, increased facilities should be given to those who could ill-afford an expenditure of money. He suggested the adoption of a simple system, such as paying a penny in the pound for orders. He knew that in asking for these two concessions he was raising the question of revenue, which, especially at this moment, would be regarded by the Chancellor of the Exchequer as of great importance. But he maintained that his proposals would not result in any loss. Whenever we gave a reduction in postage or increased the facilities, the loss of revenue for the moment was more than compensated by the increase of the business which would ultimately take place.

Mr. Akroyd seconded the motion, and said that although we were the first to introduce cheap postage, we had since remained stationary. Continental Powers had accepted and adopted our ideas, and we had had to copy them. He seconded the motion, because he believed it was one which would be appreciated throughout the country.

Mr. Monsell fully appreciated the importance of the questions raised, and he hoped he should be able to state the proposals the Government were prepared to make, and to find that they were satisfactory, as he believed they would be, to the honourable member and to the country at large. With reference, however, to the system adopted in other countries, he would at once say that the sums paid abroad for the carriage of mails were little or nothing as compared with the amount charged to the Post-office in this country. In adopting a new system, it was very important to arrive at something which had the element of finality in it. In commercial transactions it was not impossible for persons to carry on their business satisfactorily and make constant alterations in that business; and the same rule, he thought, applied to the postal arrangements. In considering this question, he should put aside the present arrangements, by which newspapers, books, and trade circulars were now carried by the Post-office; but would just remark that, although recently there had been a great increase in the number of articles which were sent through the post, there had been no diminution, but, on the contrary, a considerable increase in the number of letters that were sent. He came now to the question of open and closed parcels. It appeared to him that there was no good in maintaining any distinction between closed and open parcels, and that parcels, of whatever sort they might be, should be sent either closed or open as the sender desired. If this was so it would result in diminishing the work at the Post-office, by rendering it unnecessary to inspect the articles so sent, with the view of seeing what they were. It would also produce economy. He, therefore, thought the House would agree with him that it was expedient that henceforth open and closed parcels should be sent at the same rate. The next point was, what should be the weight of such parcels. He had consulted a great number of persons from different parts of the country, and he had also had the advantage of receiving a deputation, consisting of gentlemen representing some of the most important manufacturing towns, and they were generally of opinion that the limit of the weight should be fixed at twelve ounces. If the House agreed with him on these two points, he would next proceed to consider another point which was of vital importance. That was what the initial charge should be. On that point he thought there would be very little difference of opinion among hon. gentlemen who had given much attention to the matter. The mainspring of the postal system was the penny charge for letters. Ninety-five per cent. of the letters now sent through the Post-office were 1d. letters, and 90 per cent. of the revenue derived from the Post-office came from them. In the year 1863, the number of letters sent was 600,000,000, and that number had increased in the year 1870 to 800,000,000, and had contributed somewhere about £800,000 a-year towards the revenue. It was by means of this 1d. letter that everything that had been done had been done in the direction to which his hon. friend had alluded. By this system they had been able to adopt a new mode of communication, establish districts, and try experiments with the pattern post, and he contended that on this system depended the maintenance of the penny initial charge. It had worked satisfactorily, and, if it was abandoned, the house would abandon a revenue of £1,500,000 a year, and the Post-office, instead of being a source of revenue, would become a great spending department, having all those difficulties to contend with which were experienced by the spending departments, and of conferring expense upon the public. The Post-office, then, instead of conferring year by year a benefit and advantage to the country, would cease its career of progress. Well, then, having decided the parcels should be sent either closed or open, he had come to the conclusion that the rate should be for parcels and letters of all sorts not exceeding 1oz. 1d.; 1oz. to 2oz., $1\frac{1}{2}$d.; 2oz. to 4oz., 2d.; 4oz. to 6oz., $2\frac{1}{2}$d.; 6oz. to 8oz., 3d.; 8oz. to 10oz., $3\frac{1}{2}$d.; and 10oz. to 12oz. 4d. The weight of the parcels would be limited to 12 oz. By the present arrangement, articles by the pattern post were charged 3d. for 12 oz. By the new arrangement they would be charged 4d. But by this alteration they would have the advantage of sending parcels closed or not, as the sender thought fit, and he thought on the whole the public would derive considerably greater advantages by his proposition than by maintaining the present rate, or by adopting the proposition of his hon. friend, the member for Liverpool. But he thought the great advantage which would result from his system would be the introduction of the element of finality and sound principle. He ventured to think that the country would be satisfied with the proposed change. Nothing would give him greater pleasure than to co-operate in bringing about an arrangement which would benefit the railway interest, and at the same time the public. He admitted that the object of money orders was to benefit the poorer classes, and that their establishment was not contemplated as a source of revenue; but, at the same time, it was quite clear that if the proposition of the hon. member (Mr. Graves) were adopted, the result would be a considerable loss to the revenue, and the greater the business that was done, the greater would be the loss. What he recommended, however, and intended to embody in a Bill, was to reduce the charge upon orders from 10s. to one penny, from 10s. to £1 twopence, from £1 to £2 threepence, increasing in the same ratio up to £10. That would be advantageous to the poor sections of the community, and, he hoped, be the means of putting a stop to a fertile source of crime and demoralization among the Post-office *employés*, resulting from the transmission of money and stamps in letters. He also proposed to prohibit postmasters from purchasing stamps. In his scheme his great aim would be to attain something like finality, and if that could be done a great public benefit would be achieved.

Lord H. Lennox congratulated the right hon. gentleman on the greater part of his proposals, which he believed would be welcomed with the greatest pleasure all over the country; but, on behalf of the Society of Arts, which he represented, and which had spent much time and money in the prosecution of the subject, he could not subscribe to the doctrine of the right hon. gentleman, that his present proposals had the merit of finality. They were a great step in advance, but he hoped some day to be able to persuade his right hon. friend to extend a little further the boons he was about to confer on the community. He could assure the right hon. gentleman that he in no degree grudged the newspapers the exceptional postal facilities they enjoyed. On the contrary, the public journals must be regarded as among the best instruments of advancing the education and cultivating the intelligence of the people; and he only desired to suggest that the Postmaster-General might wisely extend to periodicals published fortnightly the advantages now granted to the daily and weekly press.

After some further discussion, Mr. Graves withdrew his motion.

FIFTEENTH ORDINARY MEETING.

Wednesday, 15th March, 1871; G. C. T. Bartley, Esq., Treasurer to the Society, in the chair.

The following candidates were proposed for election as members of the Society:—

Bamlett, A. C., Thirsk, Yorkshire.
Bogie, James, Queen Insurance-buildings, Liverpool.
Lockwood, B. C., 25, Highbury-grove, N.
Scott, James Renat, Coal-exchange, E.C.
Southwell, Charles, 44, Prince's-street, Leicester-square, W.C.
Spiller, William, F.C.S., The Chesnuts, Lower Clapton, N.E.

The following candidates were balloted for and duly elected members of the Society:—

Ainsworth, William Francis, Ravensworth-villa, Hammersmith, W.
Beale, John, Conduit-house, East Greenwich, S.E.
Herbart, Rev. T. W., the Vicarage, Southern, Essex.
Hills, Harris, Feering-house, Kelvedon, Essex.
Lee, J. Hutchinson, Balston, Torquay.
Tillyard, Ebenezer, 2, Serjeants'-inn, W.C.

The Paper read was—

ON THE DIFFERENT METHODS OF EXTRACTING SUGAR FROM BEET-ROOT AND CANE.

By Ferdinand Kohn, Esq., C.E.

The attention of the Society for the Encouragement of Arts, Manufactures, and Commerce has been very frequently directed to the art of producing and manufacturing sugar. It is a subject of vast interest, and one of the most important sources of national wealth, and it has, for a long time past, been considered as an industry deserving and requiring the special protection of the government. This policy of government protection has created an exceptional position for sugar manufacture, and has never ceased to influence the welfare and progress of this art, for good or for evil, up to the present day, when the last remnant of this system is still in existence in the form of a differential sugar-duty, intended for protecting British sugar-refiners and the sugar-cane planters in the British colonies against foreign competition. The interest of sugar cultivation has in this manner exercised an important influence upon the colonial and general policy of this country, and its history is therefore more closely related to the political history of the British nation than any other branch of arts and manufactures.

At an earlier period, sugar cultivation was to a certain extent identified with slave labour, and its destinies were materially affected by all the political struggles and changes which finally brought about the total abolition of slavery in the British dominions. The wars between England and France had an equally direct and important influence upon colonial sugar cultivation. The Continental blockade, decreed by Napoleon I., was aimed principally at the sugar interest in the British colonies, and it succeeded far beyond expectation, by giving birth to the cultivation of beet-root sugar. This new industry, fostered by a protective system which Continental nations adopted from a spirit of opposition to the favour enjoyed by colonial planters, had ample opportunities for its gradual development, until it finally reached a degree of perfection which places it upon a par with the most favourable conditions under which the cultivation of cane and the manufacture of cane-sugar are carried on in the tropical countries at present.

In this new form, sugar manufacture is now again attracting the interest and energies of agriculturists and manufacturers in this country, and re-appears as a subject occupying the attention of our leading statesmen, and raising expectations of political advantages which are very clearly indicated in the last Budget speech of the Chancellor of the Exchequer, in the following words:—"We know that the beet-root industry of the Continent seems to have got over its difficulties, and to be spreading very widely. There is also the prospect of the growth of beet-root with this object in our own country, and if we could hope for anything so good as that it should be introduced with success into the south of Ireland, it would be one of the greatest blessings that could possibly befall that country."

The two plants to which the manufacture of sugar is at present principally applied are beet-root and cane. The sugar in both these plants exists dissolved in the juice which is held within the vegetable cells, but the character and composition of the solutions is different in the two kinds of juice. Beet-root juice contains from 7 to 15 per cent of sugar, a considerable proportion of insoluble and soluble albumen, and a quantity of salts, which generally give to this juice an alkaline character. The cane juice is charged with insoluble nitrogenous matter of different kinds, with soluble albumen, and also with salts; but the character of cane-juice is always acid, and the contamination with salts is less in proportion as compared with the juice of beet-root. The per-centage of sugar in cane-juice ranges between wide limits, but may be taken as averaging from 15 to 20 per cent in ripe cane. The cane-juice generally contains a sensible proportion of glucose, or so-called fruit-sugar, which is of a different composition from the cane-sugar itself, and is incapable of being crystallised in the ordinary process of sugar manufacture. Beet-root juice does not contain any considerable per-centage of this kind of sugar. The beet-root contains 96 per cent. of juice, and only 4 per cent. of a solid, insoluble substance, which forms the marrow or pulp. The sugar-cane is composed of 90 per cent. of juice, and of 10 per cent. of wood-fibre, which latter composes the cane trash or bagasse. The process of extracting the sugar from these plants consists in a separation of the saccharine solution from the surrounding solid masses, and it is the purpose of the present paper to describe and compare the different means hitherto practically employed for effecting this separation.

The traditional and most primitive method of extracting the juice from beet-root and cane consists in the application of mechanical pressure. The action of the mechanical force in compressing the mass of the raw material destroys the cellular structure of the tissues of the plant, and bursts the individual cells, the liquid contents of which are liberated and forced out of contact with the solid residue. The juice expressed by mechanical force is therefore charged with all the soluble and insoluble impurities originally contained in the plant, and it is, moreover, mechanically intermixed with minute fragments of the fibrous solid mass, which is more or less disintegrated by the action of the mechanical force. The beet-root, before being exposed to this process of extraction, requires a preliminary treatment of great importance—viz., the reduction to a fine pulp, by means of the so-called pulper or rasp. The pulping machine, in its most generally applied form, consists of a double revolving drum, fitted with toothed saw-blades, or scrapers, which, in their rapid rotation, effect the disintegration of the roots, and convert the mass into a fine, soft pulp. The action of the rasp effects the principal part of that destruction of cellular structure to which the subsequent separation of the liquid and solid constituents of the beet-root is due. This subsequent operation consists in charging the beet-root pulp into woollen bags, for being operated upon by a powerful hydraulic press, which drives the liquid juice through the meshes of the bags, and compresses the solid residue into a dry, dense cake. The quantity of pulp remaining in the bags averages 18 per cent. of the weight of the beet, giving a yield of juice equal to 82 per cent., instead of the theoretical quantity of 96 per cent. This large difference, which cannot be sensibly modified by increased pressure or time of extraction, is principally due to the imperfect disintegration of the cells by the action of the rasp. The operation of pulping leaves a large proportion of the vegetable cells unbroken, and therefore less capable of giving up their juice under the action of the hydraulic press. The proportion of such unbroken cells is greater in the coarser kinds of pulp, as compared with finer pulp, which latter contains a greater number of disintegrated cells, and is, therefore, capable of yielding a larger proportion of juice. In practice, the differences of yield from this cause are counteracted, and the general yield of juice from the beet-root considerably increased by the expedient of mixing water with the pulp in the process of rasping. The addition of water to the pulp effects a partial extraction of the sugar from the unbroken cells, by the action of endosmosis and exosmosis, and the increased yield of sugar obtained by these means from the beet-root pulp affords an ample compensation for the expenses of evaporating the additional quantity of water which is in this manner mixed with the natural juice of the root. The yield of juice can be increased to about 87 per cent. by the addition of a quantity of water, which amounts to 15 or 20 per cent.

of the original juice. The process of beet-root extraction by means of the rasp and hydraulic-press has been very well described in all its details in a recently published work on the manufacture of beet-root sugar in England and Ireland, by Mr. W. Crookes, F.R.S.

For the extraction of sugar-cane, the application of mechanical pressure has been almost exclusively confined to one form of apparatus, viz., the well-known roller-mill. The numerous imperfections of this class of machinery have been recognised for a long time past, and many changes of construction have been suggested, tried, and abandoned, without departing, however, from the general principle of extraction by means of mechanical force. One of the most ingenious and promising attempts in that direction was the sugar-cane press, invented by Mr. Henry Bessemer, in 1849. The history of that invention, or, at least, that of its early trials, is prominently recorded in the annals of the Society of Arts; it is not, necessary, therefore, to dwell upon its details at present. It will be sufficient to say that Mr. Bessemer, very correctly recognising the defects inherent to the action of the roller-mill, intended to replace this machine by a hydraulic-press, worked direct from the crank of a steam-engine. Mr. Bessemer's cane-press has not, however, established itself in practice, and has left the sugar-mill intact, and with nearly all its defects unchanged, although these defects have since then been more generally recognised, in consequence of the clearness and precision with which they were pointed out by Mr. Bessemer in his often-quoted specification. Mr. Bessemer says:—

"In order to extract the juice from a cane by means of a rolling mill, it is obvious that the rollers must be set sufficiently close to give a very tight pinch; but the rollers must not be too close, otherwise the cane-trash is so lacerated and broken as greatly to lessen the value of the waste or megass for fuel; besides which, the too hard pressing of the cane extracts certain other matters therein contained which are found to be highly prejudicial to the saccharine juice. It is therefore clear that, to produce the best effect, the rollers should be set at a certain ascertained distance apart, which distance ought of course to depend upon the thickness of the cane; for, suppose two rollers are placed so as to produce the best effect on a cane of one inch and a half in diameter, and that in the course of work two canes pass through together, one of which is an inch thick and the other two inches, it must follow that both must be done imperfectly, since their respective bulks are as four to one, the small one being only partly pressed, and a small portion of the saccharine juice extracted, while by the larger one a larger amount of saccharine juice will be expressed, but mixed up with much of the foreign and injurious matters before referred to. This defect is common to all and every of the mills in use, and is totally irrespective of the number and position of the rollers. Further, when a cane is passing between a pair of rollers, the pressure at any one time does not extend to more than two or three inches of its length, and the extreme pinch is exerted on a mere line only, where the rollers approach nearest together, the pressure gradually decreasing on each side of the centre of pressure. Now, when rollers of two feet diameter are making ten revolutions per minute, their surfaces, and consequently anything passing between them, must be moving at a rate exceeding one foot per second; therefore, if we assume that the effective pressure upon a cane amounts to three lineal inches at one time, it is clear that one quarter of a second only is allowed for expressing the juice from each portion of the cane under operation, a period wholly inadequate to effect the thorough displacement of the fluid from the congeries of cells in which it is contained. Neither can this evil be remedied by any alteration of position or arrangement of the rollers.

"Another most serious defect of the roller-mill is the extraordinary facility it affords for the re-absorption of the juice after it has once been expressed. The cane, it is well known, consists of an outer rind enveloping a spongy cellular mass, which contains the saccharine juice. The spongy mass possesses a considerable amount of elasticity, when deprived of the juice, and as the cane emerges from its momentary pressure between the rollers, this elasticity causes the cane to expand in the same way as sponge does when relieved from pressure; then it reabsorbs the juice which is following in contact with it among the rollers, and thereby not only wastes the juice, but leaves the refuse cane so saturated with it, that it is found necessary to spread the cane-trash in the mill-yard to be dried by the sun before it can be used for fuel. I have before stated that the pressure on the cane while passing between the rollers of a mill will always be in proportion to the relative thickness or diameter of the cane, and the amount of space between the rollers; but the amount of pressure exerted upon the different parts of the cane is far from equal, since the rind and knots are more hard and woody than the rest of the cane, and therefore subjected to a much heavier pressure than the intermediate parts, which are composed chiefly of soft cellular matter and juice; and thus it is, that so much green wax, chlorofile, and other objectionable matters are expressed from the knots and rind, which should, if possible, have escaped pressure altogether. Their superior hardness and solidity cause the rollers to exert a far greater pressure upon them, by which the injurious matters before referred to are expressed, the juice greatly contaminated, and the power of the mill absorbed. This defect is common to all roller-mills, however the rollers may be varied in number or position.

"Lastly, the action of the rollers upon the canes, when great or repeated pressure is exerted upon them, tends to lacerate them to a considerable extent, causing thereby many of the larger fragments to fall into the juice, and forcing out and mixing with it innumerable small pieces of the delicate cellular tissues, of which the structure of the cane is chiefly composed, the mixture of which with the juice greatly increases its tendency to fermentation, and impedes the process of defecation."

Of all these numerous defects pointed out by Mr. Bessemer, now more than twenty years ago, only one has been slightly modified in modern constructions of sugar mills, viz., the speed of the rolls. It is now understood that the periphery of the rolls in a well-proportioned sugar mill does not run faster than at the rate of 18 or 20 feet per minute. Although this necessitates the employment of proportionally larger, more powerful, and therefore also more costly sugar-mills, for the extraction of any given quantity of cane, it must be considered as a decided step in advance, and as an improvement which has actually raised the average yield of juice from the cane by a very considerable per-centage. The average yield of juice produced by the old sugar-mills ranged from 50 to 60 per cent., whilst the best constructions of modern mills give an average yield varying from 65 to 70 per cent. of juice upon the weight of the cane. There are many eminent manufacturers of sugar-mills in this country and on the Continent who claim for their mills a superior power of extraction, amounting to 75 per cent. of juice, and who not only guarantee this result, but actually succeed, on trial, to reach this proportion. There is, however, a great and unavoidable difference in practice between the results obtained by a skilfully conducted trial of a few hours, and the real average of an entire season's work, and it is at present well-established by experience that the best of these "guaranteed" mills rarely reach the figure of 70 per cent. as the actual average yield of juice in practical working. The maximum extraction of juice by mechanical pressure, practically applied to sugar-cane, realises therefore a yield of 70 per cent. instead of the theoretical quantity of 90 per cent. actually held by the cane. There is, therefore, a quantity of juice equal to 20 per cent. of the weight of cane left in the trash, or bagasse, and the saccharine components of this portion of the juice are utilised in no other way except as a fuel for raising the steam in the sugar factory. In comparing these results with the yield of juice from beet-root by the hydraulic-press, which, when assisted by a quantity of water, realises 87 per cent., and leaves only 9 per cent. of juice in the pulp, it appears obvious that a very wide margin for improvement is still left in the process of cane extraction, while the work of the hydraulic-press seems to have approached so closely to theoretical perfection, that little improvement can be desired or expected from any change in this method of beet-root extraction. This conclusion, however, is only partly correct, and in reality it is a well-known fact that beet-root sugar manufacturers have for a long time past spent an enormous amount of time, energy, and capital in attempting to supplant the hydraulic-press by another more convenient apparatus for extraction. The extraction by means of the hydraulic-press, although apparently very simple, has many disadvantages in practice. The operations of packing the pulp into sacks, and of forming the piles of such sacks, which are inserted between the fixed and the movable platform of the hydraulic-press, requires skilled labour of a special class. The speed with which a set of properly experienced hands perform these numerous successive operations is more than double as compared with the work of beginners. The question of hand-labour is, therefore, of great importance everywhere, but particularly in this country, where beet-root sugar industry is entirely new at the present moment. There is, moreover, the inconvenience and expense of washing the sacks, each of which must pass through the washing-machine once or twice a-day ; and last, but not least, the repairs and frequent renewal of these pulp-sacks, which forms a very serious item in the cost of extracting beet-root sugar by means of hydraulic presses.

The inventions and designs for improved methods of beet-root sugar extraction are so numerous that time would not permit to refer to all of them in this paper, and it will suffice to select only those processes which have been carried out in practice on a commercial scale, and have given results which compared favourably with the average performance of hydraulic presses.

The first of these processes in chronological order is the extraction by means of centrifugal force, invented by M. Schutzenbach. The roots are passed through the washing and pulping machine, but without adding any water in rasping. The pulp is then filled into a sugar-turbine. This machine consists of a cylindrical-sieve, or perforated drum, of about 3 feet diameter and 18 inches in height, which revolves upon a vertical spindle at the very rapid rate of 1,000 or 1,200 revolutions per minute, and is inclosed in an outer cylindrical casing. The beet-root pulp is filled into this revolving cylinder, and the action of the centrifugal force, which corresponds to the high velocity of rotation, effects a rapid displacement of the juice, while the solid portion of the pulp is retained within the cylinder. A quantity of water, amounting to 30 or 40 per cent. of the weight of the pulp, is injected into the centrifugal, during this operation, in finely-divided streams, for the purpose of assisting the displacement of the juice. Each operation occupies about fifteen minutes, and the proper charge for each turbine of the size above-named is about 200 lb. of pulp. The extraction by centrifugals has been adopted in several sugar-factories in Germany, and the results obtained under careful management and supervision were very fair. The yield of sugar from the beet reached as high as 88 per cent., the expense of manual labour was considerably reduced as compared with the hydraulic press system, and the inconvenience and expense of pulp-sacks was entirely abolished. Nevertheless, this system has not gained ground on the Continent, principally from the cause of its depending too much upon the skill and care of management in working the turbines. The slightest variations in the quality or quantity of the pulp charged required a scientific readjustment of the proportion of water injected, and of the time and speed of spinning the turbine. The centrifugal has, therefore, earned the reputation of being too capricious and unreliable for insuring a fair average yield under all conditions of practical work.

The inventor, M. Schutzenbach, subsequently introduced another method of treating the beet-root pulp, which he called maceration. He charged the pulp into a so-called battery, consisting of a number of open tanks, each of which was provided with a double bottom, the upper being formed by a perforated iron plate, the lower forming the solid bottom of the tank. These vessels were placed in one row, at different levels, descending step by step, so that the juice, running out from the bottom of each vessel, would find its level at the top of the next following. From the last and lowest vessel the juice was again pumped up to the highest, when required to do so. In this battery an equal weight of water was added to the pulp, but the first weak juice produced by this mixture, and drained off through the perforated bottom, was brought into contact with fresh pulp in the next vessel, and the richer juice there produced passed into the third, and so on, until after passing ten or twelve such tanks, the juice was concentrated within two or three degrees of the saccharometer of the natural density of the juice. This method of extraction is more economical in steam-power and hand-labour than either the press or the centrifugal, and is capable of affording a very good yield, if carefully managed. It would, in all probability, have gained ground gradually, but for the fact that it was surpassed in its success and advantages by another more recent invention. This is the process of diffusion, invented by Mr. Julius Robert, of Seelowitz, in Austria, one of the most eminent beet-root sugar manufacturers on the Continent, and the son of Florentin Robert, the inventor of the triple effect vacuum-pan, which is well known by his name as the "Robert Apparatus."

The diffusion process dispenses entirely with the application of direct mechanical force for the purpose of extraction. It is based upon Graham's celebrated discovery of the osmotic properties of organic cells, and it extracts the saccharine matter from the closed cells without destroying their stucture, and without bursting them open by mechanical means. The name of diffusion has been given by Graham to a peculiar process, which takes place whenever two liquids containing different bodies in solution are separated by an organic membrane. The liquids mutually exchange their soluble matters, and gradually equalise their composition and degree of concentration. The organic membrane appears, therefore, to be bodily permeable to the substances held in solution by the liquids with which it is in contact. There is, however, a great difference of speed with which this exchange and equalisation takes place, since all crystallisable bodies, such as sugar and salts, pass through the organic partition at a quicker rate than the bodies which are not crystallisable, such as albumen and other nitrogenous compounds. It is obvious, therefore, that the unbroken cells of beet-root or sugar-cane, when immersed into water or into weak saccharine solutions, are capable of yielding a part of their sugar and salts to the surrounding liquid. A slice of beet-root or sugar-cane, containing for example 10 per cent. of sugar in its juice, when immersed into an equal weight of water, will gradually part with its saccharine contents, which pass into the water, until the juice in the cells of the plant is reduced to 5 per cent., and the water outside has arrived at the same degree of concentration, and holds 5 per cent. of sugar. If, instead of immersing the fresh slice into pure water, a saccharine solution holding 5 per cent. of sugar is used for this purpose, there will be an equalisation between the 10 per cent. of sugar within the cell and the 5 per cent. outside, and the result of diffusion is a per-centage of $7\frac{1}{2}$ in both liquids; on the other hand, if the partly-extracted slice, when reduced to 5 per cent., is brought into contact with a fresh quantity of pure water, it will again give up one-half of its sugar, and retain only $2\frac{1}{2}$ per cent. of sugar dissolved in the juice of its cells. It is obvious, therefore, that by a repetition of operations, bringing the pure water into contact first with nearly exhausted slices, and then gradually passing the weak saccharine solutions over slices which have parted with a smaller proportion of their sugar, the solution produced by diffusion can be brought very nearly to the density of the natural juice of the plant; on the other hand, the slices coming into contact successively with weaker and weaker saccharine solutions, and finally with pure water, will give up nearly all their sugar, and become completely exhausted in the course of this operation. The difference of speed between the diffusion of sugar and that of the nitrogenous compounds, moreover, produces that important result, that, after a given time of action, the proper proportion of sugar and soluble salts has passed into the outer liquid, while only a smaller portion of the nitrogenous impurities have been given up, and all the insoluble impurities are prevented entirely from leaving the cells of the plant and passing into the diffusion juice. This is an important advantage which the diffusion process possesses over all methods of extraction from mechanically broken or disintegrated cells, since the juice produced by diffusion is always purer and less liable to spontaneous decomposition or fermentation than the juice extracted by mechanical force, which latter necessarily contains both the soluble and insoluble impurities of the natural juice of the plant in an undiminished proportion. The diffusion process has been applied to beet-root and to sugar-cane with an equally complete and decided practical success.

The process in a beet-root diffusion factory commences with washing the roots, and carrying them up by an elevator to a slicing machine, which is placed at the top floor of the house, for facilitating the distribution of the cut slices to the different diffusion vessels. The slicing machine consists of a revolving disc, which carries a number of peculiarly-shaped cutters or knives, and cuts the beet-root into prismatic slices of about $\frac{1}{4}$ in. or $\frac{3}{8}$ in. in width and thickness, and of a length which corresponds to the size of the roots. The slices are charged into small waggons or trucks, which run on rails, and are readily discharged into any one of the vessels which form the so-called diffusion battery, and which are placed in a row on a floor below the line of rails. A diffusion battery consists of nine or ten cylindrical vessels, closed at the top by a removable lid or cover, and provided with a hole at the bottom, which is closed by a door when the vessel is in operation. These vessels are connected with each other and with an overhead reservoir by pipes, which are provided with valves for the purpose of regulating and conducting the flow of the liquid through the entire battery at will. Another pipe-connexion exists between the vessels of the battery and a heating cistern, which is placed overhead, but at a lower level than the top reservoir, which gives the necessary head or pressure for moving the liquid through the vessels. A third connexion, finally, is requisite for running the finished juice from any one of the vessels into the clarifier. The vessels are charged in rotation with beet-root slices, and an equal quantity of water is added to the slices in the first vessel, which is directly connected with the water reservoir overhead. The thin juice formed in this first vessel is sent into the second vessel, for obtaining a higher degree of concentration: it then passes into the third vessel, &c., until it is drawn off, as concentrated juice, from the seventh or eighth diffuser, and run into the clarifier. Two vessels in each battery are always excluded from the passage of the liquid, one being in the process of receiving the fresh slices, and the other being emptied after complete extraction. The partly extracted slices in the vessel, which is in direct connection with the water-reservoir, receive a fresh charge of water from the overhead cistern, for each successive step which the juice makes in its transit from vessel to vessel. These slices are, therefore, gradually deprived of their sugar until, after having been in contact seven or eight times with their equal weight of fresh water, they are completely exhausted. The vessel No. 1 then requires emptying, and must be shut out of the connexion with the battery. This is done by opening and closing the corresponding valves, and the fresh water from the overhead tank is then admitted to the vessel No. 2. In this battery, therefore, each vessel takes its turn in the series of operation by rotation. The vessel newly filled with slices always forms the last link in the chain, and it receives the juice which has previously passed through the whole series of vessels before, and then takes up its final addition of sugar in passing over these richest newly-charged slices of the saccharine plant. This last vessel, therefore, discharges into the clarifying-pan a juice very nearly as concentrated as the press juice, while, at the opposite end of the battery, the extracted slices are discharged from a vessel with only a minute per-centage of sugar left in them. A diffusion battery of nine vessels working with beet, which gives a juice of 8 degrees Bc., when extracted by pressure, without the addition of water, will yield diffusion juice of 7 to $7\frac{1}{2}$ degrees. It extracts about 90 per cent. of juice, and the discharged slices contain less than one-half per cent. of sugar. The temperature at which beet-root diffusion takes place is an important element of success. The degree of heat which has been found most suitable is 122° Fahr., and in practice it is carefully kept up by means of the reheating cisterns for thin juice, which are placed overhead, and into which the thin juice is passed when its temperature requires to be raised. The extracted slices are equally valuable as a food for cattle as the pulp from the hydraulic press; they are, however, charged with a large surplus of water, and this forms a serious drawback whenever it is necessary to transport them to any considerable distance.

To meet this difficulty, Messrs. Seele and Co., of Brunswick, have constructed a simple and quick-working hydraulic press, which removes the greater portion of the water from these diffusion slices at one operation, and compresses them into a suitably reduced volume. It may be objected that this press will squeeze out a portion of the valuable elements of food, and thereby reduce the nutritive value, but this reduction is not very serious in practice. The diffusion battery is now an established success, and the recognised modern type of beet-root sugar machinery. There were 150 beet-root diffusion factories at work on the Continent during the last season, and many more are in course of construction.

The success of the diffusion process in the beet-root factories of Europe led to the application of the same process to the extraction of sugar-cane. A double diffusion battery, consisting of 20 vessels similar to those just described, has been erected, in 1867, in the factory of the Aska Sugar Company (Limited), at Aska, Madras Presidency, in India, under the management of Mr. F. J. V. Minchin. The machinery for cutting the cane into thin slices has been constructed analogous to that used for beet-root, only the form of hopper for feeding was changed, to suit the nature of the cane. The Aska factory has six cane-cutting machines, each capable of cutting about 32 tons of cane in 24 hours on an average, and requiring one-horse power for working it. A steam engine of 12 horse-power is employed for working the whole diffusion plant. The average quantity of cane worked up per day is 96 tons. The diffusion vessels have a capacity of 170 cubic feet each, and require 33 minutes for filling. The average number of vessels filled every 24 hours is 40. The diffusion process works without intermission day and night. The diffusion juice produced is very pure; it has a bright yellow colour, and gives off little scum in the clarifier. During the best part of the season, when the cane is perfectly ripe and in good condition, the diffusion juice requires no filtration through animal charcoal, and can be passed direct into the evaporators and vacuum pans, for the production of good, high-class raw sugar. The density of the diffusion juice produced in Aska ranged from 12 to 14 degrees of Balling's saccharometer, whilst the density of the natural juice of the cane was from 17 to 19 degrees of the same scale. There was, therefore, an excess of water in the diffusion juice which amounted to about 20 per cent. The quantities of cane extracted in Aska in the three seasons, 1868, 1869, and 1870, were 3,300 tons, 6,739 tons, and 5,025 tons respectively, and the juice was employed, partly for manufacturing sugar and partly for distilling rum. The average yield of juice (reduced to the original density of the natural juice of the cane) amounted, in 1868, to 84·5 per cent., in 1869, to 84 per cent., and, in 1870, to 81·9 per cent., upon the weight of the cane; and the final yield of saccharine products, established by the experience of these three seasons, ranges between the following figures:—Green sugar (saccharine matter and salts) from the juice, 13 per cent. to 14·8 per cent. on the weight of the cane; yield of crystallised sugar, 9 per cent. to 9·9 per cent. on the weight of the cane; yield of saccharine matter, &c., in molasses, &c., 4 per cent. to 4·9 per cent. on the weight of the cane. These figures, when compared with the best practice of colonial sugar factories, seem to indicate that the diffusion process is capable of affording an incalculable benefit to the cultivators of sugar-cane, and that the advantage to be derived from it in colonial sugar factories are even more important than those which it affords to modern beet-root sugar works.

In comparing the yield of juice by diffusion, taken at the figure of 82 per cent., with the highest practical yield of sugar mills, at 70 per cent. upon the weight of the cane, it appears that from every 100 lb. of cane diffusion will extract 82 lb. of juice, against 70 lb. of juice produced by the mill. The crop of a cane plantation will therefore produce an increased yield of 19 per cent. when extracted by diffusion instead of being crushed by the mill. But the advantages of diffusion are not confined to this. The diffusion juice being purer than the mill juice, and requiring less purification in consequence, yields a larger proportion of crystallisable sugar as compared with mill juice. In this manner the production of nine or ten per cent. of crystallised sugar upon the weight of cane is far beyond the yield at present obtained in colonial practice. It is well known that the central factories in general return only five per cent. of sugar to the planter, and the most liberal return allowed anywhere is six per cent., the factory in that case having a margin of less than one per cent. over and above the value of molasses to work upon. Compared with such results, the increase of yield in dry crystallised sugar afforded by diffusion is 43 per cent.

It is well worthy of attention to consider whether and to what extent there are disadvantages and difficulties connected with this new process of diffusion, which may tend to counteract the advantages of increased and superior yield. In this respect the first question which presents itself is the increased quantity of water which must be evaporated from the diffusion juice, and which may amount to 15 or 20 per cent. of the natural juice extracted. This question, reduced to figures, means that one pound of water must be evaporated over and above the water naturally held by the juice for every pound of sugar which is gained by diffusion. In practice, the evaporation of six to eight pounds of water is effected by the combustion of one pound of coal, and it follows from this that the additional quantity of fuel required for diffusion amounts to about two ounces of coal for every pound of sugar gained. A more important drawback is the fact that the value of the trash or bagasse is lessened, because the sugar is extracted from it, and cannot therefore serve as fuel. There remains, however, all the wood fibre in the diffusion trash, which dries very readily in the open air, and can be burnt with facility upon a properly constructed grate. The manual labour for working the diffusion battery is very nearly the same as that required for working the mill. The first cost of a diffusion battery is less than that of the mill for equal quantities of sugar produced, but since the question generally presents itself in that form, viz., to provide a plant for working up a certain quantity of cane, the cost of a diffusion battery is, as a rule, somewhat greater than that of a sugar mill. The most important difficulty to be dealt with in some localities, in introducing the diffusion process, is the scarcity of water. The actual demand of diffusion is one ton of water for every ton of cane extracted, but the proper supply for working a battery should be larger than this, and is sometimes very difficult to procure. A closer investigation of the actual condition of the water supply of such plantations, however, very frequently show that the water is not in reality scarce, but that it only required collecting at the proper season, and that this can be done at a comparatively small expense, when attention is once properly directed to this subject. So far as the past experience with the diffusion process is concerned, there is not, therefore, any serious drawback or disadvantage known which could materially affect its practical advantages, or impede the progress of its introduction in the sugar-cane factories.

Mr. Robert has, at a recent date, introduced an ingenious and promising modification of his diffusion plant. Instead of a battery of diffusers, he employs only one single vessel, which is open at the top, and into which the slices are introduced at the bottom by a central mechanical feeding apparatus. The fresh water runs in at the top of the vessel in a continuous stream, and the slices rise slowly and gradually from the bottom to the top of the vessel. They give up their soluble contents until they arrive at the top of the vessel completely extracted, and are discharged by a mechanical rake, while the water, in its descent, becomes charged with sugar, and is drawn off from the bottom of the vessel as concentrated juice. Mr. Robert has two diffusers of this kind at work in his own factory, one applied to sugar manufacture, and the other for beet-root distillation, and they are working with remarkable speed and regularity. The juice produced by these vessels has an equal density as that drawn from the battery, and the extraction of the beet is equally complete. For the extraction of cane, this modified apparatus is likely to afford great advantages, on account of its economy in space and manual labour. An experimental plant of this description has been sent to the Plaisance Estate, in Trinidad, belonging to Messrs. Charles Tennant, Sons, and Co., but it has not as yet been set to work. It appears hardly doubtful that the single vessel will succeed with cane equally well as it has done in extracting beet-root, when once the necessary experience in managing the process is gained.

The above-described processes for sugar extraction are equally applicable for the manufacture of sugar and for the production of spirits, since the saccharine juice, when extracted from the plant, is easily fermented, and rendered fit for distilling. There, are, however, special processes for so-called beet-root distillation in existence, and some of these deserve a brief notice. Dombasle, some 50 years ago, attempted to extract beet-root slices by means of hot water, but he obtained a juice which was unfit for the manufacture of sugar, on account of the large quantity of pectin which is extracted from beet at a high temperature. The juice was suitable, however, for distilling, and this so-called hot maceration has found favour in beet-root distilleries. It has been improved by Champonnois, who employed the hot wash from the still, instead of pure water, for maceration. The purpose of this is, first, the utilisation of the heat in the spent wash, and also the preservation of the nitrogenous matter within the cells. The wash from the beet-root still is charged with all the soluble nitrogenous matter first extracted from the beet, and according to the laws of diffusion, such wash is incapable of extracting any more of these substances from the cells, whenever it has arrived at a similar per-centage of such matters as exists within the cells of the plant. By these means all loss of valuable feeding substance from the beet is avoided, and the extracted slices contain a maximum of nitrogenous food. Another special process of beet-root distilling is that invented by M. Leplay, and which is now being tried on a large scale at Buscot-park, in Berkshire, by Mr. Robert Campbell. The Leplay system consists in fermenting the juice within the cells of the plant, without previous extraction. This is effected by cutting the beet-root into slices, and immersing it into a fermenting liquid, which induces fermentation within the cells of the plant. The beet-slices are thereby charged with alcohol instead of sugar, and the extraction of the spirit takes place by bringing the slices bodily into a specially constructed still, which consists of a cylindrical vessel, fitted with a series of perforated trays, upon which the fermented slices are spread. Heat is applied from the bottom, and the rising vapours, in gradually ascending from tray to tray, become rectified to a certain extent, and are finally drawn off as raw spirits. The distilled slices serve for feeding cattle, like all other residue of beet-root extraction.

In concluding this paper, it will not be out of place to approach, in a few words, the important question of competition between beet-root and cane. The manufacture of beet-root sugar cannot exist without the simultaneous and proportionately extensive production of meat. The manner in which these two branches of agricultural industry are connected, and the conditions under which they are capable of a commercially successful application in this country, has been fully described in the publications of Dr. Augustus Voelcker, F.R.S., of Mr. Arnold Baruchson, and in the report on Belgian sugar industry, made in 1863 and 1865 by Mr. Barron, then H.M. Secretary of Legation at Brussels. Within the limits of the existing demand and capability for producing meat in any beet-root growing country, the scale turns in favour of beet-root, and against the cane; beyond these limits, however—and there is a vast field for sugar production outside of these limits—the sugar-cane still remains the principal and most important raw material for the production of sugar, and so it will continue, in all probability, for an indefinite time.

DISCUSSION.

Mr. De Mornay inquired if any deterioration took place in the pulp in consequence of the time occupied in the process, and the temperature at which it was conducted.

Mr. Kohn said the time occupied was several hours, but it was carried on in a battery entirely shut out from the air, and nothing approaching fermentation took place. The juice was entirely confined in closed pipes until it was run into the clarifier, where it was immediately subjected to such a temperature that fermentation would be out of the question.

Mr. R. A. Macfie, M.P., said he had listened with great pleasure to the very able paper which had been read by Mr. Kohn, especially as it was only within the last few years that this process of extracting sugar from beet had been invented; therefore a description of it was interesting. He should like to know what depth was required in the vessel in which the continuous process was conducted, and also whether Mr. Duncan adopted it in his factory. The only part of the paper in which he did not concur was that in which the writer rather deviated from the subject proper, and spoke of the protective system, which, he thought, still remained. He (Mr. Macfie) was not aware that there was anything of the kind. There was no desire to protect, but rather to equalise the duty according to the saccharine value of the different sugars imported. It was evident that if the same rate were charged for the weak sugar of India as was imposed on the higher qualities of Germany and Mauritius, it would be very prejudicial to the producers in India, and also to refiners in this country who worked up these poorer qualities. Still, he believed that would not stand in the way for one moment of anything which was admitted to be an improvement in the manner of applying the duties; but they would be very glad either to manufacture sugar in bond, or which would be better still, if the duties could be removed altogether. All the recent improvements in sugar manufacturing seemed to him to point to the introduction into this country of domestic sugar manufactories. He believed that Mr. Duncan had done an immense service to agriculture and to the commerce of the country by his bold and painstaking experiments, and he certainly deserved honours at the hands of the Queen as much as any man. He could only hope that his factory would be the precursor of hundreds in England and Scotland; and he should be very happy if the same benefits could be extended to Ireland also.

Mr. Pearsall said he did not quite gather from the paper the exact nature of the organic septum employed in the diffusion process, nor whether any difficulties were connected with its practical use. It was well known that on the Continent, where these experiments had been tried, that after a time the membrane that had been used gradually failed in its action, and its use could only be restored by washing it over with sulphuric acid. He should be glad to know, therefore, whether any separating substance was now employed, which would go on from hour to hour extracting per-centage after per-centage; or whether that septum became effete, and whether, in that case, there were any means of renovating it; also, whether the ordinary persons employed in the manufacture could easily detect when such renovation was required.

Mr. Appleby said the distillery at Buscot-park, which had been referred to, was set up by his firm, and to a considerable extent under his own personal supervision, and he therefore felt great interest in the process. The author appeared, after considering the various processes, rather to favour that of M. Jules Roberts, which, he was sorry to say, he had not yet been able to see in action, but hoped to be able to do so some day. He did not quite gather whether the author had considered the matter simply from a distiller's or refiner's point of view, or whether he had looked at it from the agriculturist's stand-point. A short reference only had been made to the Leplay system, which differed materially from that of M. Jules Roberts, although there was a certain amount of similarity between them. As it appeared to him, the great merit of the system was, that there was so little manual labour, and such a large per-centage of return; but it did not appear so clear that the same agricultural benefit would be derived from the pulp as was the case with the Leplay system. In the latter, the slices of beet were put into a vat, where they were fermented, and from thence removed into the stills at once. Steam was then turned on, the spirit evaporated from the slices, and the latter were thoroughly cooked, thus fixing all the nutritive matters, and at the same time destroying those which were not useful to the cattle. It was known by experience that this pulp would keep for six or twelve months, and he believed it had been kept for two years perfectly good, the practice on the Continent being to store it and use it whenever fodder was required. He should like to know from Mr. Kohn, whether he considered Roberts' system as good for farmers as the Leplay, for in this country he considered that question was one of very great importance, because if the beet-root distillation or the manufacturing of sugar was to be carried on to any great extent, it appeared to him that the question of food was almost, if not quite as important as the per-centage of sugar or spirit obtained; for what the farmer wanted was to carry back to the land the products which had come from it. The system therefore which would do that most effectually was the best adapted for this country, even if it were not quite so productive to the distiller or sugar manufacturer. He should be glad to hear further details as to the method of distilling by Roberts' system.

Mr. W. E. Gill said he should have thought, but for the explanation of the lecturer, that there would have been a loss by fermentation, as was suggested by the first question which had been put. Mr. Kohn, however, had stated that no loss arose in that way, which he was glad to find; for to his knowledge fermentation very easily took place in the tropics when the cane was exposed to the atmosphere, and therefore they were very careful to use the canes the same day they were cut. He believed it was this exposure which set up the acidulation to which reference had been made in the juice, because normally he did not believe the juice had any acid character. This had been proved by the juice failing to colour litmus paper. No doubt the apparatus referred to, when it got into the hands of workmen generally found on sugar estates, would be very liable to get out of order, from the ignorance which prevailed there, though no doubt it would work very well in this country, where skilled labour was always at command. He imagined that the knives of the slicing apparatus would soon get blunt from the silex which enveloped the sugar cane, and provision must be made to meet that difficulty. With regard to the introduction of beet root into this country, he was afraid that there was a mistaken idea which required to be removed. The quantity of sugar now obtained from the sugar cane was about 5 or 6 per cent., not of the cane, but of the juice. It had been stated that the juice contained 15 to 20 per cent. of sugar, but he had always understood the per-centage to be from 18 to 25 per cent., and the difference between that and the 5 and 6 per cent. which was commonly obtained was a positive loss, which ought not to occur if it were properly treated. In fact, the cane juice was capable of yielding much more sugar than was commonly obtained from it; and when Sambo and his friends were superseded by workmen of greater education, there would no doubt be a much greater result than at present; and when the same land produced a greater quantity of sugar, it would be brought to this country both cheaper and of better quality. Now, as the price of beet-root sugar was dependent entirely on that of cane sugar, it must be borne in mind that when this increased quantity and superior quality of cane sugar was obtained, it would become a question whether the beet-root sugar manufactory could be carried on at a profit. He hoped gentlemen, therefore, embarking in this enterprise would weigh that aspect of the question.

After some remarks from **Mr. Botly**,

Mr. Kohn, in replying to the various questions which had been put, said the size of the vessel was dependent upon the quantity required to be extracted in 24 hours, the depth required being such as, at the speed with which the apparatus was fed, would give the beet-root about three to four hours' time to ascend to the top, that being the period which was shown by experience to be amply sufficient for entirely extracting the saccharine matter. The vessel in use at M. Robert's own works was ten feet in depth, which was found to be ample; and when a larger apparatus was introduced, it was not always thought desirable to increase the depth in the same proportion. A vessel of seven feet in diameter and eleven feet in depth was capable of working up sixty tons in the 24 hours. Mr. Duncan had visited M. Robert's factory only last season, though he had not yet introduced his process, having had his premises fitted up long before he heard of it; but he believed he was on the Continent, when he would probably avail himself of the standing invitation which he had to visit and inspect M. Robert's establishment. The question of the sugar duties was one which would open a vast field for discussion; but he had only referred to it in tracing the history of the past, though he must confess he considered the last remnant of the protective duties still existed. It was not acknowledged until last year, when the differences of duties were halved, that the other half was a protection; but the question was very simply argued in this way, that the difference was required in order to pay for the dirt coming from some places, and which ought not to pay duty as sugar. This showed in itself that there was a protection. Now, in the West Indies—and he might speak especially of Trinidad—it was the practice to work with open pans, where half the juice was burnt by the scorching heat of the fire, and what was produced was filled into the hogshead in a very thick and dirty state, just the same as it was a century ago; there was not one vacuum-pan in the island. Of course, if this dirty sugar was not protected against that which came from Mauritius, the French colonies, and especially from the beet-root factories on the Continent, the producer had no market, nor was there a market for the refiner who had laid out his works for the purpose of refining this coarse sugar. Still, if these men lost their market, he believd they would soon strive to regain it, and this might easily be done by getting more skilled labour, which, if difficult, was not impossible. This, therefore, was the last remnant of those protective duties which had been destroyed by free-trade. Mr. Pearsall, who had asked a question with regard to the action of organic membranes, had not quite understood his description of M. Robert's process, no special membrane being used, but simply the skin of the cells themselves. With regard to the action of organic cells, there was a difference of opinion in theory, some persons holding that the action could not take place so long as the cell was alive, and that it was necessary therefore to subject it to a high temperature, or to the action of sulphuric acid. This had been carefully considered in working out the system, but the results seemed consistent with these theories. The treatment applied was the application of a very moderate degree of heat, not sufficient to produce pectine from the pectose bodies in the cell, which would spoil the juice, but at the same time sufficiently high to effect what French savans called the amortisement of the cell. As soon as the cell was affected by this action, or by that of sulphuric acid, the process of diffusion commenced, and the only care required on the part of workmen was to see that the temperature was at the right degree, which was easily effected by means of a thermometer. The use of sulphuric acid was frequently resorted to in the case of distillation, for if it were desired to obtain alcohol from the beet root, where you had nothing but cane-sugar to begin with, it was necessary first to convert this into glucose, or sugar containing one more equivalent of water, which was effected by the addition of a small per-centage of sulphuric acid. If this process took place before diffusion commenced, the latter might take place at a low temperature, whereas if diffusion took place first, being assisted by means of heat, and then a small quantity of sulphuric acid were afterwards added, decomposition of the sugar would immediately be produced, and fermentation would commence. He had purposely avoided giving an opinion as to the relative merits of Leplay's and Robert's processes, the former not having yet been sufficiently tested by practical experience to allow of a fair comparison being made. He might say a word or two, however, on the theory of the two processes, especially as bearing on the nutritive quality of the residue. He had not carried his description of Robert's process beyond the production of the juice; but when this was required to be distilled the process was as follows:—The saccharine juice which came from the bottom of the vessels, and which in the sugar manufacture would go at once into the clarifier, was conveyed into a battery consisting of six or eight fermenting vats, all connected together, the top of one being on a level with the bottom of the other, in the same way as Schützenbach's macerator, and fermentation thus went on while the liquor was in motion. This was quite a novel method of conducting the fermentation, for it had long been supposed that, in order for any liquor to ferment, it must be in a state of perfect rest. Modern experiments, however, had proved that, so far was this from being the case, that the liquor fermented more rapidly when in motion, 12 hours only being required for the fermentation of the beet-root liquor, whereas under the old process from three to six days were required for the same purpose. One great advantage arising from this was, that continuous distillation could take place at the same time as continuous extraction. In fact, it was one continuous self-acting process by which the beetroot was converted into alcohol, the fermented liquid being conveyed into one end of a continuous rectifying still, and the raw spirit being drawn off at the other, whilst the wash was discharged in a continuous current. The actual process, therefore, was this:—The beetroot was brought up to the upper slicing-machine, and, by a self-acting movement, it went into the extracting vessel, and from that the juice passed on through the fermenting battery and into the still, whence it was finally discharged in the form of two products—alcohol and the refuse wash. It was, therefore, the most complete self-acting apparatus with which he was acquainted, requiring scarcely any manual labour throughout the whole process. There was certainly a slight resemblance between this system and Leplay's, viz., that the beet-root was cut into slices; there the similarity began and ended. In Robert's system, the principle was to first extract the sugar, and then convert it into alcohol, thus getting the process of fermentation under control, and having to deal with the liquid only after the time when the fermentation commenced. Leplay, however, started with this idea, that it was difficult to extract the sugar, and, therefore, he would first convert it into alcohol while still in the cell. Fermentation was a process of decomposition of sugar into carbonic acid and alcohol, and this process in Leplay's system was effected in the cell, the membrane of which was permeable to gases as well as to liquids. In order, however, to induce fermentation in these closed cells, a certain kind of diffusion must be commenced in order to set up the process, and for this purpose the slices of beet-root were immersed in a tank filled with liquor in a state of fermentation, which always has a tendency to set up the same process in any other liquid, even if separated from it by a permeable cell, provided, however, that the cell be killed either by the action of sulphuric acid or of heat. The first thing to decompose in such a case was the nitrogenous matter held in the cell, and which was, in fact, the same substance which formed the yeast. The nutritive substance in decomposition produced yeast, which was the active medium in inducing fermentation in the liquid. Therefore, by the very action of fermentation in the cell, it was deprived of a certain quantity of these nutritive matters which Leplay claimed to maintain in it; and it had yet to be proved that after this change they were still as valuable for food as before; for instance, that yeast would be as valuable for nutritive purposes as the gluten from which it was formed. This was a theoretical point on which he could not quite agree with what was claimed for Leplay's process, that as the fermentation began in the cells the same quantity of nutritive matter was retained in them as they originally possessed. True, it was not mechanically removed, but it certainly did not remain in the form in which as food it would be most valuable. It might be that practically very little difference arose on this point, because the decomposition required for inducing fermentation was but very slight. In the process of diffusion a large portion of the nutritive qualities remained in the cells, in consequence of the difference of osmosis with regard to crystallisable and non-crystallisable bodies, so that the soluble albumen, &c., would pass through much more slowly than the sugar. It would hardly be correct, therefore, to say, theoretically, that one process was superior to the other, as far as the quantity of food left in the cells was concerned. The practical difference was not appreciable, and the spent cells, whether produced by Leplay's system or Robert's, were fully capable of being kept for any reasonable time, and were both equally valuable as food. He would not dispute whether the sugar-cane juice was or was not naturally acid, for, inasmuch as it was always acid when procured, it did not make much practical difference whether it was naturally acid or not. The idea that cutting it up into slices would induce fermentation was one which occurred to most persons when the question was first put before them, but experience showed that there was no difficulty on this account. It must be remembered, however, that immediately on being cut, the slices were put into the hopper, and were not left lying about for any considerable time. There was no doubt that the canes, having a silicious covering, were rather detrimental to the edge of the knives, but that difficulty was met by having a double set, so that one set might be in use when the other was being sharpened; for a great deal of the success of the operation depended on the knives being sharp, so as not to tear and bruise the cells, and thus introduce impurities into the expressed juice.

The Chairman said the process described by Mr Kohn seemed to afford a most remarkable instance of the application of pure science to practical and commercial purposes; and in these days, when science and scientific instruction were so much considered, it seemed to him that this was a most forcible example of what might be done by carrying out purely scientific investigations; and there seemed no reason why a continued application of the same ingenuity might not lead to even further and more valuable results. With regard to the sugar duties, he must say he did not consider they were in any manner protective; but unfortunately the public revenue had to be raised by taxes of some kind, and a small portion was levied upon sugar. Looking to the fact that sugar formed such a large element in the consumption of the poorer classes of this country, being in fact almost a necessary of life, he thought every discovery of the kind just described, which tended to cheapen, improve, and increase the production, was really a philanthropic as well as a commercial success. He had much pleasure, therefore, in proposing a cordial vote of thanks to Mr. Kohn for his interesting paper.

The vote of thanks was carried unanimously.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The Council have arranged for six concerts in the Royal Albert Hall, in aid of a National Training School for Music. The first concert will be given on April 12th, and it will be the first public performance in the hall after the opening ceremonial by Her Majesty the Queen. The second concert will take place on April 19th. The dates of the other concerts will be announced. The prices for admission to reserved seats will be as follows:—

Gallery, subscription for the six concerts	£0	15	0
Arena, subscription for the six concerts......	2	2	0
Balcony, subscription for the six concerts....	2	2	0

Amphitheatre, subscription for the six concerts	3	3	0
Box (grand tier), to hold ten persons, for the six concerts	30	0	0
Box (amphitheatre tier), to hold eight persons, for the six concerts	25	0	0
Box (second tier), to hold five persons, for the six concerts	15	15	0

Tickets to be obtained at the House of the Society of Arts, John-street, Adelphi, W.C.; at the Royal Albert Hall, Kensington-gore; at the Royal Horticultural Society's Offices, Exhibition-road; at the ticket-office, Exeter-hall; the City Box-office, 4, Royal Exchange buildings, E.C.; Messrs. Keith, Prowse, and Co., 48, Cheapside; Messrs. Chappell, 50, New Bond-street, W.; Mitchell's Library, Old Bond-street; Austin's Ticket-offices, St. James's-hall and 28, Piccadilly; S. M. and A. Warren's Ticket-office, 1, Edwardes-terrace, Kensington.

OPENING OF THE ALBERT HALL.

Tickets to admit to the ceremonial at the opening of the Royal Albert Hall by the Queen, on the 29th March (balcony only), can be obtained of Mr. Samuel Thomas Davenport, the financial officer of the Society of Arts, 2*l.* 2*s.*; one box, to hold eight persons, is still vacant.

INDIA COMMITTEE.

A Conference will be held on Friday next, March 24th, at Eight o'clock in the evening, "On the Establishment in England of an Oriental Congress." To be opened by Mr. Hyde Clarke.

CANTOR LECTURES.

The third course of Cantor Lectures for the Session will be delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will consist of Five Lectures, commencing on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. W. Fothergill Cooke and Professor Charles Wheatstone, F.R.S., in "recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Council invite members of the Society to forward to the Secretary, on or before the 22nd of April, the names of such men of high distinction as they may think worthy of this honour.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

The Exhibition.—The Committees of Selection for Painting and Sculpture have now finished their labours, and the arrangement of the selected exhibits is now being proceeded with. In a week or so the British section will have assumed the appearance it will present when opened to the public on the 1st of May. The other committees have also been sitting during the past week. The walls of the entrance-halls and staircases at the ends of the quit-galleries have been coloured a deep maroon, relieved by a dado of black and white bands.

Foreign Section.—Although the foreign section does not appear to be in quite so forward a state as the British section, this is really not the case. When the exhibits arrive in this country, nothing will have to be done but to put them into their places, as they will have passed through the process of selection before leaving the exhibiting country; and in the case of Belgium, which has entered into the matter in a most spirited and energetic manner, the pictures and other articles were exhibited in Brussels in precisely the same position as they will occupy when exhibited in London. Those exhibitors, therefore, who will be prevented from visiting the exhibition will have the satisfaction of knowing how and in what manner their works will be placed on the walls of the exhibition buildings.

France.—France has at last put in an actual appearance at Kensington. The French Commissioner, M. De Somerrard, has arrived, and a large number of exhibits are on their way to it, if they have not positively arrived in this country. Messrs. Chaplin and Horne have received intimation that their services will be required for the unloading of five or six steamers freighted with valuable exhibits. Before the war, and before the siege shut up Paris from the rest of the world, all the arrangements were made, and a large number of articles were got together. Now that the war is happily over, the authorities have with promptness commenced pushing forward with great activity the preparations that have been so unfortunately delayed, and a large number of artists and eminent *industriels* met and addressed to the Minister of Agriculture and Commerce a letter declaring themselves ready, at any sacrifice, to sustain the reputation of France in the arts of peace, and to reply to the marks of sympathy addressed by the English people and the British Commission. Some of the most interesting exhibits in the French section will be those that have been completed in Paris during the siege. Carpenters are busily at work erecting the necessary stands in the annexe which has been erected at the expense of France, and in otherwise getting it ready for the use of French exhibitors.

Bavaria.—Some very heavy consignments have been received during the week, consisting principally of works of fine art. So numerous are the exhibits that there is some doubt as to whether it will be possible to get them into the space originally allotted. Some of the exhibits from this country have been more three weeks on the road.

HORSE-FLESH AND THE SIEGE OF PARIS.*

By Dr. Leon Soubeiran.

Since 1860, when the first slaughtering of horses took place in Paris, under the patronage of the "Committee for Horseflesh," the consumption of the meat has always been increasing, as is shown by the following figures, which comprise also some asses and mules:—

	Horses.
1866 (1st six months)	902
1867	2,152
1868	2,421
1869	2,758
1870 (to September)	2,799

The Committee for Horseflesh has had to contend with the prejudice of the ignorant, and the indifference of the better-informed, but it has succeeded in making horseflesh accepted as food throughout France, particularly at Nancy and at Paris. At the time of the siege of Paris, there existed in that city thirty butchers who sold horseflesh, when the Prussian armies had invested Paris, and rendered its revictualling impossible. There existed, in addition to preserved meats, a stock of some millions of bullocks and sheep, which had been collected in expectation of the siege, but which were in too small a number to allow of a sufficiently prolonged resistance by the people, surprised by circumstances, but who would not yield to the first demands of a hated enemy, having the conviction (unhappily an erroneous one) of being able to drive them out of their country. From the commencement of the siege, some persons thought, by using horseflesh, resistance might be prolonged, and they persuaded their friends to overcome the general dislike to this new food. The rationing of butchers' meat whilst the sale of horseflesh was free, served to give it a powerful impulse. Those who preferred the meat ration were interested, also, in popularising as much as possible horseflesh, since the number of these animals in Paris was considerable, and held out a prospect of a large addition to the food supply.

From M. Ducroix's researches, it appears, before the Administration had decided to take an account of the quantity of horseflesh available, that there were, at the beginning of the siege, approximately, 100,000 horses, including those of the army.* In reckoning 30,000 horses for the army and other necessary services, there would then be 70,000 left. Assuming that, on the average, each horse would supply 250 kilogrammes (about 500 lbs.), the 70,000 horses would give 17,500,000 kilogrammes (about 35 million pounds) of fresh meat. In distributing this quantity at the rate of 50 grammes (less than two ounces) daily to each person, as was the case with beef, there was horseflesh for 175 days, children receiving only half rations. The saving made upon these served to increase the rations for the soldiers encamped around the fortifications; but, unfortunately, there was only a tardy resort to the necessary measures. At the beginning there was a shameful waste and a great abuse, which it became necessary to repress. From the 15th of October, the Minister of Agriculture and Commerce, at the request of the Committee for the Use of Horseflesh, and with a view of preventing the rise in price which certain butchers were charging, fixed the tariff of prices for horseflesh at 1 franc 80 cents. per kilo. (about 9d. a pound) for prime parts, 1 franc 40 cents. (about 7d. a pound) for the second qualities, and 80 cents. (about 4d. a pound) for the third. Notwithstanding the increase of the price of horses, from 20 or 30 francs to 600 or 700 francs (from 15s. to £24), the tariff has not altered for upwards of a month, which caused the closing of several butchers' shops, which could no longer be kept open, owing to the tariff price as compared with the cost price. On the 10th of October, the Minister of War, at the request of the Minister of Agriculture, ordered that every day each regiment should make known the number of horses unfit for service and suitable for food. On the 17th of October, the Horse-meat Committee asked for an account to be taken of all the horses in Paris, with a double object of killing and salting all those in excess of the number which could be conveniently supported (the taking an account of hay and oxen had already been done), but this account was not ordered till a month later, by a decree on the 25th of November. On the 23rd of October, the Committee asked the Minister to decree the rationing of horse-meat, in order to prevent the waste consequent on the unlimited consumption, and pointed out that there were killed about 400 horses daily. Some days later, a committee was charged with marking all horses suitable for killing, and limiting the number to be killed to 300 daily, but every butcher was free in the sale of his meat who contracted for supplying the consumer at the same time with beef. On the 11th of November a decree appeared which reserved to the State the right of buying horses for food, and dividing the meat and the offal, as had already been done with beef, among the 20 arrondissements. From this time, waste, clandestine destruction, and the exorbitant rise in price was considerably checked.

The consumption of horses for food for Paris during the siege has been—September, 1870, 984 horses, 15 asses; October,† 12,420 horses, 329 asses, and one mule; November,‡ 7,372 horses, 274 asses; December, from 15,000 to 18,000 horses; January, from 15,000 to 18,000 horses; which gives in round numbers from 50,000 to 60,000 horses which have been slain to supply the food of Paris. But these figures are not exact, for, in spite of the decrees of the authorities, clandestine slaughtering, though it decreased very much, did not cease entirely. It is not yet possible to give the exact figures, government not having yet stated them precisely.

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* Taken principally from the works of M. Decroix, chief veterinary surgeon to the Republican Guard of Paris, who, for the last ten years, has devoted himself to promote the use of horse as food.

* Monsieur Decroix's figures have been considered too high by some, who estimate the number at the beginning of the siege at 80,000.

† Besides the number charged by government, account must be taken of clandestine slaughtering within and without the barrier.

‡ In this number are not included the animals slain by order of he government for salting.

But while the Parisian population was fortunate enough to find in horseflesh a means of prolonging resistance to their enemy, it must be acknowledged, without wishing to lessen the merits of horseflesh, that it occasioned amongst numerous persons disgust and internal complaints, proving that it has its drawback as a regular article of food. Nevertheless, it may be remarked that this opinion may be received with reserve. The manner of preparing the meat has a marked influence. Cooked as a *ragout*, horseflesh occasions derangement of the health, which is never observed amongst those who have eaten it roasted. It is as well also to remark that if internal complaints have been very prevalent during the siege, but few stomach complaints have existed, from which it may be considered that the food strictly rationed has not allowed overloading the stomach with too large a quantity of food. The use of meat killed only a few hours before eaten, the want of vegetables, and the small proportion of bread, often of an inferior quality, which the Parisians had at their disposal, must also have had an influence on the health of a population whose dietary was completely upset.

SILK CULTURE IN JAPAN.

The third report upon silk culture in Japan, by Mr. Adams, one of Her Majesty's Secretaries of Legation, contains an account of a journey undertaken for the purpose of ascertaining the progress making in the culture of the silkworm. To this is appended a series of drawings, that illustrate the observations made by the party, and a map, showing the route taken upon this and a former occasion. Owing to the manifest interest which the Japanese government were evincing in the matter, it was considered an act of courtesy, and likely to prove beneficial in an international point of view, if a Japanese gentleman were associated in the expedition. Accordingly, a near relative of one of the highest officials was asked to join the party, and we learn that, for the first time, a native of rank has been associated with foreigners in an extended tour through the country, in the interests of commerce.

The party left Jeddo on 6th June, 1870, and, for the first time, came upon the mulberry plants about forty miles distant from the capital, where their investigations commenced. The 10th and 11th were spent at Shimonita, a place apparently not hitherto visited by foreigners, although it has always been famed for producing some of the best hanks of silk that were sold in the Yokohama market. There was an appearance of health about the people, of cleanliness about the rooms appropriated to the worms, and it was evident that silk culture was the one important business of the whole locality. The most interesting visit of the first day was to the house of Ishgami Sanyemen, who said that silk-culture had been practised in his family for a hundred years, and that he himself had reared worms for eleven years. The seed came originally from Shinshin, the great silk district of Japan, but that now his worms were partly hatched from these eggs and partly from his own; that he reared them in general for eggs, to be sold as well to people in the neighbourhood as in Yokohama; that last year there were a great many "uji," but that this year a good crop was expected, owing to the favourable weather, and to the healthy appearance of the worms. These were found to be in first-rate condition, mostly approaching the period of spinning, and no particular disease was complained of. He showed the party his mulberry plantations, and pointed out several kinds of trees. Drawings of six different varieties of leaves which were taken may be found annexed to the report.

One important object of the journey seems to have been to gather information respecting the *Bombyx yamamai*, or oak silkworm, which is reared in the open air. To do so, it was necessary to visit Matsumuto, the native land of this species. In the neighbourhood, it appears that there are sixteen villages, the inhabitants of which form an association called the "Matsukawa-gumi," and are entirely engaged in the culture of the "yamamai." According to the information given by the head-man and others, this culture was first initiated about forty years ago, and since then has gradually taken greater dimensions, till the number of cocoons annually sold by the association alone is computed at not less than 20,000,000. The three principal informants stated that the number which they severally reared each season averaged 170,000, 100,000, and 80,000, the price of each thousand being estimated at about four dollars; also that the cocoons, as well as the silk, now met with customers from an extended circuit. The best sort of silk is sold at about 840 riyos a picul, and the inferior at about 530 riyos. A stout kind of netting is manufactured from the silk, and it is also made up with other raw materials, such as cotton.

The elaborate and scientific observations of M. Guérin-Meneville and M. Personnat, in France, and of Dr. Wallace, in England, having already made known the habits of the "yamamai," and the mode of rearing it in those two countries, Mr. Adams was satisfied simply to record what he saw and heard in the district. The result of these inquiries are elucidated by very interesting drawings of the trees upon which the worm flourishes, with the methods employed for reeling the silk. The persons who gave the information were evidently in easy circumstances, and they answered the questions readily and with intelligence. On the eve of departure, they were invited to a meal, partly Japanese, and partly of European food, in order to testify the sense entertained by the party of their willingness to assist with all the practical knowledge which they possessed, and there is reason to believe that, upon this and other occasions, the visit of Europeans will be remembered with some little pleasure. At another point, called Margebasi, where Mr. Adams and his party arrived, they found reeling going on in every street, and 300 bales of silk were said to have been already sent to Yokohama. Some of the merchants were very earnest in requesting them to call the attention of the Japanese government to certain existing defects, and to enforce a uniform system of paper-ties throughout the country. At Shunamura, two new magnaneries had been created; a sketch of one appears.

Amongst the general observations, Mr. Adams records the increase of the mulberry plants, and in some parts a decided movement with a view to the improvement of the silk. The suggestions which have been made in a former portion of this series of reports, with reference to the necessity of introducing European machinery, in order to remedy the grave defects in the reeling of Japanese silk, and which have been urged upon the government by the British minister, seem to have begun to bear fruit. Opposition must doubtless be expected at first from many who are accustomed to the primitive system now in use, and whose wives and daughters have found employment in the trade during a certain period of each year; but when once it is shown in different districts that silk reeled by European machinery is superior to that which has hitherto been turned out by the natives, and that it consequently commands a higher price, such opposition will grow fainter and fainter.

The most troublesome question to deal with is that of the "uji." The Japanese silk cultivators have accepted this scourge, year after year, as inevitable; and considering it as such, they have never dreamed of carrying out experiments with a view to discover what becomes of the "uji," or to provide means for lessening its ravages. Appended to this report is a document which has been addressed to the whole mass of silk cultivators by the Japanese government, in which they urge for written observations to be sent in periodically. But if the observations made this year should lead to no discoveries, then the only course would appear to be for the Ministry of the Interior to cause intelligent experiments to be conducted by competent men, who should visit the various silk districts. Owing, therefore, more especially to the gradual introduction of European machinery, and to the measures which will in all probability be taken to check the ravages of the "uji," reasonable expectations may be entertained that the trade, both in silk and eggs, will show a marked improvement.

MILITARY EDUCATION IN THE UNITED STATES.

The education obtained by the officers of the United States' army is principally furnished by the West Point Academy. The Academy, which is entirely supported by the State, though nominally military, is looked upon as a nursery for the training of civil servants of the public almost as much as that of military officers. Many acquire at West Point scientific knowledge and habits which cause them to be sought for important posts in civil life. Some obtain lucrative positions as professors in the different State Universities. Some become connected with railroads and other public improvements, whilst amongst the ranks of the legislators, jurists, agriculturists, merchants, and divines, may be found many who acquit themselves with honour, and to the advantage of the State. We learn, from the inquiries made under the direction of the Military Commission, that the United States army is officered from three sources—namely, from civil life, from the rank and file, and from the cadets at West Point. The first class are appointed by nomination, without any previous military training, and without requiring any qualification. The second are taken from the sergeants of the army, who must first pass an examination in some of the very elementary branches of education. The third class are appointed from the cadets of West Point, the condition being graduation at the institution.

From 1815 to 1832 the army was small, and almost exclusively officered from the Military Academy. The war against the Florida Indians, from 1832 to 1837, the war with Mexico, from 1845 to 1848, and the Civil War, from 1861 to 1865, necessitated an expansion of the army, by the raising of a volunteer force, and regiments were then largely officered from civil life. At the present time, West Point supplies about one-third, and cannot supply more than one-half of the vacancies which annually occur. The special object of the Academy is to obtain, by the means of one central institution, the same results as those sought to be attained in England by the special colleges of Sandhurst, Woolwich, and the Staff College. Candidates, with certain exceptions, must be over seventeen and under twenty-two years, and although the examination on entrance is not difficult, the prescribed tests, both medical and intellectual, are rigidly applied, and many are rejected. At first the system is simply qualifying, but afterwards the competitive enters into every branch of instruction, and continues in full force to the end of residence. The length of the course of study, for all who may succeed in graduating, is four years; its nature is principally professional, and the course of study is identical with all the students. In addition to the theoretical studies, the months of July and August in each year are entirely devoted to practical instruction, the battalion being then placed under canvas, and relieved from all study.

The system of estimating proficiency in the different subjects studied is very elaborate. Each instructor keeps daily notes of the proficiency of the cadets forming the section of which he has the charge, the degree of excellence shown by a cadet at any recitation being recorded by marks. These reports, which are made weekly, form the most important element in determining the relative standing of each pupil in their class at the period of graduation, but a verifying test, or corrective, is supplied by the *vivâ-voce* examinations which take place in January and June. At the former, a larger proportion, usually one-sixth or one-eighth of the whole, are yearly pronounced as deficient. The June or annual examinations take place in the presence of the Board of Visitors, the members of which are specially appointed by the President of the United States, and whose duty it is to report on the state of discipline, instruction, &c., of the academy.

To assist the board in determining the accurate classification of any section about to be examined, the immediate instructor of that section hands to the board, before the examination commences, a roll in the order of merit in which he considers the members should stand, based on the weekly credits which he had himself assigned. At the close of the examination, the same instructor hands to the board a second roll, in the order in which he conceives the members of the section should stand, judging by the result of the examination. The instructor then retires, and each member of the board, having kept careful notes, the relative standing of the cadets of a section in proficiency is determined by discussion. The members of the graduating class have their choice of the services to which they shall be appointed, according to their standing in the roll in order of merit. Beyond this privilege, the only direct inducement held out to distinction among his class-mates to any cadet is one which is purely honorary. By an order from the Secretary of War so early as the year 1818, the five cadets most distinguished in studies and discipline in each class at the June examination are published each year in the *United States Army List*. The distinction is highly prized.

The disciplinary code is probably more severe than at any European school or college. It is, moreover, inflexibly enforced, and the more easily that it is supported by public opinion among the cadets themselves, with whom a high sense of honour, as well as a high estimate of the obligations of military duty, are sedulously inculcated. The moral tone and gentleman-like feeling existing are of a high order, and in all the duties there is a smartness which is apparent whether on or off parade. The general character of the officers who have passed stands remarkably high, and the fact of having graduated at the Military Academy invests such with a status and consideration in the opinion of the army at large which those who have not been educated at West Point do not possess. The process of elimination to which the cadets of any one class have been subjected has been so searching, and the ordeal through which graduates have passed has been so severe, that a diploma is regarded as a high honour, not only by the army, but by the nation at large, a distinction which the *amour propre* of the successful graduates is closely concerned in upholding at its full value.

GAS AS A SUBSTITUTE FOR OIL IN LIGHTHOUSES.

Some interesting experiments have been made to substitute gas for oil in lighthouses, the particulars of which have recently been laid before Parliament. It appears that in the first instance these attempts were made at Granton, in October, 1868; and in consequence of the gas not being considered so good as might be obtained, permission was given to erect certain apparatus for the express purpose, under the approval of the Board of Trade. The experiments were, therefore, resumed on the 22nd March, 1869, and continued during six evenings, from the elevated position of the Calton-hill, near Edinburgh. The result of the former trials showed that, with the annular lens, used for revolving lights, the oil lamp gave a more brilliant light than the gas, while with the cylinder refractor used for fixed lights, the advantage was in favour of the gas as compared with the oil. The second series of experiments so far corroborated those previously made as to leave no room for doubt that the gaslight, when used with an annular lens, notwithstanding the greater size of the flame, was not superior to the effect of the smaller flame of the mechanical lamp, the explanation being, that the greater portion of the large-sized 7-inch gas flame, consisting of 52 jets, is *ex-focal*, and is therefore lost, so that with the lens no advantage is gained by increasing the size of the flame beyond certain limits, and these seem to be pretty nearly attained in the ordinary four-wick lamp. So apparent was this, that it was agreed to give up the idea of experimenting on the gas burner, in its present form, as applicable to revolving lights, and to confine the trials to its use for fixed lights, in which, owing to the light being distributed equally over the horizon by the cylindric refractor, some advantage is gained by the employment of the larger flame of the gaslight.

After the experiments had been fully organised, and several preliminary trials made, they were, during the last three evenings, so arranged that the observers were ignorant of the order in which the competitive lights were exhibited for trial. The observations were always made by two or more observers, and the lights were viewed with the naked eye, and also with Mr. Stephenson's liquid photometer. The mean results obtained show that, even with the gas then specially manufactured, they did not warrant the adoption of the proposed substitute for the present mode of illumination.

One of the most important considerations likewise involved was the relative cost of maintaining the gas and oil lights. Under the most favourable circumstances, this was in favour of the latter; whilst, to all rock-light stations the gaslight would be inapplicable, and in isolated situations, where there many miles of land transport, the carriage of the coal would render it altogether prohibitory. Although these experiments were not productive of any result, so far as superseding the present methods, yet they have been highly valuable in showing the limit to which the size of a radiant may with advantage be increased, when used in the focus of the apparatus now employed in lighthouses. It appears that, with lenses used in revolving lights, no advantage is gained by using burners of the large diameter employed in the gaslight, and that for fixed lights a slight advantage is obtained. But whilst acknowledging the superior power of the gaslight, to the extent already stated, in the fixed-light apparatus, it is essential to keep in view that the large size of the flame employed to obtain the increase in intensity is, in some cases, an undesirable feature, for by increasing the divergence of the instrument to about 11° with the 6¾-inch burner, it would render it inapplicable in all cases where the light has to cut sharply off to indicate points of danger.

Upon the coast of Ireland, certain other experiments have since been made by Professor Tyndall, which proved more favourable to the gas than those named at Granton. This may arise from either of two causes, or perhaps from both. First, the power of the oil-light used in making the trials may not have been the same in both cases; or, second, an improved form of burner, admitting of more perfect combustion of the gas may have been employed; and should it be thought desirable to repeat the experiments at Granton with the burners there used, we learn that every facility for so doing will be afforded.

EDUCATIONAL NOTES.

The Religious Question at the London Board.—At the meeting of the Board, on Wednesday, a debate took place on what was termed the "Roman Catholic difficulty," a resolution having been introduced by Mr. Hutchins, on behalf of the Roman Catholic members, giving power in schools where not less than 40 children belong to the Roman Catholic faith, to appoint a person to read to them the Douai version of the Bible, and to give them religious instruction. This was lost by a majority of 35 to 6, but an amendment by Mr. Macgregor, allowing the use of a "Bible ordinarily used by Roman Catholics or Jews in respect of children whose parents express the desire for such use," was only rejected by 19 to 18. A motion proposed by Mr. W. Green — "That such explanations and instruction as are recognised by the resolution of Mr. W. H. Smith (passed last week) shall be given by the responsible teacher of the school," was carried, the purpose of the resolution being to prevent any interference with the teacher.

The New Code.—This has been discussed in both houses of Parliament during the past week. In the course of the debate in the lower house on the 10th inst., Mr. Cross dwelt on the article relating to night-schools, suggesting that the present requirements of 80 attendances and 50 meetings should be lowered to 60 and 40 respectively. Dr. Lyon Playfair gave a general approval to the Code, but complained of the small encouragement given to music and drill; and Mr. Dixon, maintaining that the effect of last year's Act had been more denominational than was expected, moved an amendment to restrict any further increase of denominational grants. Mr. Winterbotham protested strongly against the exclusion of music from the Code. Mr. W. E. Forster, in his reply, met all the various objections taken, and explained *seriatim* all the changes made, and the motives which had governed the Education Board. Mr. Dixon pressed his amendment to a division, but he was beaten by 231 to 64. In the House of Lords, on Monday last, Lord Nelson accepted the New Code as a *bonâ-fide* fulfilment of the pledges made by the government last year, but he pointed out two or three points which still demand reconsideration. Lord Shaftesbury expressed his deep regret at the exclusion of music from schools. He bore testimony, derived from the observation of many years, to the humanising influences of the hymns and simple songs taught in schools, not only upon the children, but upon many wild and lawless parents; and he thought that to strike out music from the schools was to surrender one of the greatest advantages God had put into our hands for the refinement of the humbler classes. The Right Hon. W. E. Forster has received various deputations on the subject of the New Code, during the week. The Tonic Sol-fa Association pressed upon him the importance of music, and in reply he said he agreed with the most enthusiastic of the deputation as to the value of music, and the reason why it was omitted was, because at present the Privy Council did not find their inspectors were able to give that thorough examination in that subject which they ought to give. That the inspectors were thus unable was the fault of the education of the country. In conclusion, however, Mr. Forster promised to try and find out, before putting in a fresh edition of the Code, whether what was wanted could not be managed under the present system of inspection; if not, how far it might be well to consider whether the government should do for music what was done by the Science and Art Department for drawing. Miss Burdett Coutts has written forcibly against the Code, and after pointing out various drawbacks to it, says:—"The one change in the Code which I believe every woman in the country would deprecate is, that grants are not to be given to children under four years old. This is a permanent injury, and every means should be used to get it remedied. It is not true that an infant under four does not learn; it is always learning; but it will gather some of its earliest and most enduring lessons from the gutter instead of the school. This may be some saving of expense. Schools and teachers may be expensive, but so are gaols and reformatories. Surely, when for the first time a school rate is adopted, and parents must send their children to school when they might be earning something, it will be very hard if the poor ratepayer is compelled to keep the infant at home, when it would be a boon and comfort to be able to send it to school." The *Times* highly approves the regulation in reference to the granting of certificates to acting teachers. "It was one of the cardinal regulations of the Revised Code that no school should receive a grant unless the master had passed an examination prescribed by the Department and had received a certificate. This rule pressed with peculiar severity during the first years of educational reform. There was no difficulty in training pupils up to the standard of the examination, but there were men of middle age who had grown up in the practice of their profession, and who found themselves excluded from its rewards by their failure to meet an artificial requirement which they had never been led to contemplate. So far as this personal injustice is concerned, the change proposed by Mr. Forster will meet the requirements of the case. During the next three years, certificates will be given without examination to acting teachers, provided that they are above thirty-five years old, that they have been teachers for ten years at least, that they can produce a certificate of good character, and that the inspectors report them to be efficient in their work. Under this rule all good masters who have been refused recognition under the Revised Code will be able to make good their claim by reference to their work alone. But it will be seen, from the restriction of this concession to the next three years, that the Department does not surrender the principle on which it has hitherto acted. It remedies a specific grievance; but it maintains the rule that government grants are to be given only to schools conducted by certificated teachers." This the *Times* condemns, and observes:—"We do not believe the grant will be administered with due economy until the simple principle of payment by results is uniformly adhered to, and the results are left to be produced by the sure rule of supply and demand." On the question of music, it thinks that the public generally will support Mr. Forster in his refusal to give public money for education in such "æsthetical attainments."

Influence of the London School Board.—A correspondent of the *School Board Chronicle* says:—"The limit to the influence exercised, more or less consciously, and more or less pointedly, by the London Board is difficult to assign. The immediate work it has to do in the metropolis is one thing, and the character of its work elsewhere is another; and though, in practice, the two may not be and should not be distinct, yet outsiders may make such a separation, and it will not harm individual members of the Board to know that in deciding for themselves they are very greatly assisting others. The Board, in fine, may stand to lesser ones, not so well provided with able men, as the Education Department stands to the whole, though not as exercising the same functions. It will guide their debates, colour their ideas, and fortify their conclusions. Abstract questions, or those ordinarily considered to be so, will crop up and receive common-sense treatment such as will ensure fair examination elsewhere. Drill, art, science, and other matters will find advocates able to do them justice, and show exactly where they impinge upon ordinary mechanical and commercial pursuits. In this way, the London Board will be a repertory of opinion, afford numerous precedents, and quietly and rationally educate other boards, steadying them in their flights, preserving them from absurd parochialism, and ensuring them against doubt on the one hand and disaster on the other."

School Boards and the Census.—The Home Secretary has given the Wolverhampton Board reason for hope that, even yet, the census returns may be rendered available for statistical purposes by the School Boards, as soon as they are collected in the different districts.

The League and the Scotch Education Bill.—A meeting of the Executive Committee was recently held at Birmingham, when the Scotch Bill was discussed by the committee, and a paper indicating the numerous defects in it, and clearly bringing out its "entirely sectarian character," was presented, and ordered to be printed for circulation.

The Working Classes and Compulsory Education.—There is a story current that at Bridgwater the collector employed for the purpose of procuring the educational returns, said, in reporting progress to the School Board, that in the lower quarters of the town he was overwhelmed with abuse and insult wherever he went; and the children when they saw him coming would cry, and, running to their mothers, implore them in piteous accents not to let them be sent to school. It was in the neighbourhood of the same town that a member of the Board was accosted by an apparently honest-looking fellow, a labourer. "Well, master," he said, "and is this Bible-truth what I do hear—that you gentlefolks is agoing to eddycate my children whether I likes it or no?" The member of the Board explained. "Well, master, you say as how they must be eddycated; I say as how they mustn't, and they shan't. I'll drown 'em first." It is to be hoped, at least, that this is not a common case.

CORRESPONDENCE.

MEMORIAL TO SIR JAMES C. ROSS.

Sir,—The subscribers to the memorial of the late Rear-Admiral Sir James Clark Ross, so renowned for his scientific researches and discoveries in the Arctic and the Antarctic regions, will be glad to know that the portrait is now nearly completed by the artist, Stephen Pearce, Esq., of 54, Queen Anne-street, W., who hopes it will appear in the forthcoming exhibition of the Royal Academy, previous to placing it in the Painted-hall, Royal Hospital, Greenwich.—I am, &c.,

Eras. Ommanney, Rear-Admiral, Hon. Sec.

6, Talbot-square, W.

THE PRINCE CONSORT MEMORIAL IN HYDE-PARK.

Sir,—It will be acknowledged that an appearance of stability is essential to a monument in the open air. Whether the memorial in Hyde-park be secure or not, does it look so? Would it not be better that it should be solidified in the centre by some elegant structural arrangement, which might provide four niches for statues of the Prince in the different phases of his character—as the royal prince; as the religious knight; as the man of learning, science, and art; and as the man of beneficence? These might be standing figures of marble in deeply recessed niches, so that only one could be seen at a time. And would not that be much better than that with which the public is at present threatened, namely, a colossal gilt seated figure, which will grate on the feelings of the age? Also this above arrangement of the solidification of the memorial would provide a statue for each front, thereby completing the architectural arrangement, and avoiding the present anomaly of a distance of less than a hundred yards, backing against the Royal Albert Hall, to look at the front of the statue of the prince, and half a mile into Kensington-gardens to look at the back, in a chair!—I am, &c., Epsilon.

March 14, 1871.

ORNAMENTATION.

Sir,—I believed that if any one rule of ornamentation had been firmly established by recent writers on art, and enforced by the teaching of the South Kensington Museum, it was this, that materials should be honestly decorated, and not made to look like something else. I conceive the rule (*pace* Mr. Moody) to be a sound one. What, then, was my disappointment at seeing the pillars in the top gallery of the Royal Albert Hall, which are, as I am informed, made of iron, "decorated" with a hideous yellow marbling. Who is responsible for this? What has he got to say in his defence? And is it too late to alter them?—I am, &c., L.

March 11th, 1871.

ORNAMENTATION A HIGH ART.

Sir,—Since writing my letter, which you kindly printed in your issue of Friday last, two other communications respecting my paper on ornamentation have appeared in your *Journal*. I allude to those published on the 3rd instant. The first of these is the complaint of a manufacturer, respecting the want of art-knowledge by the public. I assure you, Sir, that I feel deeply the the difficulty of which the writer speaks, and as an ornamentist having a large practice, I daily meet the difficulty as he does, only he meets it in the public, and I in the manufacturer; but let him take heart, for, first, patterns in good ornament are selling much better than they were even two or three years since, and are even taking in the American market; and second, it is not undesirable that we should have white, even as a prevailing colour (if I may call white a colour), in dark halls and passages.

If we refer to the ceilings of the Turkish mosques, we find them frequently coloured with nothing but vermillion, white, and black; and so as to give the maximum of strength to the "colour effect," the black is used on the white, and not on the red. If such colouring were seen in broad daylight it would be very unpleasant, but when seen by the obscure light of one, or at most a few lanterns, it is soft and pleasing. So if a passage is dark the colouring should be strong, if light the colours should be more subdued. Let us always seek to adapt our works to the circumstances amidst which they are intended to be placed. I am happy, then, to say that the public are, in a great measure, willing to hearken to art-teaching. With regard to the letter of Mr. Moody, I pass by its personalities, as I am not disposed to bandy epithets with the writer. I am perfectly willing to discuss my subject fairly with gentlemen, but the time of every one should be too valuable to be wasted in giving or returning abuse. I will reply to the *arguments* of Mr. Moody's paper, although it does not even attempt to contradict the position which I sought to establish by my paper, read on the 10th ultimo; but I shall not do so to any other which contains personalities.

In this letter I am regarded as a great theorist; as an art-critic, professing art-knowledge, yet without the smallest amount of innate or acquired art-feeling; as having the "flat" malady very full out upon me; as having disgraced the "name" and "*prestige*" of the "Society of Arts;" as a weak man, spinning sophistries by which I, in imagination, lop off the limbs of giants; that by my theories I show the writer my utter want of art-learning; and, finally, that the only cure for my ignorance is art-knowledge. Sir, may I ask that you notice this one fact, that in order that the writer see with such astuteness as he says he does my utter want of art-knowledge, and the extent to which I have degraded the Society of Arts, that in order that he see with such clearness, as he evidently does, the manner in which I spin sophistries in order to slay or maim the giant, and in order that he perceive, so kindly as he does, that my theories reveal total ignorance of art, he must stand on some lofty eminence, from which he can make a wide survey of the art-universe, and he must possess an acuteness of perception which does not appear to be given to men in general; but this assumption of a power to look from the pinnacle of the Holy of Holies down upon such as your unworthy servant, who is unfit for the "outer court" of the temple, and to discover from the merest theories his utter degradation as regards art-knowledge, and, further, that he is merely "braying" out false condemnations, manifests neither "arrogance" nor "conceit."

It is difficult for me to answer the charges hurled with such violence, without stepping beyond the bounds of what it is considered fair that a man should say of himself.

1. I am a great theorist. I did not clearly see, up to the time of the appearance of this letter, that it was altogether a theory that decorative art should be truthful in its expression, any more than it is a theory in morals that our words and actions should be truthful; I should rather say "let it be granted" that truthfulness of expression is always necessary, and then let us proceed to argue from this point. Nor did I know that I was advancing a great theory when I argued that "ornamentation was high art," but as Mr. Moody says these are theories, I suppose it must be so.

2. I am regarded as an art critic (an amateur), without the smallest amount of innate or acquired art feeling. That I always have had an innate feeling for art I know, although even Mr. Moody says to the contrary. As a child, I spent a large portion of my time in drawing and painting in the manner of a child, and I was never happy without a paint-box; and this I know, that I once got into great trouble for exchanging a box, which my father had given me to lock my little treasures in, for one of the old-fashioned twopenny paint-boxes.

That I was intended by nature as an artist, I doubt not; but let it ever be remembered that, with the view of causing me to become one, my parents placed me at a "school of design;" as a consequence, I may not be an artist; and this I know, that after being a student there for seven years, I spent five years in continuous efforts before I succeeded in making one penny by ornamental designing. Whether I am or am not an artist, I am content to leave the public to judge, but I may fairly say this, that I am not simply an amateur. As an architect, I have as much work as many of my fellows, and as an ornamentist I have much the largest practice in the kingdom; so far as I know, there is not one branch of art-manufacture that I do not regularly design patterns for, and I hold regular appointments as "art adviser" and "chief designer" to several of our largest art-manufacturing firms. If I am no artist, and I suppose I cannot be, as Mr. Moody says so, manufacturers are yet very willing, I am happy to say, to avail themselves of my ignorance, and I am willing to appeal to the public, and to artists generally, and ask whether the patterns on wall-papers and carpets have not improved since I commenced to design for them, and through the influence which I have brought to bear on the manufacturers.

3. I have the "flat" malady. Well, Sir, I have heard boys say, "What a flat you were to tell the truth;" as my "flat" malady results from a desire to tell the truth, I bear the censure and the complaint patiently; but I deny that this was a common complaint thirty years since. Truth in art was almost unheard of in England then, and a "flat" carpet or wall-paper was a thing almost unknown.

4. As to having disgraced the name and *prestige* of the "Society of Arts," well, perhaps I have. I must not judge, neither will I regard Mr. Moody's judgment. My respected friend, Dr. Lyon Playfair, M.P., must be blamed, however, rather than the "herb doctor," for this, as he suggested to your learned Secretary my reading the paper. Perhaps Mr. Moody can well afford to despise the wishes of such men as Dr. Playfair; but as I have found him for years to be a true gentleman and friend on all occasions, I am not desirous of so doing.

5. I am a weak man, spinning sophistries with which to "lop off the limbs of giants." I did object to certain

decorations at the South Kensington Museum, on principle, but I have yet to learn that I was thereby, even in imagination, lopping off the limbs of giants.

6. By my theories I show the learned writer my utter want of art-knowledge, and if Raphael differs from me so much the worse for Raphael. I cannot but hope that, as a rule, ornamentists are not so narrow in their views as many pictorial artists are. In the discussion which followed the reading of my paper on the 10th of February last, Mr. Burchett said that I reminded him of a shoemaker who proposed that a town be fortified with leather. This cry of "nothing like leather" appears to me to apply to such men as Mr. Moody, and many other pictorial artists, much more than to the true ornamentist. I have never uttered a cry against pictorial art, as such; I have publicly taught, orally and by writing, both in London and the leading provincial towns, that there is a nobleness in a true picture which it is refining and ennobling to consider; what I object to is, pictures being placed in inappropriate positions. A framed picture on a wall, I can fully appreciate; but against a picture as a back-ground to furniture, where part of it must be hidden—against a picture as a floor-covering, which is a thing to be walked-over—against a picture when painted on the bent surface of a plate, as it extends from one rim into the hollow and up into the other rim, I do raise my voice. I never knew an ornamentist, worthy of the name, who wished to make his decorations, if they were to be applied to the enrichment of a picture-gallery, or of a room in which pictures were to be hung, otherwise than a background such as should enhance the good appearance of the pictures, and yet make the room appear more beautiful than it would do without such enrichment. Yet, at the same time, I hold that ornamentation can produce alike beauty and equal interest with pictorial art.

As to my condemnation of Raphael, permit, Sir, a word of explanation. I consider that the exertion of all the mental energy of a life is necessary, in order that a man become a great picture painter. I also consider that the exertion of all the energy of a life is necessary in order that a man become a great ornamentist, and I never knew nor heard of a man who was great at both. Raphael was a great painter—a truly great painter—who gave a marvellous expression of spirituality to his greatest works, and yet I believe him to have produced only failures when he drew his arabesque decorations. Mr. Moody speaks of being born in the "obscure quarter of the globe called Europe." Allow me to say, that while in Europe pictorial art has had its highest development, that it is, nevertheless, obscure as regards ornamentation when compared with India, Turkey, Egypt, Siam, China, and Japan. It is this "nothing like leather," this one idea of art that it must be pictorial, that causes such men as Mr. Moody to speak as they do.

Lastly, as to the cure for my art theories, which is "art knowledge." Happy should I be to imbibe the remedy, even to the last drop. It is the panacea for which I have earnestly and laboriously sought for nearly thirty years. Happy shall I be to find it. But if I am to draw this precious draught from a consideration of Mr. Moody's decoration of the great refreshment-room at the South-Kensington Museum, or if the draught, when imbibed, is to lead me to produce such art-work as this decorative scheme, I would rather, yea, much rather, live and die in my present ignorance, and remain even outside the "outer court" of the great Temple of Art than take the much-needed catholicon.—I am, &c.,

Chr. Dresser.

Tower Cressy, Notting-hill.

ORNAMENT; FORM AND COLOUR—MUSIC WITHOUT WORDS.

Sir,—Most educated men are acquainted with those delightful musical compositions, "Liede ohne wörte." It has just struck me that this title may help us to an analogous expression, admirably adapted to show the just relation of ornamental to pictorial art. Let us, then, consider the former, or ornamental art, as the music of form and colour without words, and the latter as thoughts or words set to music. The object of painting and sculpture, like that of poetry, is a setting of thoughts to appropriate or accordant measures, and as poetry has ever been considered a higher art than music, because it more directly appeals to the intellect, so the art of producing pictures and statues has been considered higher than that of ornamentation.

Let it be granted that ornament has a sensuously wrong as well as a right phase of development, that which incites as well as that which attempers sense; yet the pictorial artist must be as completely conversant with these phases, the tendencies of certain combinations of forms and colours as the ornamented, but to this he must supersede a higher and more extensive knowledge. I therefore conclude that, although ornamentation is a delightful art, a high art if you please, it is not the highest. We scarcely know by what authority we set one art lower than another, in that great concert of being in which the just harmonic measures of everything are necessary to an accordant whole, excepting that the attaining of man, intellectually and morally, is the more certain and direct way of securing harmony in lesser matters, and hastening that millenium in which public buildings, homes, and furniture, are all to be tastefully and chastely decorated. The decoration of the human house must precede that of other walls and ceilings, therefore the art which immediately addresses the intellect must, for the present, be considered as that most entitled to be styled, *par excellence*, high art.—I am, &c.,

W. Cave Thomas.

203, Camden-road-villas, N.W.

INSTITUTION OF NAVAL ARCHITECTS.

Sir,—I shall feel obliged if you will allow me to direct attention to an advertisement in your columns, stating that the meeting of this institution, announced for Wednesday, 29th March, will not take place, in consequence of the opening of the Royal Albert Hall, on that day, by the Queen. I am anxious that this change of programme may be made known as widely as possible, from a very large number of invitations to our meetings having already been issued with the date in question.—I am, &c.,

C. W. Merrifield, Hon. Sec.

9, Adelphi terrace, London, W.C., 16th March, 1871.

THE PATENT LAWS.

Sir,—I regret that pressure of business prevented me from writing to you on the subject of Mr. Newton's paper in time for last week's issue of your *Journal*. As the appointment of a Select Committee to inquire into the Patent-laws has been resolved upon since the reading of Mr. Newton's paper, I think it will be better to await the result of its inquiries, because the publication of any particular views as to minor matters of detail, may give rise to an erroneous impression that serious differences of opinion exist among those professionally engaged in patent matters, as to the nature of the alterations required in the Patent-laws; whereas, the fact is, that considerable unanimity prevails among experienced patent-agents on all the leading points of the question.

Under these circumstances, I will abstain from any further comment upon Mr. Newton's excellent paper, which contains much I heartily concur in.—I am, &c.,

W. Lloyd Wise.

Chandos-chambers, Adelphi, W.C.,
March 14, 1871

Sir,—It cannot be for a moment maintained, that patent laws are a benefit to the nation at large, because a great portion of the population—the consumers—find that a patented article is generally much dearer than one not possessed of that privilege. Patentees, as a body, are also losers, because so few patents turn out lucrative—perhaps not five per cent., and their losses go in payment of fees of office, for stamps, and as remuneration to patent agents, and to lawyers, the only parties really benefited, for, as a rule, those gentlemen derive their incomes in every case, equally from both the winners and the losers.

The only true and natural patent right consists in excellence of material, superiority of workmanship, and low charges, a combination that can defy the world to infringe.—I am, &c. Henry W. Reveley.

Reading.

THE COMMERCE OF INDIA.

Sir,—I was reluctantly obliged to be absent at the reading of Mr. Dadabhai Naoroji's paper on the "Commerce of India," but I have since then carefully read it, and the remarks made upon it; and, as I may be prevented attending at the adjourned discussion on the 3rd proximo, I beg leave to make a few remarks on the paper in this form.

There are, among many striking points in the paper, four which occur to me as particularly inviting remark:—1. To use a mild term, the truly reproachful tone of the document as against the English nation, ascending in one instance to a charge of wilful misrepresentation against the "past India House." 2. The clever and undoubted earnestness with which the author pursues his premises. 3. The extraordinary breakdown in proposing remedies for the gigantic evils he has conjured up for the occasion; and 4. The dexterous way by which he has ignored some stupendous acts of benevolence by the British government of India, when the very strongest considerations of self-interest, unchecked by any opposing forces, urged it the other way.*

I cannot doubt, as Mr. Franklin anticipates, that the "heavy indictment brought against the government of India" will be answered at the adjourned discussion, although the reproachful tone of the whole paper will remain, and may, among certain individuals in India, raise a ready response, although it is the colouring matter of special pleading rather than the result of careful weighing of facts by a "friend of India." The drift of many of the author's remarks and accusations is attributed by some of the speakers to a natural earnestness on the part of a native of India representing his countrymen here, to have wrongs redressed and injustice put an end to, but the author does not, I believe, aspire to being a representative man of any of the great races or great classes which make up the wonderfully varied population of what is commonly called India; he does not represent by any title the 150 millions of British subjects, nor the 50 millions of the native states, nor does he typify the millions of aborigines scattered over the mountains and jungles, nor the Hindoos who may have ruled there in ancient days, nor the Buddhists who did so to a great extent, nor the Mahommedans, who gave emperors to Hindostan, nor even the Mahrattas, Sikhs, or the rising men of "Young Bengal." It should therefore be kept well in mind by our countrymen who join in advocating the issues of the author as it were for the people of India and against the people of England, that there is no constituency to back him; and that, however ably he may represent the natives of India who have profited in general knowledge by English education, he does not at all, I believe, represent the real feeling entertained towards English rule by the wisest and best of our subjects there, and of the people of the native states. On the score of earnestness, I would submit that hundreds of our countrymen who have served long in India are just as earnest in their wishes for the benefit of the people as the author; and for myself, after 35 years' devotion to their interests, I will not yield in that respect to any native of India; yet I cannot see cause now-a-days for this wholesale condemnation of our rule. The complaint about tribute paid by India in the shape of pensions in England is another injustice laid to our door; whereas they are no more than the wages of hard work done for the people of India. The native servants of government have their pensions as well as we have, and moreover, about £250,000 a year is paid in pensions to natives of India who have never served the state at all, and this is a record of benevolence and liberality altogether ignored in the paper. In the same way, the nature of our services in India is equally ignored. What is the work from youth to age of Englishmen in India in civil employ? It mainly consists in keeping down oppression and injustice by the natives against one another, and not in self-serving or in benefiting their own countrymen, who have really a very small share indeed in the carrying on the executive administration of the country compared to the natives. There are dozens of districts in outlying provinces in which one or two Englishmen only are employed in each, every other person is a native of the country and well paid by government. Many persons in England are altogether ignorant of the state of things in India in this respect, and believe that as it is governed by the English their countrymen derive the greatest benefits from administering it. This is sheer delusion, and should be thrown off by everyone taking an interest in that country. "India" has always been in our time "for the Indians," as it ought to be; but it must pay for safety from foreign invasion, and for domestic peace and protection to property. This can alone be looked for from England. In all deference to those who talk of the day when England, having educated and trained the Indians to a certain extent, she may, with a clear consciousness of having discharged her duty to them, pack up, and leave them to govern that land themselves, I venture to say that such statements lead to a cruel delusion, unless I am so utterly deluded by my experience in India that I cannot understand what these talkers mean, nor have I ever seen any reasonable attempt to show how such a consummation can be brought about, or worked, if it were attempted. India, as we hold it, from Burmah to the mouth of the Indus, is not peopled by one race or nation whom we have displaced, and who could, if relieved from our presence, as the Lombards and Venetians were from the yoke of Austria, assume their governing functions and nationality. It is overspread with divers races, and has within its limits the representatives of many kingdoms, as wide apart in language, religion, laws, and traditions, as the Russians are from the Italians. Now for a few words on the author's break-down in his proposed remedies for "poor India's wrongs." Not one of them is new; and, moreover, every one of them—except the admission of natives into the new engineering college, which is not yet open to anyone, is actually in course of being applied by the government. Irrigation and canals are in full progress now, so is the rail, the great regenerator of India, and the government has decided on borrowing, I do not know how many millions of money to be laid out on new railways, as soon as it can get engineers enough to be entrusted with the work, and can decide on the most urgent and profitable lines. The author would have the government raise the loans right and left at once, with no other result than adding to the permanent deficit he so much deplores already. No doubt the government in England has been slow, very slow, to admit the necessity of increased and better means of communication, and to aid in the development of India's resources in vegetable and mineral products. But this has passed away, and the new disposition to make roads and foster commerce is clear enough. The government work on tea, cotton, silk, and cinchona is all that can reasonably be asked for; and the introduction of cinchona alone into such a fever-stricken land as India is an enormous boon, and might have roused the most rabid detractors of English rule to some small acknowledgement of wisdom and benevolence. But there was scarcely a word said at the discussion, *ex cathedra* or elsewhere, except by Mr. Clarke, to show how unjust and ungenerous the author's aspersions really were in every direction.

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* Tippoo's family pensions, restoration of Mysore Raj; Peshawur pension, restoration of Nepaul taxes, &c., &c.

In one matter, however, there is a real grievance against the government, although the author did not notice it. It is the extraordinary and unaccountable delay in giving railway communication to all the hill stations, without which a considerable portion of the European army cannot have the benefit of healthy climates, and the cost to government by an increased death-rate among the soldiers cannot be obviated. Further, by this cruel delay, European invalids in commerce, trades, and agriculture, with their wives and families, are deprived of a blessing close to their door, but unattainable. But, although it is rather hard to say so, the soldier, the invalid, the sick wives, and dying children do not knock as hard at the doors of the India-office as the men of Manchester and the natives of India do, and hence perhaps the delay. There is another thing for India's good which the author did not ask, but might well have done so in the interest of commerce—his professed theme—that is, the opening up more effectually of trade routes along the whole line of our frontier from Burmah to the mouths of the Indus. Slight, very slight, and desultory efforts are made in this direction, but there seems to be no fixed and persistent policy in this direction, otherwise why do we not now open up Thibet along the whole of Bhootan and Sikhim, and use our best endeavours to open up Nepaul along its 500 miles of conterminous frontier to the passage of our Indian and English products to the North, in reciprocity for our open doors at every point of that long border to all the people of the Nepaul kingdom.—I am, &c.,

A. Campbell.

February 28th, 1871.

Sir,—I hope you will allow me to give a short reply to Mr. Lees' letter in your last issue. I am much obliged to Mr. Lees for the notice he has taken of my paper on "The Commerce of India," but I shall feel ten times more obliged if he would kindly take the trouble of reading my paper more patiently and carefully than he appears to have done, for the only reply I can give him on most of his points is to refer him to my paper. There are one or two new points in his letter which I shall gladly exchange ideas upon with him at the proper time. I think the best thing that can be now done is to discuss first two or three of the fundamental questions, one at a time. I may assure him that I shall not hesitate to acknowledge any mistakes really made by me when pointed out.

I begin with asking Mr. Lees whether the statement made by the India-house, in the return of 1858, that the excess of exports above imports during the preceding 21 years was regularly liquidated in silver, is correct or incorrect? If Mr. Lees will show it to be correct I shall feel obliged to him. If, on the other hand, my figures are correct, then it is necessary, in the cause of truth, that attention should be directed to the incorrectness of the statement, so that all the theories and conclusions regarding the commerce and economical condition of India, hitherto based upon such incorrect statements, may be reconsidered.

I take this opportunity of correcting an oversight on my part. About the middle of page 306 of your last *Journal*, instead of "£3,600,000, it should be about £3,000,000.—I am, &c.,

Dadabhai Naoroji.

East India Association Rooms,
March 13th, 1871.

GENERAL NOTES.

Darjeeling.—Lord Napier of Magdala will send up to the beautiful climate of Darjeeling, the sanitary capital of Bengal, half an English regiment and a battery of artillery. It is said that Kurseong, in that settlement, is also to be got ready for troops.

Free Lectures on Geology.—Dr. Cobbold, F.R.S., commenced a course of twelve lectures on geology (being the "Swiney Lectures"), on Saturday evening last, at eight o'clock, at the Museum of Practical Geology, Jermyn-street. The lectures will be continued on successive Saturday evenings. The admission is free.

Iron as a Deodorizer.—Dr. Voelcker calls attention to the use of spongy iron as a deodorizing material of greater potency than animal charcoal. Sewage water passed through a filter of this substance is completely purified, and this filtered water, after having been kept six months protected from the air, was perfectly sweet, and free from any fungus growth. The spongy iron is obtained by calcining a finely divided iron ore with charcoal. Mr. Spencer, whose name is connected with the discovery of the electrotype, has for some time been advocating the use of a filter of this description. Its power of rendering water beautifully transparent, and apparently free from all organic matter, is its strong recommendation.

Steam Ploughing.—Lord Dunmore has been experimenting with a plough, drawn by one of Thomson's traction engines, on some land that has not been ploughed for 40 years, at Dunmore. The plan adopted in ploughing with Thompson's engine and the balance-plough, is to leave a headland of forty feet in which the steamer can turn. The plough of three furrows is then drawn up and down the field till finished, the headlands being afterwards ploughed across as with the ordinary plough. This leaves forty feet at the corners of each field to be done by horse or other labour, instead of 18 feet as at present. The engine turns at the headlands in 32 seconds, so that no time is lost; and on Tuesday the length of furrow turned over in eight minutes was 500 yards. Working ten hours a day, Lord Dunmore calculates that seven acres of autumn stubble can be ploughed per *diem*, at a cost of 2s. 9d. per acre; and in spring ploughing lea, five acres per *diem*, at 3s. 10d. per acre.

Barton's Patent Recording Telegraph.—This consists of two plain revolving dials, each having a double groove at the rim to admit of an endless cord or rope, also a handle and a finger, or indicator; and these are connected by an endless band of steel wire-rope, or any other fitting material. Upon this endless band or rope are fixed hanging swivels or holders, into which any kind of message written on ordinary paper or any other material, or a sealed missive, if necessary, is inserted. This done, the sender, A, simply turns the revolving dial until a small bell above the same gives the alarm, which by doing so announces that A.'s message has reached the receiver, B. Should B at the other end wish to send an answer back to A, he proceeds in the same way as A did at starting, the arrival of B.'s message to A being similarly announced by the ringing of a bell. If preferred, the messages can be sent from one department or office to another through tubes. If not thought desirable to send written messages, numerals or letters of the alphabet can be used instead, each numeral or letter of the alphabet representing some pre-arranged order or message for the day. If preferred, previously prepared messages—before the duties of the day commence—can be slipped in spaces around the dials instead of using numerals or alphabetical signs. Other applications of a similar apparatus are suggested.

Military Settlements in India.—The formation of a colony of military pensioners, at Challagaum, in the Bombay presidency, has failed and been abandoned, as is the fate of most such experiments. Civil colonisation on the hills would best absorb the pensioners free of cost, and colonisation can be promoted free of cost by placing English troops in the hills.

Steam Cultivation.—At a recent exhibition of the process of steam-ploughing, at Stowe Castle, the engine at work was a 12-horse power portable. The maker claims for it several specialities. The windlass, which is the principal feature of the apparatus, is an invention of Mr. Hayes, who has patented it. It has been described by the *Engineer* as one of the most ingenious combinations of mechanism in use. Its great advantage is, that when the cultivator reaches the headlands, the mere turning of a handle by the engine-driver throws the strap on to the opposite pulley, and the work goes on continually without stopping or reversing the engine. If it should be necessary to stop the cultivator at any point, the belt is thrown on to a loose pulley, occupying a central position between the working pulleys, the engine not being interfered with. There is also an arrangement by which the anchor-men in the field can stop the cultivator if all of them are out of sight of the engine-driver. The cultivator was one of Mr. Hayes', and it is said to have broken up the ground in first-class style.

Report of the Royal Sanitary Commission.—The report of this commission, which was presided over by Sir C. B. Adderley, M.P., professes to meet the reference made to the commissioners—namely, to suggest improvements in the operation of the sanitary laws, by recommending the consolidation of those laws and the establishment of a local authority in every place to carry them out, to be kept in action by an inspecting and assisting central department. The report proposes to bring every place under one complete authority for self-government—corporate towns under their councils, other populous places under elected boards, and all the rest of the country under boards of guardians especially charged with such functions—a central authority being adequately empowered to keep all such local machinery in action. It is proposed that the area of local government of various kinds should be made identical, the union, petty sessional, and highway districts being as far as possible brought together. So much of the machinery of poor-law administration is found to have already become applied to that of sanitary law that the leading principle of tentative practice should be followed out, and that one minister should preside over two co-operating departments, for the superintendence, in the first place, of local sanitary government generally; and, in the second, of the relief of the poor. At present such local government as there may be finds itself under the superintendence of, and final reference to, three or four central departments, the two chiefs of which have only lately come to a mutual "concordat" as to their respective functions, namely, the Local Government Act Office in the Home Department and the medical officer of the Privy Council. It is recommended that not only the local officers who are now employed by both the Poor-law and Sanitary Departments should be continued in the united service, but that the same inspectors should bring the central eye to bear on the whole, and that the central medical staff should be the same for both purposes. The reduction of the present series of sanitary enactments into one consolidated statute is one of the main recommendations; and that the process of consolidation should be commenced by a total repeal of every existing enactment, so that every authority should have its powers and responsibilities clearly laid before it. In aid of this important work the next part of the report offers a summary of the entire law on every branch of the subject, and on the opposite page suggestions of any amendments, or notes of present conflict or repetition, are presented in connection with the points in the summary to which they apply.

Meters for Water Supply.—A paper has been read at the Royal Scottish Society of Arts "On Water Meters, as in use by Water Companies, and Design for Simplifying and Cheapening their Construction," by Mr. John Reid, F.R.S.S.A., Engineer and Manager of the Edinburgh and Leith Gas Company. Mr. Reid, at some length, explained the functions of the water-meter, and some of the difficulties attending their construction. He described a meter of his own invention so far as regarded the movement of the piston. This movement he likened to what takes place when turning a card over on one edge on a table—sliding it back to its original position, turning it again in the same direction on its opposite edge, and so on as before. A projecting part of the central spindle gives action to a registering index outside the instrument.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

March 22.—On "Drill, the Complement of the Present School Teaching." By Major General Eardley-Wilmot, R.A.

March 29.—On "Woman's Work, with Special Reference to Industrial Employments." By Miss Emily Faithfull.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Engineers, 7½. Discussion on Mr. Thomas Wilkins' paper on "The Machinery and Utensils of a Brewery."
Victoria Institute, 8. Rev. J. H. Titcomb, "On some Curiosities of Ethnology."
Social Science Association, 8. Dr. Guy, F.R.S., "On Vagrancy, its Nature, Causes, and Cure, with special reference to recent legislative efforts bearing upon it."
Royal United Service Institute, 8½. Capt. J. G. Goodenough, R.N., on "The Preliminary Education of Naval Officers."
Entomological, 7.
British Architects, 8.
Medical, 8.
Asiatic, 3.
London Institution, 4.

Tues. ...Royal Institution, 3. Dr. Foster, "Nutrition of Animals."
Society of Biblical Archæology, 8½. (Inaugural Meeting.)
Civil Engineers, 8.
Statistical, 7¾. Mr. Frederick Purdy, "On the Preparation of Returns to Parliament."
Pathological, 8.
Ethnological, 8.

Wed. ...**SOCIETY OF ARTS, 8.** Major-General Eardley-Wilmot, R.A., F.R.S., "Drill, the Complement of the Present School Teaching."
Geological, 8.
Archæological Association, 8.

Thurs...Royal Institution, 3. Dr. Odling, "Davy's Discoveries."
Royal, 8½.
Antiquaries, 8½.
Royal Society Club, 6.
Society for the Encouragement of the Fine Arts, 8. Mr. Wyke Bayliss, "Hobgoblins in Poetry and Art; or, The Beauty of Truth."
London Institution, 7½.
Charity Organisation Society, 10. Conference on "The Organisation of Charity in its relation to Poor-law Reforms, with special reference to the question of Outdoor Relief." (At the House of the **SOCIETY OF ARTS**.)

Fri.......Architectural Association, 7½. Mr. C. Baily, "Ironwork of the Middle Ages."
Royal Institution, 9.
Charity Organisation Society, 10. Conference on "The Best Mode of Repressing Mendicity throughout the Country." (At the House of the **SOCIETY OF ARTS**.)
SOCIETY OF ARTS, 8. India Conference. Mr. Hyde Clarke, "On the Establishment in England of an Oriental Congress."
Quekett Club, 8.

Sat ......Royal Botanic, 3¾.
Royal Institution, 3. Mr. O'Neil, "The Spirit of the Age."
Royal School of Mines, 8. Dr, Cobbold, F.R.S., "Geology." (Swiney Course.)

Journal of the Society of Arts.

No. 957. Vol. XIX.

FRIDAY, MARCH 24, 1871.

PROCEEDINGS OF THE SOCIETY.

SIXTEENTH ORDINARY MEETING.

Wednesday, 22nd March, 1871; Sir Coutts Lindsay, Bart., in the chair.

The following candidates were proposed for election as members of the Society:—

Boyle, Richard Vicar, C.S.I., 9, Stanhope-place, Hyde-park, W.
Brigg, Benjamin Septimus, Burlington-house, Keighley.
Cama, Dorabjee Pestonjee, 16, Holland-villas-road, Kensington, W.
Lardner, George Darley, care of Messrs. Price and Bowstead, 34, Craven-street, W.C.
May, John William, F.R.M.S., 9, Fairfax-road, St. John's-wood, N.W.

The following candidates were balloted for and duly elected members of the Society:—

Beanes, Edward, Avon-house, Dulwich-common, S.E.
Brunsdon, Richard, 92, St. Vincent-street, Glasgow.
Burra, Henry, Rye, Sussex.
Larsen, J. D., 1, The Avenue, Blackheath, S.E.
Phipson, Herbert M., 15, Delancey-street, Regent's-park, N.W.
Pratt, Daniel, Tentercroft, Cuckfield, Sussex.
Webster, William, 15, Highbury-hill, N.

AND AS HONORARY CORRESPONDING MEMBER.

Roberts, Samuel Hartley, 116, Swanston-street, Melbourne.

The Paper read was—

ON DRILL, THE COMPLEMENT OF EXISTING SCHOOL INSTRUCTION.

By Major-General Eardley-Wilmot, R.A.

It is possible that the notice relative to the reading of a paper on drill, by a military officer, may create in the minds of some persons a tendency to repeat to themselves the old adage, "There is nothing like leather." It will not be thought surprising that a soldier should advocate drill, because the name as well as the practice has, in this country, been hitherto usually confined to those connected with the operations of war, whether by land or sea. The object of the present paper is not to advocate its importance to a military force, though this must be touched upon as the ultimate standard, but to form a short basis on which discussion and opinion may be founded, concerning its value as an adjunct to the physical, mental, and moral training of all classes of our countrymen and women. I am conscious of approaching the question under this further disadvantage, that it has met with considerable attention and interest from many persons during the last few months. It has already been determined to introduce it in certain schools, while in others it has been successfully carried on for some time, and it has also received the general approval of the government. It is not possible to present it under any new aspect, but, in obedience to the wish that has been conveyed to me, I will briefly commend it to your notice, reminding you that it is a subject in which our Society has taken an active interest.

How the term drill has been introduced in the sense now so commonly understood by it, is not very clear. In a mechanical nation like ours, drilling is a word in hourly use, and in this other sense an English writer, in homely verse, thus applies it—

> "My body through and through he drilled."

The military meaning of the word is indicated by its application to the case of a man being led on by degrees and gradually instructed, as when Southey speaks of a man "being drilled from one folly to another," while its complete military sense is set forth in the words of Hudibras—

> "The foe appeared drawn up and drilled,
> Ready to charge them in the field."

I say, complete sense, because drilled is here put for the whole of that mental condition in which is included a readiness to act in obedience to a directing mind, in concert with others, and yet with self-dependence and individual resolution. For as those are still true words, spoken by the great orator, "It is not possible, O Athenians, that a power should be permanent which is marked with injustice, perjury, and falsehood," so is it equally true that it is not possible that a nation should be able to defend itself whose people, under whatever terms or name they may be called to her defence, are ignorant, debased in morals, and undisciplined. True discipline, of which drill is but a branch, becomes more and more necessary as liberty and intelligence become more highly valued, because the decision respecting peace and war, with other great questions, ceases in some measure to rest in the will of rulers or governments, being controlled by public opinion; that is, too frequently by the general feeling rather than the "second thoughts" of the country, sometimes led, in this as in everything else, by the press. It is this true discipline which is, in many cases, more to be valued than numbers, even if it cannot take their place, and hence it assumes the highest importance in the eyes of a leader.

> "He through the armed files
> Darts his experienced eye, and soon traverse,
> The whole battalion views; their order due,
> Their visages and stature as of gods;
> Their number last he sums."

In these modern days of our country, the old prevailing motive, the love of glory, softened and sanctified by the influence of a Book more extensively circulated and read than any single book in the language, has assumed the nobler name of duty. The true soldier, still clinging to his characteristics of courage, loyalty, obedience, and reverence for what is noble and beautiful, no longer assumes that they are peculiar to himself, but believes that he shares them with the thousands of his countrymen in civil life. Hence he hails with satisfaction every movement which helps to gather together the scattered units of dutiful and loyal feeling, and weld them into a national and united body. Every public recognition of such principles tends to the security of that true freedom which is based on the royal law, "Do unto others as you would they they should do unto you;" and when there is seen arising out of the depths of the national heart an earnest desire for a more generally extended, as well as a higher standard of education, combined with a consciousness that there is but one source from whence the true doctrine of the manly life can be drawn, and in which the one example of the true man can be studied, the soldier may be tolerated if he desires to see the practical completion of the work, and would gladly see the children of this country taught from their earliest youth the great lessons which are involved in that union of action and self-denial, the very bond of strength, which are embodied in the somewhat despised notion of drill. "Practice," says Locke, "must settle the habit of doing, without reflecting on the rule;" and if we train up the child in the way he should go, both the man and the nation will be benefited.

The fundamental principles involved in the notion of drill, and carefully cultivated when it is properly carried out, are attention, readiness, obedience, and unity of purpose and action. Is there an instructor of youth in this country that will venture to say that these qualities, so essential to the soldier, are not of incalculable value in the formation of the character of his pupils? I spent nearly three years at the Royal Military Academy, before entering the army, forty years ago; and while I can look back, like many others in all classes of life, to opportunities of study not fully taken advantage of, I can confidently assert that the lessons that I then learnt in these respects have been of incalculable advantage to me, and it is my experience of their power and value which induces me to appear this evening as an advocate of the system in national and in all other schools.

I have been greatly surprised by hearing objections urged by eminent men against drill, even at a military college, as if it were a necessary evil at such an establishment, and should be made as little account of as possible. They adopt something like the opinion expressed by the philosopher in Whitehead's fable:—

> "With indignation I survey
> Such skill and judgment thrown away.
> The time profusely squandered there
> On vulgar arts, beneath thy care,
> If well employed, at less expense,
> Had taught thee honour, virtue, sense."

Some there are who would not only eliminate drill, but uniform also from military colleges, as indications of treatment only desirable for what are called "private soldiers." When, however, we see the overwhelming successes of an army every member of which, from the crowned head which commands it to the humblest individual that helps to complete it, has passed through the ranks, and performed the duties of every grade, it is time for England's sons to lay the lesson to heart, and not to be led away by any amiable rubbish.

I have said that among the ideas involved in drill are attention and unity of action. It is not necessary to impress the value of these qualities on many here present, whose profession or occupation brings this daily before their eyes. I must refer you to the remarks of many men far abler than myself, who have quoted the statements of Whitworth, Fairbairn, and others, as to the advantages which they have seen to be derived from the employment of men that have been through a merely ordinary course of drill. I would refer you to a paper read at the United Service Institution by a member of our Council, Mr. Edwin Chadwick, C.B., and to papers and discussions at the Social Science Association meetings. In some operations, such as casting large masses of steel from many small crucibles, as at Krupp's celebrated factory, the drill of the artisan is as necessary to success as is that of the soldier in his duty. It may be safely asserted that there is scarcely a trade or an occupation into which a lad can enter that the advantages derived from drill, and the qualities evoked by it, would not give him a decided advantage over his less instructed companions.

Objection is sometimes made by educated men against carrying this bugbear of a "military system," as it is called, into the ordinary avocations of the school life, and consequently the notion of marching in to dinner, or school, or to divine service, is considered as most undesirable, and to be deprecated. This objection never occurs to those that regard drill as a means to an end, in addition to its specific end as a military necessity, but it meets its answer to the mind of any one who pleases to visit any of the great metropolitan schools, where he will at once see how large schools, both for boys and girls, can thus be managed by a comparatively small staff, and with an amount of reproof or punishment surprisingly small. It is greatly to the honour of those that have the direction of these schools, and especially to a member of our Council, Mr. E. Carleton Tufnell, her Majesty's Inspector, that they have already practically carried out their views on these subjects with great success, and have thus shown an example of what can be satisfactorily accomplished. Captain Phipps, R.N., in charge of the Marine Society's ship *Warspite*, at Charlton, writes:—"It is now rather more than a year and a half ago since we introduced the system of drill into this ship, and it is now carried out even to the formation of boys during their exercise with sails. I find the greatest benefit from it, as I get steadiness, silence, and prompt attention. I find also that the minor punishments are very much reduced. For these reasons, as one who has the dealing with a large number of boys, I cannot speak too highly in favour of drill."

I will read an extract from a letter lately written to me, by one who has passed with great honour through every rank of the army up to that which he now holds, as a captain and adjutant in a very important volunteer corps. He says—"In regard to the drilling of youth in private schools, few have had more experience than I have had on that subject. I can therefore speak with confidence as to the utility of teaching the young military drill and exercises. I superintended many schools in this branch of their studies. I will take as an instance one that numbered over 100 boys, from the age of 10 to 16. All the pupils of this school were first taught the position drill, setting up drill, extension motions, facing, marching, manual and platoon exercise. In addition, the elder boys were taught sword exercises, fencing, gymnastics, all of which were carried on in strict conformity with the regulations. These exercises not only kept the boys in order, in robust health, physical strength and activity, but materially assisted the master in carrying out discipline in the establishment, which he often acknowledged to me was due to the military training the youths had undergone, as it made them obedient to order, and improved their moral courage, and their regularity in many ways. Some of these have since greatly distinguished themselves on service."

It may be a question, though some able officers differ from the opinion, whether it would not be a happy thing for public schools that drill should be introduced, not only as part of school discipline, but also as a main feature of school punishment. The objection urged is, that it does not do to make that a punishment which is also a duty, and that by so using it there would arise a carelessness and listlessness about drill very prejudicial to its quality. That would depend on those that manage it. Supposing that this tendency did exist, the evil would not be so very enormous, as we may hope that the number of those punished would be small in proportion to the whole. But contrast this with the present system of large schools. What is a common sentence at such institutions? "Write out 100, 500, or 1,000 lines of Homer," or any other author. If the boy has not already got a stock in hand, written out for him in anticipation perhaps by his sisters, during the holidays, he sets to work and scrawls through his interesting task, acquiring, let us hope, a greater love for the "swift-footed Achilles," or for the suffering Trojans, according as his sympathies are engaged. Certainly, he is doing one thing—he is acquiring a scrawl, which is anything but an accomplishment, and which may be a serious disadvantage to him in after-life. I was lately informed by a member of an influential firm, that the difficulty of obtaining young gentlemen as clerks who could write a decent hand was very great. In speaking to a gentleman in one of the large public offices of the country, he thought he had sufficiently accounted for the wretched writing of one particular branch by saying, "They are all young gentlemen brought up at public schools." A very excellent name is given to this class of punishment, it is called "an imposition." I heartily agree that it is rightly named, for it is an imposition on the parents of the boys, whose hand-writing is ruined instead of improved, and it is an imposition on the boys who are kept from healthy exercise by a punishment in the devising of which neither ingenuity nor common sense is manifested.

In the conduct of a school, the advantage to be derived from making drill a systematic portion of the course of instruction is very great, and a certain portion of each day should be as regularly devoted to it as to any other acquirement. Experience has shown that its introduction, employing a certain portion of the time for this purpose which would otherwise be devoted to book-work, so far from retarding, has actually accelerated the proficiency of the scholars. I am satisfied that not a few failures at examinations could have been traced to the neglect of that due and regular exercise which systematic drill would furnish; and where success has been achieved, in how many cases has it been accompanied by lost health, and followed by a career of consequent disappointment.

We should think poorly of a school at which the system of diet consisted in providing a store of food, and allowing each boy to take as little or as much as he pleased, and at any hour that suited his fancy; and so it may be confidently stated that the maximum amount of work can only be got out of a scholar with safety, when it is combined with the regular and sufficient exercise which is insured by some simple system of this sort.

Affording a necessity for united action, it would help to meet one of those growing faults observable in many young men in the present day, namely, a want of consideration for anything that militates against their own opinion, comfort, or convenience, that want of reverence which is remarked in the youth of all classes. At the same time, the habit of command which is involved in taking by turns the subordinate direction, and so learning that the skill and attention of each part is necessary to the perfection of the whole, would tend towards forming a more valuable character for each. "Without chiefs," says Xenophon, "nothing either great or profitable can be achieved on any occasion, least of all in war; for as discipline preserves armies (and he might have added schools and nations), so the want of it has been fatal to many."

Within the last few years, we have seen arise among us a movement which is called "national," though confined in its operation to comparatively few. This movement has been generally welcomed, and the motto, "Defence, not Defiance," has been accepted as the principle on which it is based, for

> "The arms are fair
> When the intent of bearing them is just."

And, in this case, as Carlyle says, "all uniforms shall be good, so they hold in them true valiant men." There is thus afforded what many desire, an ultimate specific object to be obtained by drilling youth during the school stage of life. We should be preparing fit and proper youths to fill the ranks of the volunteer corps. It could not be said that we were cultivating an improper taste for the military profession generally, though that profession would doubtless gain in the quality of its recruits who had already been taught the discipline and the ordinary movements of drill. This system would not remove the pupil from the influence of the teacher, but rather strengthen the tie between them. It would still be the duty, and doubtless also the pleasure, of the teacher to enforce the lesson,

> "In a false quarrel there is no true valour,"

And it would be found that this national training, grafted on national courage, would not only foster fearlessness but forbearance also.

The weak point of all volunteer service is that, whether military or civil, it is not to be entirely depended on for willing subordination. Skill in the use of weapons, or in the combinations required to bring men into the best positions for their use, are of small avail unless there is instant and willing obedience. It is the reputed want of this that has caused so many able men to think, and some few to speak, of our volunteers as a comparatively valueless force, and one which, if not improved in this respect, will always merit applause for its appearance, instead of approbation for its value. One remedy for this may be found in the enforced drill during school days, where the habits so essential to the value of such a force may be formed. And, in addition, whatever organisation of national defensive service is adopted, we should, by this system, possess a "raw material" of the utmost value, already imbued with the principles of national responsibility, and requiring a much shorter time to bring it into a useful shape.

In this country, the principle advocated is already at work in the elementary schools known as infant schools. I need hardly say that it is by a system of drill that the small scholars are taught the lessons of attention, and the habits of order, that enable them to make more rapid progress when they join the higher schools. In this there is nothing but the taking advantage of an acknowledged fact, namely, that childhood is the period when the instinct urges to action rather than to reflection, and that it is the wisdom of the parent or teacher to make use of this engrafted necessity in a profitable manner. In parts of the Continent, this view is carried out far more fully by the use of a vast variety of employments and exercises, commenced at an earlier, and continued to a later age. A friend tells me of having lived in the Black Forest, where he constantly saw a large school of boys, not only at elementary but battalion drill. During the summer months, they made excursions, sleeping in barns, &c., in fact, roughing it to some extent, and acting in accordance with that simplicity of life and habit which as yet marks the difference between the youth of Germany and of our own country.

In practically carrying out such drills, care should be taken to make them short, and the time should be taken from that appropriated to study, not to recreation. Over-exactness in non-essential things is an error to be avoided, and one into which the professional drill-master is more likely to fall than the schoolmaster. Drill cannot be regularly followed without imbuing the boys with some habits and feelings in favour of organisation, in which we are all more or less deficient, but which is required in the daily life of thousands among us, if we are to ensure order, regularity, happiness, and content, which are nationally almost as important as daily food.

To the teacher himself such a system would be of great value. Not only would he be refreshed by the variety provided by the stated period of out-of-door work, but the very fact of having a large number of scholars acting under his own eye, and dependent on his quickness and observation for their due control, would quicken all those good qualities which go to make the able schoolmaster. As in the highest things, so in the improvement of general character, it is necessary to "stir up," by practice and exertion, the latent qualities of the man.

Perhaps, while speaking of the effect of drill on the general character, I may be pardoned for saying a word in illustration of the effect, in its advanced stage, on the older class of pupil. You probably know that at the "School of Gunnery" at Shoeburyness, officers of artillery go through a practical course of instruction—no fancy work, but one which has appeared to the most eminent soldiers of all nations so thoroughly practical and laborious, that they could scarcely credit that they were officers that they saw at work. I will not give you my opinion of its effect, but will quote that of a brother officer—now, unhappily for us, retired from the service—but perhaps the best practical artilleryman of the day—Major-General Gardner. He says:—"I have had ample opportunities of seeing the effect of drill, according to our idea of it. The diffident, hesitating, or bungling officer (and the same is true of the soldier) at the beginning of the course, was transformed into the bold, quick, and intelligent man, full of resources, and apparently never put out. With this quickness, there was the consciousness of physical health and strength to do things he never dreamt of before, and to stand cold weather and exposure."

There are those that object to any system of drill, and occupations of a similar character, for the school period, as tending to form the students into one mould, and to stereotype a sort of national pattern of youth. Experience, however, proves that individuality is not compromised by similarity of teaching, for the words and acts of every man, connected with the same truth heartily received or the same exercise laboriously acquired, are sufficient evidence that the danger is imaginary. Indeed, as the removal of error from the mind can alone clear the way for true individuality, so the giving to the body the training due to its natural conformation can alone perfect its due development, and bring out the specific differences between one and another.

Others object to such a system being introduced into the education of the nation as tending to foster military feelings, and as an infringement of that spurious liberty which many parents claim for schoolboys as well as for themselves. Liberty is a good thing, when rightly understood, for the basis of true liberty is faithful service. The best trained and the truest soldier is not the most pugnacious; and the possession of a good weapon does not imply a readiness to use it in an unwise manner. A nation ought not to be a pile of stones loosely cast together, and growing in shape according to the fancy of the passer-by, but a living tree, spreading and growing, with the same life and character pervading the whole.

It is scarcely expected of modern statesmen that they should initiate great changes. Their habit is to follow. But there are already sufficient examples of the value of drill, and there is enough interest in this question on which to found a ground for action. It well becomes rulers to direct and enforce whatever can tend to improve the national culture, and not delay through the influence of that feeling of hesitation so common in the affairs of life. It is that condition described by the poet—

" For ever on the brink of being born,'

which loses so much good fruit to nations as well as to men.

We are only now entering upon action as regards general education, having, as usual, much encouraged ourselves by what has been done "abroad" in this respect. And yet it is more than 200 years ago since, in our own country, Sir Henry Wotton wrote:—"If any man shall think education (because it is conversant about children) to be but a private and domestic duty, he will run some danger, in my opinion, to have been ignorantly bred himself. Certain it is that the best-composed estates did commit this care more to the magistrate than to the parent. As both writers and rulers well knowing what a stream of influence it hath into government, so great indeed, and so diffusive, that albeit good laws have been reputed always the nerve and ligaments of human society, yet are they no way comparable in their effects to the laws of good nurture."

The question now interesting the country is national defence, entirely distinct from the love of war or a desire for national aggrandizement. To this duty it might, under adverse circumstances, be necessary to call every citizen. It, therefore, becomes a national duty to train up every child in this way. While they are young, the responsibility rests with us of preparing them to take their share in the national defence. We bear the burden now; afterwards, as in all other cases, each one shall bear his own share of it. Do not, therefore, let the views now adopted by so many in this country be allowed to slumber until, like those of the learned Provost of Eton, they are dug out 200 years hence, to make us feel how slow we are to act on sound principles.

It is true, we are now rejoicing in the thoughts of the peace which has returned to the great nations which have just concluded it; and the sounds of war having ceased, we may drift back into our insular indifference. But peace cannot restore the ravages of war, it cannot fill up the void in the mourning heart, it cannot give back the wasted produce of a nation's toil and industry. Led us, then, render such a peace impossible, as far as we are concerned, by those preparations which become our national character, for patiently trying to avoid occasions of strife, but for taking resolute action when it cannot be honourably avoided. Let us prepare the minds and bodies of our youth for that great duty of national "precaution, defence, or reparation" as Paley defines a just war, which is the inherited privilege of freemen.

Except as regards this ultimate object, these observations equally apply to the training of girls. For them is desirable the same habit of attention and consideration. For them it is even more desirable that systematic bodily exercise should be employed to promote an active habit and elastic carriage. That this result is readily produced on the human body by drill, is daily seen by this effect on the recruits enlisted for military service, when observed before and a few months after their training has commenced. It is seen in the appearance of the children in schools where such drill is taught, and notably in the girls of some of the metropolitan schools, whose upright figures, aided by the solidity given to the column of march by the advantage of the womanly dress, cannot fail favourably to impress everyone that has the pleasure of seeing them. Had any such system existed in girls' schools of the present day, or even if correct notions of elegance and carriage had been current among those that do not go to schools, but are brought up at home, it would hardly have been possible that under the euphonious name of the "Grecian bend" we should have seen such singular figures moving about among us.

The practical question arises as to the character and amount of drill and gymnastic exercises which would be suitable to a school, and helpful towards the general and useful physical training of the population. As regards the gymnastics, it need only be remarked, that they should be practised with great caution, and under strict rule with the very young; and that in the later years of school-life they may be chiefly left to be a voluntary pursuit. They are so practised at several schools, and for all classes of scholars, in the country at the present time.

As regards drill, we must take the soldier as the standard, and judge how much of what is required of him can be obtained. Opinions must necessarily differ as to the amount of drill and other training requisite for making the ultimate result—a soldier, because we have no very definite standard as to what a soldier ought to be. I believe that if our existing force were a thoroughly instructed one throughout all its branches, the military power of the country would be at once vastly increased, and, even with present improvements, probably doubled. It is to this point that the efforts of many right-judging officers of all ranks, even though holding no position of importance, are mainly addressed, and thus an assistance is being given to movements in this direction which must eventually make themselves felt. It is not necessary, however, to enter fully into the important question as to the forming a "complete soldier," of artillery, cavalry, or infantry; it will be sufficient to indicate about how long it may take to prepare men with that amount of drill which will enable them to take full advantage of the teaching which results in this condition of completeness. First, I may be excused if I bear testimony from personal observation to the excellent material composing a large portion of the volunteer artillery. I could also produce the testimony of officers who know our branch of the service thoroughly, as to having found the same among many militia and volunteer artillery corps. The intelligence, willingness, and good conduct of those with whom I have had any intercourse leaves nothing to be desired. The want of "discipline," that I have observed, and all that I have heard of, is not the absence of these qualities, but a want of appreciation of the necessity of setting aside their individuality, and regarding themselves as part of a system. And this is just what the school teaching would have supplied.

Taking one of these men as a standard, it would require from three to four months steady daily training, doing nothing else, to turn him out fit to "work" with rapidity and exactness the various natures of garrison guns composing the armament of one of our modern fortresses. This would not enable him to command or direct anything connected with them ; it would give him some little insight into material, but would not teach him any of those numerous operations required of the true "gunner." A longer time would be required for a less intelligent man.

As regards the use of machines for lifting and shifting ordnance, laying platforms, &c., another three to four months would be required. During this period the non-commissioned officers should be selected.

For teaching to embark and disembark from boats or rafts for coast service, throwing up rapid defences, the learning of field telegraphy, and some other matters, another period of from three to four months would be necessary.

Hence it is easy to judge, taking the time that men could give to the work, how long they would be in arriving at each stage.

It must not be lost sight of that the habit of acquiring information rapidly, and as some think superficially, has been greatly stimulated in this country of late years, to be forgotten in proportion to the ease with which it is gained. Drill is very quickly learnt by intelligent men, but is also quickly lost without practice. Unless the habit is kept up, there is no security against this result.

A very important element is a good instructor. Just as the schoolmaster requires instruction in the art of teaching, so the drill instructor requires a special and systematic training for his duties. From the teaching of one who merely fulfils the old notion of the "drill sergeant" you can never expect a well-trained force. With such it becomes a great and sometimes fatal mistake to count up the numbers, and so reckon on your strength.

I fear that nothing of the above could be universally taught during the school period. Much both interesting and instructive as regards defence might be taught by means of sand modelling, a system which might be applied in illustration of physical geography and geology.

For infantry, the time required to train men up to the desirable point would necessarily be less, and the same difference as to intelligence, and as to the character of the instructor, must be allowed for.

As regards cavalry and mounted infantry, similar to a small but admirable corps existing in Hampshire, it is scarcely necessary to say anything, as school training cannot assist in their special requirement. In the main difficulty, that of horsemanship, the raw material is supposed to exist abundantly in this country, where "riding" is so common among us ; we must, however, carefully distinguish it from the art of managing a horse as required for the service, and it would be unwise to conclude that we are so far ahead of other nations in this respect as some people appear to think. Long journeys are no longer performed on horseback in this country, and, in consequence, much real cavalry knowledge has been lost, together with that intimate relationship between man and horse, which makes the intelligence of the man husband the physical power of the animal in numerous ways. We have riders, and we have grooms, and we have some horsemen, but the cavalry man has to be taught to unite the two last in himself, and time is required to do this.

At a school, then, there can be no pretence of making soldiers; still, much that is useful may be done. All the extension motions, and the elements of ordinary drill can easily be taught. In addition to these, some of the essential movements connected with united action can be practised with interest and success. It is not necessary to detail these on such an occasion as this. A small committee of those interested in the question could soon draw up a code that would meet all that is required, and put it in a form suitable for the purpose. My object has been, as I said before, to open discussion on the matter, not to manifest any desire to assume the position of a teacher.

But I cannot conclude without urging on you that this system of drill and discipline in schools is a matter of great national importance. How many of our population now struggling around us would have had the ability to help and organise for themselves, had such principles formed the subject of school teaching ? How much more difficult would it be for this system of self-help to be confined to defiant attitudes and class antagonisms were the bodily training, and the accompanying true subordination of the heart, as assiduously cultivated among all ranks as the intellectual faculties. We all require to learn to be governed, a harder task than to govern indifferently. It is isolation that helps forward poverty and crime, and anything that in early life helps to make men feel that they are under one discipline, and growing up under one brotherhood, will greatly strengthen the hands of the wise ruler, and thus add to the general happiness. With such a population, the question of national defence becomes greatly simplified. It would soon be seen to be the duty of all. With the present facilities for acquiring property, there would be a more general appreciation of its responsibilities, and instead of an organisation of idleness, poverty, and crime, depending on an organised police to repress it, we should have a better hope of seeing more self-denial, and a greater readiness among the leaders of men to lead those that would be more prepared to follow, in the paths of social improvement.

DISCUSSION.

Mr. E. Carleton Tufnell said he had listened with great pleasure to the paper, particularly as he had had frequent opportunities of witnessing the beneficial effects of drill in metropolitan schools. Some present might not be aware that all the children of the lowest class in the schools under his inspection, to the number of more than 8,000, were now regularly drilled, government having fully recognised the importance of this matter, to the extent of providing funds for the employment of a drill-master in each of these large schools. The improvement in discipline which had resulted it was almost impossible to over-rate. To give an instance, he might mention that in one school, where the guardians thought the expense of the drill-master might as well be saved, the destructive habits of the boys broke out to such an extent that £100 worth of damage was done in less than a month, and they were but too glad to reinstate the drilling master. In some of these schools the drilling of girls had been introduced, not, he need hardly say, with any view of making Amazons of them, but for the purpose of improving their bodily health and carriage. Indeed, as a friend of his remarked, they looked more like young ladies than what they really were, some of the lowest classes of the population ; and not only were these physical results obtained, but a marked improvement was observable in moral discipline, which was of the utmost importance in every school. Most of the schools under his inspection contained from 800 to 1,000 children, and of course in such cases the expense was much less, proportionately, than it would be in smaller establishments, but still he hoped it would soon become universal. The orderly manner in which 800 boys would march into the dining hall, in the course of a few minutes, was of itself sufficient to show the value of drill in enforcing order and discipline.

Captain Phipps, R.N., desired to bear his testimony to the good effects of drill in promoting order amongst boys, and in obviating the necessity for those minor punishments which were generally so necessary for petty offences, such as chattering, inattention, &c., which caused much annoyance. He had also been astonished to find how little time was required for teaching drill, and was very glad that he had been led to introduce the system into his ship, in consequence of the drill review initiated last year at the Crystal Palace by the Society of Arts.

The Rev. Mr. Langhorne said, as he was connected with some large schools in the neighbourhood, he could cordially agree with what had been said by the first speaker as to the value of drill in promoting order and discipline; and he should be very glad if this discussion could be brought to such a practical bearing that the School Boards, not only in London, but throughout the country, could be induced to take up the matter. Hitherto it had been, so to speak, to a great extent a matter of speculation, and therefore any practical results were very useful. In the schools with which he was connected, where there were 600 or 700 children, it seemed to him there would be no difficulty in giving two or three hours a-week for such an exercise under a properly-trained instructor, and he would add that many foreign nations, such as the Prussians and the Swiss, were far a-head of us in this matter. Indeed, in the whole art of teaching, it would be found that some of the best books on the subject were works written and published in Prussia, Belgium, or Switzerland, and there was no doubt that one of the practical objects sought in these countries was not only to improve the mind, but also to train all the powers of the body, so that there should be that *mens sana corpore in sano* which was so constantly striven after by the ancient Greeks. In public schools he did not think there was the same necessity for drill instruction, inasmuch as there were greater opportunities for bodily exercise given to the pupils; but in the lower class of schools, where, directly school was over, the boys went out in the streets, and idled about their whole time, seeming to be occupied literally in doing nothing, it was of great importance that their bodies should be properly exercised, and he hoped, therefore, this subject would be carried out throughout the country in the same manner in which it had been in the City of London Union. He should like to see a regular system of drill-masters, who should travel from school to school, spending half an hour in each, as, by that means, he thought a thoroughly good system might be established, not only of drill, but also of gymnastics, and of such games as might be found expedient for the development of the bodily powers of children.

Mr. Botly said he had seen the drill system carried out most admirably in Switzerland. In the August of 1867, he happened to be at Geneva, when prizes were to be distributed to the scholars of a large school, numbering 700 or 800 boys, and as many girls. They marched out with three brass guns at their head, and a fife and drum band, and he must say that the marching past, both of the boys and girls, was most admirable. He made the same observation to the master, who said there was more order and system in those schools than perhaps in any in Europe. He (Mr. Botly) had noticed at Anerley School the orderly and decent manner in which the boys marched in to dinner, which could only be obtained by a regular system of drilling.

Mr. G. Wylde, M.D., said it appeared to him that the present day was particularly one in which drill ought to be introduced. There was such a universal craving for what was called liberty, that he thought, without a certain amount of counterbalancing power, in the shape of drill, it would be very apt to degenerate into licence. He looked upon drill as not only that which was to improve and develop the human body, but as being of high importance in a moral point of view in its bearing on the education of the people. He did not agree, however, with the last speaker, that it was not required in public schools. He had lately sent a son to a large public school where drill was not imperative, but it was permissible on payment of half-a-crown, which seemed to him a most ridiculous sort of thing. Out of a school of some 400 boys, there were only about twenty, a miserable squad, who attended drill, and the consequence was they were laughed at by the other boys, they laughed at each other, and they laughed at the drill-sergeant. Drill, to be of any use, must be imperative and universal, and he hoped it would soon become so; and if, in connection with this, elementary drawing for the education of the eye, and vocal music for the cultivation of domestic and public harmony were included, there would be a threefold influence brought to bear on the mind, which must result ultimately in enormously improving the moral, intellectual, and bodily development of the people of England.

Mr. Hyde Clarke said he quite agreed that the subject of drill should be universal in public as well as in primary schools. The mere teaching of gymnastics, even if it were done regularly and systematically, would be insufficient; but it would be remembered that in most public schools this was, to a great degree, a matter of play, left entirely to the caprice of the boys themselves. It would be seen, therefore, that one of the great objects of drill, which had been so well enforced by the author of the paper, was, in such a case, wanting, viz., that besides the individual exercise a system of discipline was obtained, resulting from combined and co-operative action. That was one of the great moral results which must be sought for, as it was of the greatest importance, because the total of combined action was necessarily greater than the aggregate of the single units. He thought the gallant general had not done full justice to the subject in treating it mainly as one of national defence, because, although that question was pressing at the present moment, still, after all, the great advantages of drill derived from its industrial training were permanent, and would always endure to the benefit of the community. Even amongst those most opposed to the application of military exercises, it might be seen that the use of drill had been found of great benefit, for when the Society had an interview with Mr. Forster, he himself gave evidence to the effect that drill had been introduced always perforce, as a means of gymnastic exercise and discipline, amongst the Society of Friends. He should like to have heard something with reference to naval drill, particularly as the gallant author had developed the subject so far in the direction of showing how training in schools might be combined with subsequent military training. As far as the coast population were concerned, there might be the means of combining drill-training in schools with artillery practice; but in all these considerations, one of the main points to be kept in view was that, though there were certain benefits in obtaining a habit of military organisation, there was, above and beyond that, a distinct benefit to the individuals and the community from the drill itself. It was not only a means of co-operation, bringing boys and men to act in unison, but a means of better training the individual as a workman, and making him thereby a more useful and valuable member of society. In that sense he understood the meaning of Mr. Tufnell with regard to drill in the district schools. It might be supposed that because government voted the salary of the drill inspectors, they had some military object in view, but he hoped it would be fully understood that expenditure was for no such purpose, but the express object was to obtain a better means of enforcing discipline, and improving the health of the children. He feared the author of the paper, without intending it, had rather undervalued the nature of discipline obtained from the volunteer movement, for, considering carefully what was advanced in the paper, he could hardly concur in his conclusion. He had given evidence as to the value of intelligence, and there was no doubt it was of the greatest importance, but there was no reason why intelligence should not be combined with, and be one of, the best bases of discipline. There were examples enough in military history which showed this was the case; and it must be remembered that we were in no position to say what the volunteers would be in the presence of an enemy, since our volunteer force was not under war discipline; and from any licence or laxity to be seen at the present moment it did not follow that, in time of war, there would not be a much better obedience given by the members of the volunteer force than even by soldiers of the line. Experience would teach that men combined for a common patriotic object would obtain a greater moral power in enforcing the discipline which was necessary for the benefit of the body itself, and for the attainment of a common object, and collateral proof of this might be found in the case of the navy. It could not be said that discipline in the navy was less strict than in the army, although the bearing and the demeanour of the sailor were somewhat different. There was more intelligence necessary in the vocation of a sailor than in that of a soldier, but that intelligence by no means militated against the maintenance of discipline. This had also been shown during the recent war, when the education and intelligence of many of the Germans had been found in no way to interfere with the maintenance of discipline. He believed that the more intelligent and educated the community, the more you would succeed in developing, not only the military qualities of the population, but also in promoting the general prosperity and well-being of the country.

Mr. Henry Cole, C.B., said he had heard with much satisfaction from Captain Phipps an eulogium on the drill review which took place last year at the Crystal Palace, and which was a great success, 4,000 children being marched up from all quarters of London; and the military authorities present on that occasion, General Napier, Sir Charles Russell, and a number of others, well qualified to judge, having expressed their astonishment at the exactitude with which the manœuvres were executed. He was in great hopes that a repetition of that review would take place in the present year, but there was a little difficulty about it, arising from the expense occasioned by bringing up so many children from Hanwell, Anerley, and elsewhere. It had been proposed that this review should take place in Hyde-park, and he did not think the Society would be altogether ruined even if it went into the speculation, but still it would be a great assistance if members present would signify their sympathy, and if any subscriptions could be forwarded for the purpose. He had much pleasure in saying that Prince Arthur had agreed to preside if the matter could be arranged, which it easily could, provided an amount equal to about 6d. per head of the children could be raised. He would not attempt to enumerate the various moral advantages of drill, but he ventured to agree with his forefathers, that the defence of the country ought to be placed on the people of the country, and that it was a very costly mistake which had been carried on for the last two centuries, in having what was called a standing army. King Alfred laid down as a rule that every man was to be a potential soldier, and for several centuries that plan was adopted. He would not go into the various political circumstances which led to the opinion that it was cheaper and better to have a standing army, for he was quite certain, that from the point of national economy if, after a few years, all children were taught drill, though he might not live to see it, that instead of having to spend six millions a-year for what was called a standing army, the country would do the business quite as well at half the price. He was rejoiced to find that his chief, the Vice-President of the Council, Mr. Forster, who had been a Quaker, if he was not one now, had laid the foundation of this happy result, having introduced a condition into the New Code which encouraged the teaching of drill in schools aided by the State. That was the first national recognition of the importance of drill, and this was only going back to what was done by our forefathers 700 or 800 years ago. It was a curious thing that every year in Parliament an apology was made for having a standing army, which was really contrary to the constitution of the country, so that an exceptional Act of Parliament had to be passed to make it lawful. He looked forward to the general introduction of drill to bring back the country to see the wisdom of the course adopted by King Alfred.

Mr. Ogle said that, as a schoolmaster of many years' experience, he desired to bear testimony to the benefits derived in private schools from the services of the drill sergeant. It was unnecessary to say a word as to physical results, but he had been struck by a remark made by Major-General Eardley-Wilmot as to drill producing "readiness," and he had often noticed that certain boys were intellectually deficient in this respect. These were the very boys whom the drill found out directly—those who turned the wrong way and moved at the wrong time—and it was astonishing what a good effect was produced by a short period of drill upon such characters. Drill was also useful in promoting habits of obedience, and this in a manner which might not be generally known. The drill sergeant was in the habit of selecting certain members of his corps to act as officers, and of course this distinction sometimes fell to the lot of a young gentleman rather distinguished for disobedience; it was ludicrous to observe the effect. He at once felt there was a sort of incongruity in orders being given by one who so little observed them, and thus he was shamed out of his disobedience. The moral value of obedience had been sufficiently observed upon, and the importance of learning both to obey and to command had been dwelt upon both by Livy and Xenophon in their lives of Hannibal and Cyrus, wherein it was shown that no one who could not cheerfully obey was qualified successfully to command. There was another side also of the subject, which had not yet been touched upon. One of the greatest difficulties schoolmasters had to encounter was, that able and efficient assistants objected to out-of-school duty. A man who had been labouring with all his might for nine hours to convey instruction, was neither willing nor able to take upon himself the toil of mustering the boys for dinner, and looking after them during the hours of recreation. Now the drill-sergeant was the very man for this, and if his services were generally employed for such purposes, principals would without difficulty obtain the assistance of a higher class of men as masters, whilst at the same time a new field of honourable employment would be opened for respectable and qualified non-commissioned officers on leaving the service, and thus a higher class of men might eventually be induced to enter the army.

Major-General Eardley-Wilmot, in reply to the observations of Mr. Hyde Clarke, said that on reading the paper he believed it would be found that he had not really devoted much attention to the military advantages to be derived from drill; and what he had said in this respect had been simply because he was aware of what others, such as Mr. Cole, Mr. Chadwick, and Mr. Tufnell had said on the physical and general aspect of the question, and he left it in their hands. With regard to the volunteers, again, it was anything but his desire to depreciate them in any way, but his observation, drawn from personal experience, was that they were to some extent deficient in discipline, and that, he believed, any volunteer officer would confirm.

The Chairman said the paper which had been read was a very interesting and exhaustive one, and the remarks which had followed, being mostly based on personal experience, were also of great value. In the broadest sense of the word, drill meant the disciplining of men so that they might work under one head for a common purpose; but on that occasion it had been usefully narrowed to the question of children's drill, and this was a very important branch of the subject. With regard to drill in general, however, he might remark that in modern times it had much changed its character. In former days it was greatly designed for the display of troops so that they might be exhibited to the best advantage by a king or potentate to his neighbour. In the present day drill had been much simplified, and was now constructed entirely with a view to service. As had been mentioned, drill was of equal importance in an industrial point of view, Mr. Krupp's manufactory being referred to, where the success of the castings depended upon each man being trained to perform his individual share of work at precisely the right time and in the right way. Such was the case with almost every occupation when men had to act together; so that, in a sense, every man was learning drill from his earliest youth, until he ceased to be of any use to society. He could not agree in the view that drill might be usefully substituted for punishment, and should much regret to see such a thing introduced, for that which it was a duty to perform ought in no case to be converted into a punishment. He had often remarked that the dislike of many soldiers to their profession was in consequence, as he believed, of extra parades and drills being imposed upon them as punishment. With regard to the character of a man being injuriously affected by drill, he thought it absurd to suppose that such could be the case. No man was the worse for discipline; as a general rule, the more a man obeyed discipline the better he was. It was simply drill which constituted the difference between an organised army and an army of savages. The latter, had as much courage as the civilised man, perhaps more, but they could not combine their forces, and act in concert to a given end. He believed the discussion of the subject would be very beneficial. At the present day party spirit ran high, and each one was so much accustomed, whether Tory or Radical, to read none but papers representing his own opinions, that a free and open discussion, on which all sides could be heard fairly, was calculated to be exceedingly useful. In conclusion, he begged leave to move a hearty vote of thanks to Major-General Eardley-Wilmot for his able and interesting paper.

The vote of thanks was carried unanimously.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.—NOTICE.

Members who have not yet exchanged their receipts for the tickets for the six concerts to be given by the Society of Arts, at the Royal Albert Hall, under the direction of Sir Michael Costa, and the first of which will take place on Wednesday evening, April 12th, at 8 o'clock, are requested to do so at as early a date as possible. The ticket office closes at 4, on Saturdays at 2.

The members are informed that the whole of the boxes holding five persons have been subscribed for, and that only a limited number of the amphitheatre stalls remain unappropriated.

Boxes to hold ten persons, for the six concerts, can still be obtained, price	£30	0	0
Amphitheatre Boxes, to hold eight persons, for the six concerts	25	0	0
Amphitheatre Seat (reserved), for the six concerts	3	3	0
Balcony Seat (reserved), for the six concerts	2	2	0
Arena Seat (reserved), for the six concerts..	2	2	0
Gallery Seat (reserved), for the six concerts	0	15	0

Tickets to be obtained at the House of the Society of Arts, John-street, Adelphi, W.C.; at the Royal Albert Hall, Kensington-gore; at the Royal Horticultural Society's Offices, Exhibition-road; at the ticket-office, Exeter-hall; the City Box-office, 4, Royal Exchange buildings, E.C.; Messrs. Keith, Prowse, and Co., 48, Cheapside; Messrs. Chappell, 50, New Bond-street, W.; Mitchell's Library, Old Bond-street; Austin's Ticket-offices, St. James's-hall and 28, Piccadilly; S. M. and A. Warren's Ticket-office, 1, Edwardes-terrace, Kensington.

OPENING OF THE ALBERT HALL.

Tickets to admit to the ceremonial at the opening of the Royal Albert Hall by the Queen, on the 29th March (balcony only), can be obtained of Mr. Samuel Thomas Davenport, the financial officer of the Society of Arts, *2l. 2s.*

THE AIM AND SCOPE OF THE ANNUAL INTERNATIONAL EXHIBITIONS.

On the evening of Tuesday next, March 28th, there will be a meeting in the Great Room of the Society, when Mr. Edward Hall, F.S.A., with the authority of Her Majesty's Commissioners, will offer an explanation of the aim and scope of the Annual International Exhibitions, and their relations with the development of art, science, and industry, and describe the arrangements, structural and otherwise, of the buildings at Kensington, which are to be opened with the Exhibition of this year. The chair will be taken by the Right Hon. Lord Lyttleton, D.C.L., F.R.S., at 8 o'clock precisely. Discussion will be invited. Members and their friends admitted as at the Society's ordinary meetings. Other persons may obtain cards by application at the Society's House, John-street, Adelphi.

INDIA COMMITTEE.

A Conference will be held this evening (Friday, March 24th), at Eight o'clock, "On the Establishment in England of an Oriental Congress." To be opened by Mr. Hyde Clarke.

CANTOR LECTURES.

The third course of Cantor Lectures for the Session will be delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will consist of Five Lectures, commencing on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. W. Fothergill Cooke and Professor Charles Wheatstone, F.R.S., in "recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

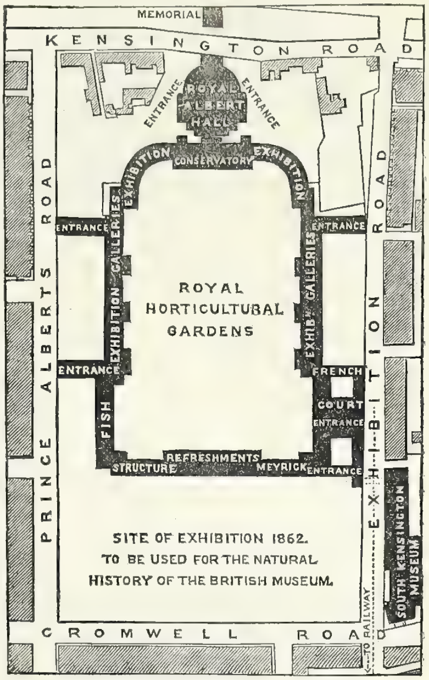
In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Council invite members of the Society to forward to the Secretary, on or before the 22nd of April, the names of such men of high distinction as they may think worthy of this honour.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

The Royal Albert Hall will be opened on Wednesday next, 29th inst., by her Most Gracious Majesty the Queen, at 12 o'clock. The following plan of the position of the hall, and of the range of buildings for the Exhibition, will give those who have not yet visited them some idea of the manner in which they have been arranged, for the purpose of carrying out the designs of the Commissioners.



Fellows of the Royal Horticultural Society and their friends possessing cards of admission for the opening ceremony can pass into the hall through the great conservatory.

Dr. Ferdinand Hiller has consented to write a grand march for the opening of the International Exhibition on May 1, and he will personally conduct its performance.

Exhibition.—A meeting of the General Purposes Committee appointed by her Majesty's Commissioners for the Exhibition of 1851 to carry out the forthcoming series of Annual International Exhibitions, was held on Wednesday at the Exhibition buildings. There were present Sir Francis Sandford (in the chair), Lord Northbrook, Mr. Edgar Bowring, Mr. Cole, Colonel Ponsonby, Mr. Thring, and Lieut.-Colonel Scott, R.E., Secretary.

The Prince and Princess of Wales, the Duke of Saxe Coburg, Prince Arthur and suites, visited the Hall on Wednesday afternoon, to inspect the preparations for the opening. Mr. Willis played a few passages on the organ, and, as it happened, the Royal party witnessed the bringing in by some score of workmen of the first of the six enormous pipes which form its towers.

MUSICAL EDUCATION.

The labours of the Society for promoting the cultivation of music as a branch of national education, which have been prosecuted for the last five years without intermission, received full confirmation in the House of Commons on Friday, the 10th March, when the following observations were made:—

Dr. Playfair referred, among other things, to the small encouragement given to the teaching of music. Music was a great educational instrument in the improvement of a school. As to drill in schools, he contended that by means of it the most discordant elements in schools were changed into harmony; that it induced habits of obedience, and brought all under its influence to work in unison. It developed the mental as well as the constitutional health of the scholars. He hoped that for the sake of the children in large towns due importance would be attached to drill in schools, and that the resolution of the hon. member for Lancashire would be adopted by the right hon. gentleman. His reading of the four years' rule was, that the attendance of no child would count unless the number of attendances was over 250. The consequence of that would be that no assistance would be given until the child was about five years old. It would be of advantage to relax the rule in that point. It was characteristic of the Revised Code that special and higher subjects were introduced into the schools of this country. That was not an untried experiment. It had prevailed in Scotch schools for upwards of two centuries, and had produced the most splendid results. Reading, writing, and arithmetic were only the tools of education, and many left the schools without knowing how to use them. But the higher education would enable the child to use these tools for the purposes for which they were adapted. He thought it a blot, however, that the whole sum of 15s. could be earned in the purely elementary subjects, because then there was no inducement to go beyond them. Still, the very acknowledgment of the higher subjects was a great advance, but, even if paid for, they ought not to displace the subjects that were elementary.

Mr. Winterbotham congratulated the House that the discussion had not been a very venomous one, for an education debate, though whether dulness had been equally avoided was more than an impartial observer might be able to say. Upon the general question raised by the hon. member for Birmingham, he had nothing to say, for he had not seen any reason to alter the opinion he expressed strongly last year; and, although his hon. friend had thought it his duty to raise the question, he hoped the House would not be divided upon it. One isolated point had not been noticed in the debate—viz., that while a great advantage of this (in the main) very excellent Code was the distinct recognition of extra subjects, thus raising the standard of primary education throughout the country, one of the most important of these extras was not only ignored, but positively excluded, viz., music. An hon. member might say "Oh," but he must be "the man who hath no music in his soul." He could not understand why music was excluded. As to drawing, he said nothing, because that was taught by the Science and Art Department; but as to music, although great progress had been made in spreading the means of teaching that art in primary schools, the Vice-President had struck out the subject, and the result would be that, although its teaching was not absolutely forbidden, yet attention would be first given to those subjects for which extra sums were paid. He appealed to the House whether children had not better spend their time in learning vocal music than in studying political economy, although he had nothing to say against political economy, which was a very interesting subject to the cultivated mind of of a man in good health. A knowledge of Lord Overstone's treatises on the Bank Acts, or of the First Lord of the Admiralty's work "On the Theory of Foreign Exchanges," or of any other branch of political economy, would be very dearly acquired if the teaching of music were sacrificed. He would remind the House that all educationists, from Plato to Goethe, had insisted on the importance of teaching music, and hon. members might remember that St. Augustine had written six learned but rather unintelligible books upon the subject. He suspected that the Vice-President was not a musician, for which he was sorry, though that, perhaps, accounted for many of his aberrations on this subject. What was the effect produced by the study of music? Music required order, method, attention, and quickness; it practised the memory, and was the only study that really cultivated the imagination of which young and untutored minds were capable. Hon. members were now trying to benefit the poorer classes, and though those classes could not be made rich, they could be made wise. To teach them music was to make them happy; and any man who knew anything of music and enjoyed it knew how capable of learning it were the great majority of children. He was educated at one of those middle-class schools which were looked down upon by inspectors who did not understand them, because they had been educated under a different system, and he, in common with three-fourths of a school of 80 or 100 boys, learnt music. Those who had kept it up in after-life knew well that it was an intense delight, and led them even to resist the fascination of coming down to this House. He therefore asked his right hon. friend to give his serious attention to this as a practical matter. He knew it would be said—and he was ashamed of the answer—that the inspectors did not know anything about music. That was so much the worse for the inspectors, and to require them to learn music would be doing good both to themselves and their families. There was, however, a means of obtaining qualified examinations, for, as the Vice-President proposed to appoint some assistant inspectors, it might be possible to require from an adequate number of them some knowledge of music. The music that he desired should be taught was not that of those howling young savages the charity children at St. Paul's, but a practical system of notation such as could be easily acquired by any intelligent man. It would be a lasting disgrace—at least it would be a disgrace as long as it lasted—if music was put under a cloud simply because inspectors could not be found who were able to examine in that subject. Let hon. members remember what was done in other countries. In America, great stress was laid on the teaching of music; there was a saying, in fact, that there was no primary school without its third piano. The right hon. gentleman was proud of the education measure, and wished his name to be associated with it. Let not his name, then, be handed down to posterity as that of an uncouth barbarian, who refused to teach the children music.

There is reason to believe that the omission of music from the New Revised Code is not to be interpreted as an intention on the part of the government to discourage music in elementary schools, but simply as a step towards placing the subject on the same footing as drawing, and under analogous regulations.

THE VALUE OF UNIVERSAL TRAINING.

The following observations are extracted from the *Spectator*. They have a strong bearing on the importance of drill as advocated by the Society:—

We firmly believe that military training for a single year, or even for half-a-year, would elevate the British people more than any other change which could by possibility be introduced by legislation, would be equivalent in all good effects to five years of ordinary education. It would, to begin with, immensely increase their physical power. Twelve months of regular and full diet, perfect sobriety, and moderate work in the open air, would increase the weight of ordinary town lads by one-third, and of country lads by one-fifth, would widen their chests, strengthen their muscles, and induce that habit of health which town men find it so difficult to gain and villagers to lose. During that period, they would learn to walk, to carry themselves, to obey orders and give orders promptly and quietly, to act in concert, and above all, to rely upon the action of their fellows. Cleanliness, self-respect, and self-restraint would become habits with the very lowest, and the first principles of civilisation, order, mutual respect, and the possibility of self-sacrifice, would be carried to the bottom of our society, to those classes whom all our efforts have hitherto failed to reach. All classes serving alike, the respect of all for each other must deepen, and, as we find in the Volunteers, good feeling takes the place of the suspicious dislike which arises only from ignorance. Every camp would be a school for the practical virtues, and there is no reason whatever why it should not also be a school for education in the ordinary sense. We should have got hold of the people at last, and might as reasonably insist on attendance at the evening classes as at the morning drill. If the system were wisely worked, as it would be, for the father of every lad instructed would be an elector, the lads, so far from losing anything, either in time or money, would go away far stronger, healthier, and abler, as much better fitted for the battle of life as an educated man is better fitted than a boor, yet without the effeminacy of habit which some men fear as a result of universal education. A man does not cart muck the worse because he has been drilled to walk instead of slouching, because he is a man instead of a lout, nor will he work less effectively at a trench because he understands how easily men can, under certain rules, be made to work together. The moral gain would be something indescribable. There is no reason whatever why such a camp should not be a well-ordered home, in which drunkenness, or unchastity, or insubordination would be as infamous as theft or cruelty now are. Tone can be spread in a camp as in a great school, and the wiser part of English philanthropy would concentrate itself on the county camps as its natural field.

The gain to the individual would be inestimable, nor would the gain to the State be less. The manhood of the kingdom would not, as in Prussia or France, be wasted in military service, but every man would be competent to defend the country, would understand what soldiership meant, would be in a position to decide whether the professional life would suit him. He would have lived the life himself under its best conditions, and the result would be, we feel certain, such a supply of "recruits" that the whole of our barbarous system might be swept away; the men enlisted as officers are enlisted for as long as they are willing to serve, and dismissal made, as in every other trade, a sufficient penalty for any offence not requiring the intervention of a magistrate. Even as matters stand, the difficulty of getting men is one chiefly of our own creating. Eight shillings a week and "all found," would give us the control of the whole unskilled labour of the kingdom, and cost us less even than we waste in the departments, would be, in fact, only £2,500,000 a-year in wages for every 100,000 men and non-commissioned officers, a sum quite within our means. Imagine terms like those offered among a people who already know all the disagreeable part of a soldier's training, who would need nothing but practice to be solid soldiers! England would be as safe as Prussia and as powerful, without a vast standing army, and without any new temptation to go to war. The military chiefs talk very wisely of the necessity for an elastic system; but what elasticity could be equal to that of an army of say 100,000 men, which could be doubled in a week by the introduction of men individually as well trained as they need to be, twice as well trained, for example, as two-thirds of the men who followed Wellington at Waterloo, and which, in the event of invasion, could rely on successive draughts from the whole population? We must not forget that if temporary and therefore cheap service in the army were possible, service for the work in hand, the expenditure on Militia and Volunteers would be superfluous—would be a waste of force in keeping up unnecessary cadres. A single force, if we could have it, with the necessary condition of elasticity, would be infinitely simpler, and more efficient.

But the cost of all this ought not, if the six months' term is selected, to be greater than the estimates voted this year. We cannot enter into the details, but even in England, with our extravagant ways, the cost of an army fully equipped and ready for service ought not to exceed £120 a-year per man, or six times the amount of wages given to the men themselves. Nothing but mismanagement can bring it above that figure, and that allows £12,000,000 for the regular army. The county training schools, on the other hand, needing neither separate departments nor separate scientific services, ought not, on the very highest calculation, one even extravagantly high, to cost more than £20 a-head for six months' drill. That is to say, able administrators intent on thrift, if backed by the people and supported by an etiquette or a law postponing marriage to the mature age of nineteen, would give us a system of defence that would place England beyond menace from the world, that would make us once more a great power, and that would civilise instead of demoralising the people, for the very money we are now expending in order to accomplish so little.

PUBLIC WORKS IN INDIA.

Mr. R. Langford Locke, a corresponding member of the Society, writes as follows, respecting public works in India:—

Native and Unskilled Labour.

My own experience, after several years' engineering employment in India, mostly without a single white face among my subordinates, amply testifies that sound, well-finished and durable, work cannot be expected without an unceasing and vigilant personal inspection. Many a time have I snatched the pick from an ungainly labourer, wasting physical power by wielding the tool by the middle of the handle, and striking at random, and showing him how to economise his strength, and to strike the likely fissure. Now, such a man would henceforward, by a sort of imitative instinct, execute his rude task more easily and efficiently, though utterly incompetent to comprehend the simple mechanical principles of wedge and lever. In the Baptist Missionaries' School, at Cuttack, I have heard capital answering in arithmetic, mechanics, and even in geometry, but to instruct the adult native, except by manual example, is a hopeless task. Practice with pick and crow would be very useful initiative exercises for the young engineer, and quite as necessary as the goose-step and drill for the ensign.

The resident engineer in charge of works, of whatever nature these may be — road or railways, buildings or drainage—may diminish expenditure, while effecting more enduring and higher-finished work, by bestowing due care on the physical condition of his men. A salubrious site for huts, undamaged rice, pure water, are all essential for the maintenance of health. The sahib possesses the *prestige* of authority, and may utilise his influence by exacting strict obedience to his orders in sanitary matters, while carefully avoiding interference with caste prejudices. Indeed, independently of the question of public works, the natives ought to be constrained, by all practical and practicable means, to labour on reproductive works, such as irrigation and culture of the soil. It is all very fine to descant on equality of rights, civil liberty, and so forth; but sentimental British theorists forget that a barren sympathy will not remedy famine, or save the population of a province from stavation. I have seen natives during the late famine in Orissa preferring to sleep and die rather than work and live. The stern discipline of industry is the only available method (if any) of suppressing constitutional indolence, and implanting in the native mind a provident care of the future. The same reasoning applies to education, which is to the mind what labour is to the body.

Again, the industrial employment of troops, at such seasons and hours as may not be injurious to health, would tend to solve two problems satisfactorily. First, the moral problem of preventing the mischievous consequences of idleness in the cantonment, and, second, the economic problem of consumers contributing to production by construction of roads, canals, &c., for conveyance of grain and merchandise. The efficiency of the Prussian Landwehr proves that the normal pursuits of civil life, nay, even of scientific and literary occupations, are not incompatible with the highest military discipline and organisation, and England may well profit by the lesson, both at home and in her outer empire. Furthermore, the example of obedience and order in the field—the battle-field of labour with the stubborn soil—is calculated to produce like effects in the native labourer, so that more and better work will be the result.

Professional and Skilled Labour.

In this division of labour, skilled workmen of the educated class are comparatively deficient, and what our Public Works Department chiefly requires is a supply of men of the clerk-of-works stamp, who have been trained under engineers and contractors at home—for Indian training is all "bosh;" men who know from experience what a brick is, and how to make it; what a sound stone is, and how to dress and set it; what stable foundations are, and how to lay them; what binding mortar is, and how to discriminate good lime; to erect and fix scaffolding, bridge centres, roof trusses, &c. Numbers of such men are to be had in the United Kingdom. Offer them fair service, promotion, and pension in India, grade them into the department, say at 200 rupees a month, to increase to 500 rupees, according to proficiency, and at the end of a certain term of probation, select a few for executive engineers from those who have exhibited engineering ability of a high order. Roorkee College does not seem to have been successful in educating natives in the higher branches of engineering science, but it may be made abundantly useful in supplying the subordinate departments, and by the instruction of volunteers from home in the forms and methods of accounts, reports, estimates, and other official matters in use in the Public Works Department of India.

It is a strange delusion to entrust the superintendence of public works to some juvenile competition wallah, all cram, and no practice. I do not mean to disparage scientific acquirements, but in India these are valueless without the practical training. If the engineer has white subordinates who have learned their business by doing it, there is some security for efficiency; but if his superintendents and stewards are natives, their skill and integrity can seldom be depended upon, and so the work, of whatever nature it be, becomes a miserable failure. The late Mr. Brassey's staff, from the able and talented engineer, competent to design and compute the cost of complicated structures, through the several gradations, down to the humble superintendent of a section, were all practical men, who had learned themselves to execute the tasks which they exacted and directed, and so success was the invariable result. Now, had he committed his Indian contracts to baboo engineers from Roorkee-college, clever competition wallahs, soldier overseers drawn from the line (not from the scientific military departments), and such like unpractised volunteers, his works would have collapsed like the Taptee-viaduct the other day, and he certainly would not have been the builder of the largest fortune created by talent and industry in modern times.

I do not submit these few suggestions without a long experience of public works in Europe, and an experience short, yet sharp, in some of the worst climates of India, where the first road had to be cut through the tangled jungle and the first bridge (of wood) cast over the swollen torrent. Throughout the civilised world, the practical genius of the English is foremost in works of machinery and engineering construction; and I believe it to be our wisest policy to encourage the introduction into India of this practical ability and trained skill, by a judicious selection and liberal expenditure; and further, to encourage the permanent settlement of those who have made fortunes in India in this or any other service by a systematic colonisation of the regions along the base of the Himalayas and other temperate climates suitable for the constitution of Europeans, thus retaining for the benefit of our eastern empire and its peoples the wisdom and sagacity acquired by long professional and political experience.

These measures doubtless involve a large expenditure at the outset, but ultimately must increase revenue manifold, and contribute to extend and confirm that ascendancy which nature and Providence have given to England in the East.

Burdwan, India, February 1st, 1871.

POSTAL REFORM.

The *Produce Markets' Review* says:—"The government have been compelled, by the public feeling with regard to the annoying character of the late so-called concessions of the Post-office, to bring forward a scheme of reform which should grapple with the grievances complained of. The principal subject of complaint was, that the Post-office had withdrawn the right of sending small packets by post, of which the public had availed themselves so extensively of late years, and on which very large businesses had been founded, and were being carried on. The government proposition, made in the House of Commons on Wednesday last, is practically to sacrifice the sample post, in order to re-establish a parcels post, with a limit of weight of 12 ounces. This limit is supposed to be the utmost which the railway companies, of whom the government appear to be much afraid, would allow them to carry by post. It is not explained, however, how it is that these formidable corporations make no objection to carrying 14 lbs. of book or printed matter, or whether this concession is due to their zeal for the diffusion of the means of education among the people. In the book post, the government proposes to make no change, nominally in its anxiety to spread information among the masses, but more probably, perhaps, from its fear of annoying the public press. The following will show the present rates for the sample post, and also those which the government proposes to adopt:—

	Present Rate.	Proposed Rate.
1 oz.	½d.	1d.
2 oz.	½d.	1½d.
4 oz.	1d.	2d.
6 oz.	1½d.	2½d.
8 oz.	2d.	3d.
10 oz.	2½d.	3½d.
12 oz.	3d.	4d.

"We may explain, in passing, that the 1 oz. samples will not practically be sent. It will be observed that up to two ounces, the most important weight of all in the sample post, the rate of postage is trebled. At four ounces, the next most important weight, it is doubled, while for the average it is two-thirds higher than it was before. We do not hesitate to say that this will materially injure the sample post, prevent its extension, and stop the rapidly-increasing convenience it had begun to prove to trade. On these grounds, therefore, commercial men who have to send out many samples will be great losers by the proposed alteration.

"As regards the restored packet post, it is no doubt a public convenience, but the raising from half an ounce to one ounce of the weight of letters permitted to be sent for 1d. is no concession at all. A person in modern times has no opportunity for writing letters weighing an ounce in weight. When letters were written once a week, and when the cheap press did not exist, sufficiently industrious persons might be found to cover so great a mass of paper, but, in the present day, the pretended concession is no concession at all. The government proposition certainly shows one marked piece of progress, but this has apparently been forced upon them against the judgment of the department, whose plan of late appears to be to make as many distinctions as possible, and to do as much work as they can afford for their $\frac{1}{2}$d. or their 1d. In consequence of the pressure put upon them, the government have at last acknowledged the principle that it is simple folly to keep up distinctions between closed and open packets, and to charge least for what gives them most trouble —through the necessity for examination. But having acknowledged the principle, they proceed to ignore it, by maintaining the entirely senseless distinctions between letters and samples, and the book-post, newspaper-post, and Parliamentary papers-post. That the restoration of the packet-post is a public benefit there can be no question, but it seems extremely hard that it should be carried out at the expense of traders. Only a few months ago, the Post-office reduced their sample rates to their present limit, and in the interval an entirely new class of business has been created, founded upon the facilities granted. It seems eminently unjust that a public department, having given facilities which led to the creation of fresh trades, should suddenly withdraw the privilege. There is no pretence that the present sample rates do not pay the government. Their recent reduction from a higher point, which is considerably exceeded by the proposed rates, shows that this could not have been the case, or the Post-office would not have made that recent reduction. Besides, the retention of the $\frac{1}{2}$d. rate, and of the present book-post weights, which correspond exactly with the present sample weights, show that these weights pay the Post-office, when applied to printed matter, and they must, therefore, pay when applied to samples or packets. If the present sample and book rates pay, why should they not be extended to the packet-post? The confession that it is because the government is afraid of the railway companies, seems a very undignified one to come from the rulers of a great empire.

"The concessions with regard to the money-order system are of the half-hearted character to which the Post-office has of late accustomed us, and their tricky character, although not apparent at first sight, deprives them of almost all value, when their real nature is on a close examination revealed. Under the present system, the charge is for sums not exceeding £2, &c. Under the new regulation, it will be for sums under £2, &c. A P.O. order for 9s. 11d. will be obtainable for 1d., but an order for 10s. will cost 2d. (or as much in addition as the extra amount sent), and so on up to the limit of £10. The value of the import and export trade of the United Kingdom amounts to no less a sum than £500,000,000, all of which must of necessity be transmitted from one part of the country to another, with the exception of the sums paid for the local consumption or production. As these vast sums are not paid to the producer or importer direct by the consumer, they must pass through many hands, and their total multiplied by the number of hands through which they pass. It is true, that only a very small fractional part of the vast amount in question is actually remitted in cash, owing to the clearing-house system, checks, bills, bank-notes, and so on. The Post-office, through its savings-bank, has introduced the principle of a national bank in every village in the kingdom. A very slight extension of its operations would ensure a vast and remunerative trade in the transport of money. The bankers' charge for sending money from Edinburgh to London is no less than $\frac{1}{8}$ per cent., which, if the amount of business were sufficiently large, would be an enormously remunerative rate. The Post-office charge is, however, more than $\frac{1}{2}$ per cent, or four times as much as is charged by the banks. The larger the sum transmitted by the post, the smaller would be the actual necessity for payments in coin at the different post-offices, as it would simply become, as in the clearing-house, a question of a credit or debit balance. At any rate, in all large towns, such as London, Liverpool, Edinburgh, Glasgow, Dublin, Belfast, and so on, there can be no reason whatever for any limit as to the sum to be transmitted. If there is no branch of a government bank in the town, it would surely be a simple matter for the government to open an account with the local bank. The limit of £10 imposed upon money-orders, renders them almost useless for trading purposes, as a charge of $\frac{1}{2}$ per cent. is prohibitive on the larger amounts. The subject is a large one, and as the government proposal is certainly an improvement, as far as it goes, it is perhaps not necessary to enter further upon the question at present, as the postal system would require extension, and a real organising head, before the money-orders can assume their proper position as the means of transferring all money from one part of the country to another.

To the Editor of the Journal.

Sir,—Reviewing the discussion at the Conference held by the Society and the subsequent conversation in the House of Commons, I beg to offer for the consideration of the Postmaster-General and the various classes of the community interested in the matter, the following suggestions, which appear to me to combine the greatest simplicity in working with the utmost accommodation to the public equally distributed, without diminishing the productiveness of the Post-office as a source of national revenue.

1. *Post Cards.*—To issue also cards with a penny receipt stamp printed at the left hand corner, so that they may be used for acknowledging the receipt of money to any amount. This would save much time and trouble to the mercantile community, and the cards would be a most convenient form of receipt for preservation and reference. As some check to the abuse of post-cards, the insertion of the name and address of the sender might be required, to insure transmission.

2. *Letters and Parcels.*—To make the rate not exceeding $\frac{1}{4}$ oz. $\frac{1}{2}$d.; $\frac{1}{2}$ oz. 1d.; 1 oz. 1$\frac{1}{2}$d.; and for every additional oz. or fraction of an ounce, $\frac{1}{2}$d. 12 oz. would thus pass for 7d.; the maximum might be extended to 16 oz., which would pass for 9d.

The advantages of and necessity for a halfpenny letter are so obvious, that I believe no postal re-adjustment will be deemed satisfactory or regarded as permanent without it. The halfpenny letter would be a great boon to the poor, would remove all inducement to send openly on a card any communication likely to be offensive to the receiver, and would greatly diminish the inducement to enclose letters in other parcels. A large increase in the number of letters might therefore be confidently expected, to compensate for the diminished rate, while the additional halfpenny on the heavier parcels would probably result in a clear increase, without being felt as a burden.

3. *Newspapers.*—To make the rate for all newspapers published at intervals not greater than seven days, and posted not more than seven days after publication, a uniform rate of halfpenny per 4 oz., or fraction of 4 oz.

Fully recognising the importance of affording, by means of the Post-office, a cheap and speedy transmission of news to those parts of the country not accessible by rail, and with every desire to allow a wide and liberal definition of a newspaper, without any such distinctions as being stitched or unstitched, I do not see why such papers as the *Graphic*, which consists chiefly of, and is bought principally as illustrations of news, or the *Saturday Review*, which simply comments upon news, should be allowed to send an unlimited weight of matter through the Post-office, and thus enjoy an undue advantage over their humbler competitors. Those who can afford to take these more expensive papers, and desire to have them by post, rather than through a bookseller or newsvendor, can afford to pay a proportionate postage, and should be required to do so. In the case of the *Times*, the greatest difficulty arises, because it is the most important newspaper; 4 oz. will always cover the news, the rest consists of advertisements, purely commercial matters. Why should a national institution convey gratuitously the gigantic commercial correspondence of the *Times*, while all other correspondence has to pay? It is surely boon enough to allow this extra matter to pass at the same rate as the news it accompanies. Then, after seven days, news becomes history, and should thenceforth circulate at the same rate as other history. The reason for exceptionally cheap and quick transmission ceases.

4. *Book-packets* to pass, as at present, at ½d. for every 2 oz., or fraction thereof.

5. *Money-orders* all to be under £5, and to be issued at a uniform rate of 1d., to be paid by the sender, the payee to affix a penny stamp on presentation for payment.

The burden, which at present falls very unequally, in some cases being borne by the sender, in others by the receiver, would thus be equally divided, and the facility afforded would remove every inducement to remit money by other means. It would be a great convenience if the Post-office were to issue stamped cheque-books, similar to those issued by bankers. A cheque and counterfoil would then be filled up by the sender, and presented, with the money, at the post-office, for postal stamp and signature, the cheque to be sent by the remitter to his correspondent, the counterfoil by the post-master to the office at which it is made payable. Post-office orders would then take the place of the innumerable small cheques which now daily circulate between London and the provinces, to negotiate which many small tradesmen are obliged to keep an account at a banker's, who would not otherwise do so.

Amounts of £5 and upwards can be remitted by bank-notes sent in halves, or by bankers' draft; if sent by post, a second fee would be required.

Finally, some people appear to think that, because the Post-office is a national institution, it should not make profit. If it belonged to a company, it would be considered legitimate to make the greatest possible profit, which would be most effectually accomplished by consulting the public convenience, and thus securing the largest amount of patronage. But what is the Post-office but the property of a joint-stock company, consisting of the whole nation? And if they can provide a convenience for which people are willing to pay, the profit is as legitimate in the one case as in the other. It belongs to the nation, and should be applied to national purposes. I confess I should like to see some other institutions, our railways, for example, made national, and managed on the same principle. What a release it would be, if the whole of our revenue could be raised by affording accommodation to the public. It is not impossible.—I am, &c., F. L. Soper.

March 21, 1871.

PARIS ACADEMY OF SCIENCES.

During the past six months, the *savants* of France have been almost exclusively occupied with subjects connected with war—means of defence, of provision, and of alleviation. Many were absent from Paris on duty or from various circumstances. The advent of peace has immediately produced a change; the academies are already actively at work, and, considering the complete derangement of society, and the necessity not only for setting that complicated machine in action again, but for examining and improving every portion of its works, the labours of the *savants* are likely to present considerable interest for some time.

The Academy of Sciences had a full and interesting meeting the other day. M. Sainte-Claire Deville had, on a former occasion, stated that French science had not shown itself equal to the demands which war had made upon it, or, as another member put the case, France had been vanquished by science. This complaint gave rise to serious discussion. Replying to objections, M. Deville explained that France had applied the progress of science to the arts of peace more than to those of war, which he considered highly honourable to the country, and added that the time was come to give a more decided impulse to scientific education. General Morin insisted, on the contrary, that France had initiated all military progress, but the improved arms had not been manufactured in time. This, according to the general's opinion, was the sole cause of inferiority, which left the scientific element, the spread of invention, and the perfection of execution, entirely untouched; in short, that France had failed simply in the material application of the very scientific novelties which she had originated. The whole mischief had arisen, said the general, not from the inferiority of French science, but from the fact that, while in France science was the privilege of a few workers, it did not penetrate into the masses there as it did in Germany. What was required was to raise the general level of instruction in France. Science must be diffused; made to penetrate everywhere. General Morin recounted the experience of his voyage of inspection in Germany. There were, in that country, no less than ten or twelve polytechnic institutions, with from 300 to 600 pupils in each, spreading scientific knowledge amidst a population of about fifty millions of inhabitants, or one establishment for five millions; while, in France, there were but the Ecole Polytechnique and its annexes, with the Ecole Centrale, for thirty-seven millions, or one establishment for nineteen millions. The diffusion of scientific knowledge amongst all classes formed the true superiority of Germany over France, and the same must be carefully cultivated in the latter, in order to give her the rank which she ought never to have lost.

This important subject has been referred to a committee of the Academy, and considering the strong impression made on the scientific world by late events, and the known practical ability and opinions of M. Jules Simon, the present Minister of Public Instruction, there is little doubt that the diffusion of scientific education will be pursued, for a time at least, with more than usual energy, and all the world will or should benefit by the fact.

Amongst the deductions drawn from the experience of the late war, is that of the great value of camphor in the prevention of hospital gangrene. M. Netter has used camphor for this purpose with great success, and records fifteen cases of cure. He recommends the use of no other means, nothing but camphor, but that in profusion.

M. Le Verrier has made a communication on the subject of a system of signals for the service of fortified places and armies in the field; this arose out of experiments made under the directions of the Superior Committee for the defence of the Valley of the Rhone, the cost of which was liberally defrayed by M. Maistre, a large manufacturer in the Herault. The object in view was, first, to establish optical telegraphic stations at great distances, say fifty or sixty miles; secondly, to organise a system of signals, of extreme simplicity and of great power, bringing into communication two *corps d'armée*, from fifteen to twenty miles apart from each other. The principal characteristic of the plan was, that the apparatus should be of such a nature that the material could be made by any ordinary workman, in any locality. The signals consist of luminous flashes borrowed from the sun, or obtained from the combustion of oxygen of magnesium, or of certain pyrotechnic mixtures; the last were found to yield the most powerful effects. The experiments were carried on for three months at Nismes. The efficacy of the signals was greatly increased by the use of the lighthouse erected at Aigues-Mortes, by Fresnel, in the year 1822. M. Le Verrier's report is very voluminous, giving all the practical details of execution, and is illustrated by a considerable number of drawings. The system was worked out so that the working might be commenced in forty-eight hours, either to place Lyons in communication with the Alps, or for the service of the various military staffs, if circumstances had called for its operation. The plates accompanying the report are drawn to scale, and include a plan of the station. It is needless almost to add that a good system of signals has quite as much value with respect to navigation as in military matters.

EDUCATIONAL NOTES.

The Music Question.—Mr. W. E. Forster, in explaining the modifications in the New Code, stated the means by which he proposed to encourage the teaching of music. He expressed his belief that this can be best done by making it part of the school work in all elementary day schools, infant as well as others; and he had, therefore, included among the new Minutes a provision that, after the 31st March, 1872, the grant to day schools shall be reduced "by one shilling per scholar on the average number in attendance, unless the inspector be satisfied that vocal music is made a part of the ordinary course of instruction." He explained that this provision must, of course, be laid on the table of the House again at the beginning of next session; but, in the belief that it will be then approved by the House, he stated now that it will be inserted in the Code of next year, in order that managers may this year make arrangements for teaching singing in those schools in which it is not already taught, and especially in order that the School Boards may provide for it in their new schools. By the end of this year he hoped also to have arranged for inspectors of music. On this last point, a correspondent of the *Daily News* suggests that the services of the different choir-masters of the Church choral unions might be made available. He says that their work is almost entirely, from its nature, in the evening, so that they are unemployed all day, and he believes them to be thoroughly competent for the musical inspection of primary schools, and that they would gladly undertake the work for a modest remuneration.

School Attendance.—In the modifications of the New Code, explained by Mr. Forster on Monday evening, it has been arranged to allow the attendance of children to be counted between the ages of three and four, though they will not be paid for unless they are four on the day of inspection. As regards night schools, for one year they will be required to be open 60 instead of 80 times, and from each scholar will be required 40 instead of 50 attendances.

The London School Board.—At the meeting of this Board, on Wednesday, a long discussion took place on the report of the Statistical Committee, the point in dispute being, how far the inquiry into the state of existing schools should be undertaken by the Board, or relegated to the Education Department. Ultimately the matter was decided as follows:—"That the inquiry into the 'suitability' and 'sufficiency' of the existing schools, points which must be determined largely by a reference to the social and religious condition of a district, be undertaken by the Board, but that the inquiry into the 'efficiency' of the schools be left in the hands of the Education Department." Upon the question of musical teaching it was unanimously resolved, "That singing be taught, so far as it may be possible, in the Board schools, as a branch of elementary education."

Physical Education.—In an address delivered by Mr. W. P. Brookes at the Crystal Palace, at the first Gymnastic Festival of the National Olympian Association, no less than four years ago, a remarkable contrast was drawn between France and Prussia in the matter of physical education. Mr. Brookes shows that for many years gymnastic exercises and outdoor amusements have been supported and encouraged throughout the length and breadth of Prussia, and that the body is as much educated in Germany as the mind. In France, we are told, that out of 1,000 youths registered in 1863 as the contingent to be furnished by certain cantons for the conscription, 731 were rejected by the revision board as physically unfit to bear arms, a degeneracy which a writer in the *Siècle* attributed to two causes, viz., excessive labour in the manufacturing districts, and the want of gymnastic training in the public schools.

Practical Training of Girls.—Miss Louisa Twining, in a long and interesting letter on this subject, points out the evils of the general ignorance on the part of girls of the practical duties of life, whether in domestic economy, industrial or household work, or the knowledge of common things. "All that pertains to the maintenance of physical life and health has been utterly ignored in the teaching of women and girls; and yet what can be more important? The very well-being of the race and the nation depends upon it, and indeed so vast would be the influence and effects of imparting this knowledge to women, that it ought to be placed first in the list instead of last." The writer thinks it would "be better to teach them the laws of life and health, and the structure of their own and their children's bodies, than the names and lengths of rivers and heights of mountains that they will never see." And with regard to their home duties, she suggests that "a public kitchen be attached to every national school, at which numbers in every parish would be thankful to procure well-cooked food, and in which each girl in turn should have the opportunity of acquiring competency and gaining prizes." As to needlework, she thinks that if a sufficient supply cannot be provided by the girls from their own or their families' stores, dresses and other garments should be taken in to be made, and no girl should leave the school till she could cut out and make them. And, for the teaching of sanitary matters, and more especially the care of children, she proposes that a nursery should be connected with the school, "to which the baby brothers and sisters might be brought, to be fed, and washed, and cared for, and washed for by their elders."

CORRESPONDENCE.

MR. FERDINAND KOHN'S PAPER.

SIR,—As bearing upon one of the statements made by Mr. Ferdinand Kohn last Wednesday, in those very able remarks which he made at the close of his lecture, namely, that by imparting motion to a liquid during fermentation, that fermentation is found to be rendered much more active, will you allow me to state what I conceive the reason to be, from some experience of mine on a large commercial scale.

I had the honour of erecting works for the manufacture of flax on a large scale for the late John Fergus, Esq., M.P., and I found that, by causing a small stream of water, at a certain temperature, to pass through the "steeping" vats during the fermenting process, I greatly hastened and perfected that process, so that I was enabled, by this simple means alone, to greatly increase the value of the flax produced, as much, indeed, as to nearly double its value.

In this case, the stream of water not only imparted motion to the liquid in the act of fermentation, but otherwise kept it "sweet," by removing the antiseptics which are formed, during the latter stages of the process, in fermenting stagnant water, and so prolonged its fermenting power.

In Mr. Kohn's case, viz., that of fermenting more perfectly the saccharine extract of beetroot by the aid of motion of the liquid only, I conceive the result to be due to the formation of those same antiseptics being deferred, by the act of bringing fresh particles of water in contact with the fermenting medium. It is an important subject, well worthy the attention of our great distillers.—I am, &c.,

JOHN C. WILSON.

THE PRINCE CONSORT MEMORIAL IN HYDE-PARK.

Sir,—In continuation of my letter of last week on this subject, containing a suggestion, with some details, for a central support to the lofty spire of the memorial, which now impends over vacancy, I would ask space for an extract from the introduction to Mr. James Fergusson's excellent "Handbook of Architecture." The passage occurs under the head "Stability," and is as follows:—"Next to size, the most important element is stability. By this is meant not merely the strength required to support the roof or to resist the various thrusts and pressures, but that excess of strength over mere mechanical requirement which is necessary thoroughly to satisfy the mind, and to give to the building a monumental character, and an appearance as if it could resist the shocks of time or the violence of man for ages to come." The columns of the memorial now appear weak to support the elaborate superstructure which, in its present state, would appear rather to threaten than to perfect any central statue of the Prince which may be placed beneath it, for the present box only encloses a plaster cast. The simplest way of effecting the fact and appearance of stability of which Mr. Fergusson speaks, would seem to be to discard the idea of a central statue altogether, and adopt in its stead some elegant but substantial and natural support, which should carry the whole weight of the spire, and, at the same time, afford, coved into it, beneath the protection of the canopy, niches to receive one or more statues of the Prince in an erect posture, in marble, and not of such enormous dimensions as those of the models which have been hitherto tried under the canopy—dimensions which remove portraits from humanity, and dwarf everything around them, without gaining for them any true additional dignity.—I am, &c.,

Epsilon.

March 20th, 1871.

THE COMMERCE OF INDIA.

Sir,—I am glad Dr. A. Campbell has taken some notice of my paper on "The Commerce of India." One thing I request to be borne in mind. My paper was not on "the blessings of the British rule." On that subject, I think I have not spoken less emphatically and clearly than anybody else, on various suitable occasions. What I, at present, have endeavoured to do is, to submit for the consideration of the English public the commercial and economical condition of India as it is, its causes and remedies. As Sir B. Frere has fairly explained my object, I need not say more. As to any omissions by me, it cannot be expected that I could treat such a large subject, in all its details, in one paper. I shall rejoice at all friends of India coming forward to say what they think desirable for its good, and to discuss, step by step, and carefully, the real condition of the mass of the people.

As to the question, whether I represent the sentiments of any of my countrymen, I can only send you the enclosed,* if you think fit to put it in, as it shows that my humble efforts have met with some approbation; and, so far as I am aware, I think the kind testimonial received the approval of almost all the principal native papers of India.—I am, &c.,

Dadabhai Naoroji.

East India Association Rooms,
March 21st, 1871.

Sir,—It seems a pity, looking at the real wants of India, as to which England cannot be indifferent, that her case should be prejudiced by such statements as that of Mr. Naoroji, when he talks of the drain of £500,000,000 (or of £12,000,000 a-year) to England.

The drain, such as it is, is made up of several elements, such as expenditure of the Indian government in England, interest on loans and on commercial accounts current, and dividends on investments in Indian enterprises, "home pay," or remittances of portions of salaries earned in India to England, and lastly, the transmission to England of fortunes amassed in India.

The grievances of India, such as they are, resemble those of Ireland. Non-resident proprietors represent a benefit missed, not an evil inflicted. The positive evil of which Indians have a right to complain, is, that their budget is not framed as it would be were regard for Indian interests the sole idea of the framers. Let them direct their attention to this point, and not occupy themselves with sentimental grievances.

The fact is worth recalling, that other nations besides India pay "tribute to this country. The United States pay a large annual sum for interest and dividends, without being the worse for it. Is it a grievance if a Cornish miner located in Brazil sends home the bulk of his earnings to his wife?

It is too often forgotten that commerce in itself must, on the whole, be profitable for both sides; and that payments for value, if they turn the balance of commerce, do not, therefore, signify loss, but only absenteeism. It is better for India to pay interest in cotton or indigo than in coin.

As respects the statistics of commerce, I should be glad to know how far they are really reliable. The values of exports entered in the tables may represent the notions of the shippers, and yet far exceed the proceeds for which they ultimately get credit. Anyone accustomed to commerce is aware of the frequent wide discrepancy between *pro-forma* invoices and net proceeds of account sales.

One reason for the excess of exports apparent on the face of the tables may be the omission of freight from the value attached to imports. Whether the accounts be so framed or not, it is apparent that they should be regulated on that principle, very little of the foreign trade of India being carried on in Indian bottoms.

I am not aware of the existence of any tables which show with such truth the values of the exports and imports of a country as to admit of a reliable calculation of the profit made by the mercantile community being based thereon. I take for granted that India is no exception to this rule, but, doubtless, if attention be turned to details, and not wasted on generalities, much may be done towards ascertaining the real circumstances and remedying the defects, whether of financial admistration or of commercial law, of which India can justly complaim.—I am, &c.,

Thomas A. Welton.

Clapham, March 11th, 1871.

PREPARED COFFEE-LEAVES.

Sir,—I quite agree with Mr. Macpherson that a medal from the Society would be misplaced for the encouragement of prepared "coffee-leaves" or coffee-tea. It is nasty stuff, neither tea nor coffee, but a bad *tertium quid*, which might help for adulterating tea more than for any other use. I speak of it as prepared in the same way as tea, the only way I know it. I am not sure that it can be produced at a cheaper rate than tea. The coffee plant which is stripped of its leaves will most probably be deficient in berry, and if so, this will enhance the cost of the leaf, and may alter the quality of the berry. I would suggest that, instead of giving a medal in the present position of the "coffee-tea," the Society would do better to reserve its offer of a medal for the best essay on Indian tea for another year.—I am, &c.,

A. Campbell.

March 7th, 1871.

PATENT LAWS.

Sir,—Having in my two last parried the blows of your correspondent Mr. Reveley, it is now, I think, my turn to attack. I am certainly entitled to object to his simply asserting that I am wrong, and to hold him to the proof, at any rate in one or two cases. I shall not be hard upon him; but shall only ask him, and shall expect him to prove, or explain to the satisfaction of yourself and readers, the following three points:—

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* Copy of an address presented, with purse, to Mr. Dadabhai Naoroji before leaving Bombay, in 1869.

1. To explain (too futile for him to notice, won't do) how it was that, during the thousands of years prior to the introduction of the system of patents, the progress of industrial art was so slow; and, how it comes to pass that it is only since the introduction of this system of rewards—which he holds is a drag, and does no good—that industrial art has made the rapid progress it has, and that, too, in a ratio proportionate to the increase in the number of patents or rewards granted? Common sense suggests an answer at once, namely, that it is due to the rewards which the system of patents has held forth. Mr. Reveley, however, says "No." He is bound, therefore, to say to what he considers it is due.

2. Necessity. There are numberless points under this head which he might be asked to prove, but take this, the electric light, as the continuous efforts to work it are familiar to the public. Let him prove that there is any necessity for this. No one denies that it would be a great improvement, or that in many cases it would be more convenient, or more suitable, but where is the necessity?

3. As Mr. Reveley would sweep away this system of rewards as doing no good, thereby implying that men will work without it, that is, without a reward, let him point out a single instance where this is the case. The general impression is, that men will not do so, but your correspondent appears to be satisfied to the contrary.

It is not supposed that, were our system of rewards swept away, there would be no improvement, or no new ideas introduced. Manufacturers who have a good business and large capital would always be seeking to introduce improvements and bring out new ideas. Many professional and many well-to-do men, with plenty of means and spare time on their hands, would also follow in the same course. The increased employment to the capital of the former, and the fame arising to the latter, would still continue to be inducements to such, without any other reward, just as they were inducements before the advent of our system of patents, though they affected industrial art but little. But it is wished to secure to the nation the ideas, not only of these, but also of the millions of keen intellects which do not enjoy the advantages of these others; intellects sharpened by poverty and the desire to rise, and many of which, for power and grasp, are fully equal to any of the others. These were all lost to the nation before the introduction of our system of rewards; and a comparison of the progress of industrial art, before and since, exhibits the wisdom of the introduction, and foreshadows the folly there would be in sweeping it away.

We have seen that your correspondent, in his desire to be true to his principles, would not only sweep away this system of rewards, but that of copyright as well. So far he is consistent, but only so far. To be consistent out-and-out, he must sweep away not only these, but every other form of reward, no matter what.

Our labouring classes, and our mercantile and professional men, all work for reward; let him sweep them away. Our military system is also one of reward; let him sweep it away at the same time. Above all, our system of pensioning is one of reward, and one, too, of the very worst kind. It is not given for labour done day by day, but for labour done years before, and which, besides, drew a reward at the time it was done. Let him, therefore, whatever he may do to the others, sweep this away as an encouragement to idleness, and a "national nuisance." Truly, Mr. Reveley has cut out a nice little piece of work for himself, but there is nothing like being consistent. In the meantime, to our subject.

You may often hear it asserted, "that a successful inventor makes for himself a position which carries a sufficient pecuniary reward without any patent." Taken from one point of view, this is undoubtedly a self-evident proposition, nay more, it is a kind of Irish bull, as we need hardly be told that a successful man is successful; but from its other point of view, the proposition is not true. The key to the matter lies in the word "successful," which has here two meanings. It means successful in regard to perfecting an idea, and successful in regard to obtaining the reward.

It does not, however, follow that because a man is successful in regard to the first, that, therefore, he is the same in regard to the second. In such cases, the proposition is not true, but it certainly is very apt to mislead, and does so.

The carrying of the principle into practical effect would be most unjust. It may be illustrated in this way:—

Captain Moncrieff has perfected a great improvement in gun carriages, and has earned a reward. Government, instead of allowing him to reap the reward in the usual way, has bestowed it in hard cash. Would it have been just, or even wise, to have said to him, "You have earned the reward, we admit, but we do not see why you should enjoy the monopoly of it. We, therefore propose to throw it broadcast to Tom, Dick, and Harry, and you must just be content with what you can secure in the general scramble." Of course the man with the largest thews and sinews would come off best, and possibly the Captain get nothing.

The same gross injustice would follow its application to inventors. They would virtually be told, "Your right to the reward is admitted, but it is not seen why you should enjoy a monopoly. Your invention is, therefore, thrown broadcast to all, and you will no doubt be amply rewarded in what you secure in the general scramble that follows." The thews and sinews of commerce and manufactures are "capital," and the man with the largest capital would certainly carry the day, and the inventor, as has been already but too often the case, gets nothing. If such a mode of reward would have been unjust in Captain Moncrieff's case, it would be equally so in any other.—I am, &c.,

H. F. Alexander.

Edinburgh, March 11th, 1871.

GENERAL NOTES.

Institution of Naval Architects.—The Council of the Society have granted the use of the Hall for the meetings of the Institution of Naval Architects, which will be held as follows:—Thursday, March 30.—Morning meeting, at 12 o'clock. Annual report of the council. Address by the President. The following papers will then be read and discussed:—"On the Improved Compound Engines, as fitted on board H.M.S. *Briton*," by G. B. Rennie, Esq., Mem. Inst. C.E., Member; "On Steel as applied to Shipbuilding," by J. B. Howell, Esq., Associate; "On a New Method of Testing Metals," by Lewis Olrick, Esq.; "On a Plan for Conveying Railway Trains across the Straits of Dover," by Evan Leigh, Esq., Engineer, Associate. Evening meeting at seven o'clock:—"On Certain Strains to which Ships are subject," by E. J. Reed, Esq., C.B., Member and Vice-President; "On the Relative Influence of Breadth of Beam and Height of Freeboard in Lengthening out the Curves of Stability," by Nathaniel Barnaby, Esq., President of the Council of Construction to the Admiralty, Member of Council; "On Calculations of the Stability of Ships, and some points of interest connected threwith," by William Henry White, Esq., Associate, and William John, Esq., Associate; "On the Efficiency of Jet Propellers," by M. B. Brin, Director of Naval Construction, Ministry of Marine, Florence. Friday, March 31st.—Morning meeting, at 12 o'clock:—"On a New Method of Mounting, Lowering, Raising, and Turning Turrets in Iron-clad

Ships," by Rear-Admiral Inglefield, C.B., F.R.S.; "On the Measurement of Yachts," by Henry Liggins, Esq., Associate; "On the Measurement of Yachts, and Allowance of Time in Competitive Sailing," by Charles H. Haswell, Esq., Civil and Marine Engineer, Associate; "On Completing the Launching of Ships which have stopped on their Launching Slips," by William Braham Robinson, Esq., master shipwright and engineer, H.M. Dockyard, Portsmouth, Member of Council; "On the Position of the Masts in Merchant Ships," by William Symington, Esq., Associate. Evening meeting, at seven o'clock:—"On the Working Expenses of Steamers of Small Size," by A. F. Yarrow, Esq.; "On the Commercial Economy and Performance of several Types of Merchant Steamers," by Walter C. Bergius, Esq.; "On a Vessel in Motion and what becomes of the Water she Disturbs," by Henry Ransford, Esq., Associate; "On the Depolarisation of Iron Ships," by Charles F. Henwood, Esq., Associate. Saturday, April 1st.—Morning meeting, at 12 o'clock:—"On some particulars of the Iron Sailing Ship, *Richard Cobden*," by John Grantham, Esq., Member of Council; "On the Correction of Compasses in Iron Ships," by Thomas Brassey, Esq., M.P., Associate; "On Sheathing Iron Ships," by Howard Ninnis, Esq., Associate; "On further Experiences of the Applicability of Zinc for Sheathing Iron Ships," by C. F. T. Young, Esq., Associate; "On the Steering of Ships," by Evan Leigh, Esq., Associate; "On a Pneumatic Sounding Machine," by Walter C. Bergius, Esq. Members of the Society are invited to attend.

Maritime Reciprocity.—A chart has recently been prepared in the *New York Journal of Commerce*, showing the practical workings of the maritime reciprocity with the United States. The chart has been compiled from the commercial statistics of the United States and the British Empire from 1856 to 1870. The following are the statistics given:—

Year.	Total American tonnage entered at British Empire ports.	Total British tonnage entered at ports of U.S.
1856	2,346,280	935,180
1857	2,184,380	965,570
1858	2,207,496	918,992
1859	2,124,537	1,098,497
1860	2,089,307	1,260,458
1861	2,721,384	1,148,092
1862	2,142,137	1,152,685
1863	1,553,778	1,353,476
1864	1,384,373	1,909,712
1865	1,096,388	1,788,663
1866	1,105,857	2,410,209
1867	1,231,875	2,406,300
1868	1,215,000	2,346,741
1869	1,200,000	3,662,797
1870	—	2,789,656

Thus it appears that, prior to 1862, the tonnage of American vessels entered at British ports was double the tonnage of British vessels entered at ports in the United States; but that since 1865, the tonnage of British vessels entered at ports in the United States has been double the tonnage of American vessels entered at British ports. The prominent and persistent cause of this complete reversion of the relative shipping interest of the two countries is stated to be attributable solely to the changes which steam and iron have wrought both in the vehicles and the modes of commerce. The question raises itself, whether the relations of maritime reciprocity which were established especially for meeting the requirements of the random sort of trade pursued by sailing ships, should not be very materially modified, in order to subserve our interests in the direct commerce pursued by steam-vessels. Practical results show thus far that the present relations of maritime reciprocity are all in favour of British steam navigation and all opposed to American steam navigation.

Deep Sea Explorations.—Dr. Carpenter, in a lecture delivered at the Royal Institution, considers the absence of animal life at great depths is caused by the presence of mud so fine as to be held in permanent suspension, which mud would probably clog the gills or other respiratory membranes of the deep-sea fauna. This has been especially noted in the Mediterranean.

Animal Temperature.—It has been ascertained by Mr. Bernhardt and Dr. Jacobson, that in even the severest cases of inflammation, the temperature of the part affected cannot rise above the degree of warmth existing at the source of circulation. It is a curious fact that the blood in the left side of the heart is warmer than in the right.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

March 29.—On "Woman's Work, with Special Reference to Industrial Employments." By Miss Emily Faithfull.

April 5.—*Passion Week.*—No Meeting.

MEETINGS FOR THE ENSUING WEEK.

Mon. .. London Institution, 4. Mr. R. A. Procter, "On Astronomy" (Educational Course.)
Royal Geographical, 8½. 1. Letter from Sir Samuel Baker to Sir Roderick Murchison. 2. Mr. S. S. Cooper, "On the Chinese Provinces of Yunnan and its borders."
Medical, 8.
Actuaries, 7. Mr. Andrew Baden, "On the Equitable Apportionment of a Fund between the Life Tenant and the Reversioner."
Institution of Surveyors, 8. Mr. Morgan, on "The Results of Sewage Farming at Barking."
Royal United Service Institute, 8½. Adjourned discussion on the paper by Capt. J. G. Goodenough, R.N., on "The Preliminary Education of Naval Officers."

Tues. ...Royal Medical, 8½.
Civil Engineers, 8. 1. Discussion on "Clevedon Pier" and "Viaducts on Cambrian Railway." 2. "Mr B. Samuelson, "Description of two Blast Furnaces, erected in 1870, at Newport, near Middlesborough."
Ethnological, 8.
Royal Institution, 3. Dr. Foster, "Nutrition of Animals."
East India Association, 8. Sir James Elphinstone, Bart., M.P., "The Proposed Plan of Cutting a Channel for Ships between India and Ceylon, and the Harbours and Lights on the Coast of India." (At the Westminster Palace Hotel.)

Wed. ...**SOCIETY OF ARTS, 8.** Miss Emily Faithful, "Woman's Work, with Special Reference to Industrial Employments."
Royal Albert Hall of Arts and Sciences, 12. Opening of the Hall by Her Majesty the Queen.
Social Science Association, 8. Mr. W. H. Michael, on "The Report of the Royal Commission on the Sanitary Laws."

Thurs...Institute of Naval Architects, 12. Evening Meeting at 7. (At the House of the **SOCIETY OF ARTS**.)
Royal Institution, 3. Dr. Odling, "Davy's Discoveries."
Royal, 8½.
Antiquaries, 8½.
Chemical, 8. Annual Meeting.
Philosophical Club, 6.
Artists and Amateurs, 8.
Society for the Encouragement of the Fine Arts, 8. Mr. J. W. Walton, Selections from Lord Lytton's Play, "The Lady of Lyons," and a Sketch of the Author's other Works."
London Institution, 7½. Prof. Bentley, "On Economic Botany."

Fri.......Institute of Naval Architects, 12. Evening Meeting at 7. (At the House of the **SOCIETY OF ARTS**.)
Royal Institution, 9. Prof. Max Müller, "Solar Myths."
Royal United Service Institution, 3. Colonel R. J. Loyd-Lindsay, M.P., on "Aid to the Sick and Wounded in War."

Sat ......Institute of Naval Architects, 12. (At the House of the **SOCIETY OF ARTS**.)
Royal Institution, 3. Mr. O'Neil, "The Spirit of the Age."
Royal School of Mines, 8. Dr. Cobbold, F.R.S., "Geology." (Swiney Course.)
Associated Arts Institute, 8¼. Mr. A. B. Donaldson, "On Art and Civilization."

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FRIDAY, MARCH 31, 1871.

OPENING OF THE ROYAL ALBERT HALL OF ARTS AND SCIENCES.

Four years ago—on the 20th May, 1867—the ceremony of laying the foundation stone of the Royal Albert Hall of Arts and Sciences took place, in the presence of the Queen and the royal family, the ministers of state, and members of both houses of the legislature, and about 5,000 spectators. Her Majesty was on that occasion received by the Prince of Wales as chairman of the Provisional Committee, and by the Duke of Edinburgh. The prince read an address, and presented a report, which was graciouly responded to by the Queen, who expressed at the same time her wish that "this hall should bear his name to whom it has owed its existence, and be called the Royal Albert Hall of Arts and Sciences." Her Majesty then proceeded to lay the first stone, and, having declared it to be "well and truly fixed," a brief prayer was offered up by the Archbishop of Canterbury, and the band and chorus executed a piece of music, the composition of the Prince Consort. An account of the proceedings is to be found in the *Journal*, on page 435, vol. 15.

To recall to the memory the fact that to the Prince Consort is due the idea of associating at South Kensington a group of edifices devoted to those pursuits whose interests he had so nearly and dearly at heart, reference may be made once more to his reply to the address delivered by Dr. Lindley, the Secretary of the Horticultural Society, in 1858, in which he says, speaking of the garden of the Horticultural Society:—"We may hope that it will at no distant day form the inner court of a vast quadrangle of public buildings, rendered easily accessible by the broad roads which will surround them—buildings where science and art may find space for development, with that air and light which are elsewhere well-nigh banished from this overgrown metropolis." It was therefore most eminently fitting that the monument decreed by a sorrowing nation to the beneficent prince whose loss we shall never cease to deplore should be erected in close contiguity to the scene of his thoughtful and useful labours; and, indeed, the Royal Albert Hall must be regarded as essentially a part of the Albert Memorial as Mr. Gilbert Scott's enriched canopy and as Mr. Foley's statue can be.

The Albert Hall was opened in person by Her most gracious Majesty the Queen on Wednesday, the 29th of March.

Her Majesty was accompanied by the Royal Family, and attended by the Great Officers and the Household in Waiting. The Royal procession consisted of nine carriages, accompanied by a field officer's escort of the Royal Horse Guards. A guard of honour of the Coldstream Guards was mounted at the entrance to the hall, and a guard of the Yeomen of the Guard, with the Exon in Waiting, was on duty in the interior. Precisely at half-past twelve o'clock, the time fixed, the approach of the Royal procession was notified to the provisional committee, who, with his Royal Highness the Prince of Wales, as president, at their head, assembled at the principal entrance to receive her. Preceded by the committee, and by Earl Granville and Mr. Bruce, the two Ministers in attendance, accompanied by the Prince of Wales, and followed by the other members of the Royal family and suites, Her Majesty, plainly dressed in black, with a small wreath of white flowers in her bonnet, was conducted with slow and stately pace to the daïs and the temporary throne placed thereon, greeted on her way with right hearty plaudits, which she was graciously pleased to acknowledge by bowing repeatedly to right and to left.

Advancing towards the Queen, who sat with her back to the orchestra, and fronting the rest of the audience, the Prince of Wales read the following address:—

"May it please your Majesty,—As President of the Provisional Committee of the Royal Albert Hall of Arts and Sciences, it is my high privilege and gratification to report to your Majesty the successful completion of this Hall, an important feature of a long-cherished design of my beloved father, for the general culture of your people, in whose improvement he was always deeply interested. Encouraged by your Majesty's sympathies, and liberally supported by your subjects, we have been enabled to carry out the work without any aid from funds derived from public taxation. I am warranted in expressing our confidence that this building will justify the conviction we expressed in the report submitted on the occasion of your Majesty's laying its first stone, that by its erection we should be meeting a a great public want. Your Majesty's Commissioners for the Exhibition of 1851, in further prosecution of my father's design for the encouragement of the Arts and Sciences, an object which he always had warmly at heart, are about to commence a series of Annual International Exhibitions, to the success of which this hall will greatly contribute by the facilities which it will afford for the display of objects and for the meeting of bodies interested in the industries which will form the subjects of successive Exhibitions. The interest shown in the hall by the most eminent musicians and composers of Europe strengthens our belief that it will largely conduce to the revival among all classes of the nation of a taste for the cultivation of music. Your Majesty will hear with satisfaction that results have justified the original estimate of the cost of the building, and that, aided by the liberal assistance of your Exhibition Commissioners, the corporation will commence its management unfettered by pecuniary liabilities, and under conditions eminently calculated to insure success. It is my grateful duty to return to your Majesty our humble thanks for the additional mark of your Royal favour which is conferred upon us by your auspicious presence on the present occasion, when our labours as a Provisional Committee are drawing to a close. We venture to hope that when we shall have resigned our functions into the hands of the governing body, which will be elected under the provisions of the Royal Charter granted to us, your Majesty will continue to the Corporation that measure of support which has been always graciously given to us."

At the conclusion of the address the Queen took from the Home Secretary a written reply, and, speaking to the Prince of Wales, said:—"In handing you this answer I wish to express my great admiration of this beautiful Hall, and my earnest wishes for its complete success." The written reply, which was not read, was as follows:—

"I thank you for the loyal address which, as President of the Provisional Committee of the Hall of Arts and Sciences, you have presented to me. In opening this spacious and noble hall, it gives me pleasure to acknowledge the generous spirit which has been manifested in the completion, by voluntary effort, of a work promising so much public usefulness. I cordially concur in the hope you have expressed, that this hall, forming as it does part of a plan in which I must ever take a deep and personal interest, may largely and permanently contribute to the promotion among my people of the love of art, as well as to the success of the annual exhibitions, which will bring successively into instructive competition the choicest products of the industries of all nations. These objects could not fail to commend themselves at all times and all places to my sympathy and interest, fraught as they are with recollections of him to whose memory this hall is dedicated, and whose dearest aim was to inspire my people with a love of all that is good and noble, and, by closer knowledge and juster appreciation of each other, to cultivate a spirit of good-will and concord among the inhabitants of all regions. I gladly give the assurance of my support to the corporation to which the hall is about to be entrusted, and I earnestly hope that their efforts to promote the objects for which it has been constructed may be rewarded by a career of abiding success."

The Bishop of London, representing the Archbishop of Canterbury, then repeated the following prayer:—

"Almighty and most merciful God, under whose protecting care this work, begun in Thy holy name, has been brought to its completion, fulfil and perfect, we beseech Thee, the designs of those who have erected this fabric for Thy honour and glory, and for the moral and intellectual culture of Thy people. Grant that within these walls may ever be sought and found the knowledge which humbles while it elevates, the tastes which purify while they adorn, and only those true pleasures which are unsullied by the stain of evil. Sanctify human science by the grace of heaven; imbue the creations of art with the 'beauty of holiness,' and make each step in the discovery of truth a nearer approach to Thee who art the truth itself. Give peace in our time, O Lord, and knit the hearts of all together in loyalty, unity, and Christian brotherhood. For Jesus Christ's sake. Amen."

The Prince of Wales, turning his face to the audience, said—"The Queen declares this Hall to be now opened.' The audience then cheered. Trumpets sounded, the choir sang the National Anthem, and a Royal Salute was fired by a battery of Royal Artillery in the park. The Queen and the rest of the Royal visitors then proceeded to the Royal box, returning across the arena and thence up the staircase leading to the grand tier level. Her Majesty stopped more than once to bow her acknowledgments of the hearty cheering which greeted her. In the Royal box, which consists of two boxes thrown into one, the central seat in the front row was occupied by Her Majesty, on whose right sat the Princess of Wales, the Duke of Saxe-Coburg, and the Princess Christian, while on Her Majesty's left were the Prince of Wales, the Princess Louise, and the Princess Beatrice. Behind were Princes Arthur and Leopold, Prince Christian, and the Marquis of Lorne.

A biblical cantata was then performed, the music being composed expressly for the occasion by Sir Michael Costa, the words being taken from the Bible. Madame Lemmens Sherrington, Madame Patey, Mr. Vernon Rigby, and Mr. Santley were the soloists, and Sir Michael Costa conducted the band and chorus of 1,100 performers. At the conclusion of the cantata Her Majesty the Queen left the Hall amid great cheering, and the rest of the concert was proceeded with. Their Royal Highnesses the Prince and Princess of Wales remained till its conclusion. The music performed included the composition of the Prince Consort, performed at the laying of the foundation stone, "L'Invocazione all 'Armonia."

The Times says:—"The tide of fashionable life began to set Kensington-wards soon after 10 o'clock. The doors were opened at half-past 10 o'clock. Nearly 8,000 people had to enter, but the visitors found no crowd, and no particular use for elbows. It was not, perhaps, quite a disappointment, but certainly a great surprise. Eight thousand well-dressed Englishmen and Englishwomen brought together, and no skirts damaged, no nerves shaken, no eager rush by six people to pass at the same moment through a narrow entrance meant only for one! It was almost incredible, but the fact remains. The new Hall, with its abundant entrances, has destroyed that secret sweet satisfaction derived from a contemplation of the jostling and confusion which your friends complain of, but which, through being prompt and early, you have avoided. Yesterday the people entered rapidly, and left the building much more rapidly, yet nobody was forced to rub shoulders with anybody.

"The seats were numbered, and a staff of 150 stewards supplied desired information. This portion of the day's arrangements was in the experienced hands of Mr. Davis Sims, Mr. W. Withall, Mr. W. O. Mitchell, members of the Sacred Harmonic Society, and Mr. Coe. But the numerous doors, corridors, staircases, and approaches—that is to say, the architect who designed them—must have the chief credit for the delightful ease in entering and leaving the building.

"Soon after 11 the hall seemed pretty nearly full. The chorus, some 900 strong, were punctual; and, marshalled in rising rows of benches—altos, sopranos, contraltos, tenors, and basses, all seated according to their kind—they formed, with the organ and orchestra, the stage to which all eyes were directed. At the base of the orchestra, trenching therefore upon the arena, a daïs was erected, upon which was placed a chair of state for the Queen. High overhead, so as not to interfere with the line of sight, was hung a canopy of purple velvet. The floor of the daïs, covered with a red carpet, was approached by a staging raised slightly above the level of the arena. Entering, therefore, at the northern porch, the Queen would pass by a flight of carpeted steps from the level of the *loggie* boxes to that of the arena, and walk along the centre of the ellipse to the daïs. The Yeomen of the Guard were stationed two and two at intervals along the staging, which was covered with crimson cloth. Their halberds, their Tudor frills, the scarlet uniform and plentiful gold lace, the quaint black velvet caps with circlets of gay-coloured ribands, added a quaint tone of mediævalism to the otherwise specially eighteenth-century spectacle."

The Daily News says:—"The Albert Hall of Arts and Sciences proved to be successful yesterday in the matter in which large public buildings usually fail. Its acoustic properties are perfect. It is not only possible to hear music in it, but to hear a single voice. The Prince of Wales naturally thought it necessary to raise his voice to a very high pitch; but he was not only heard, but heard to be speaking in a loud voice, all over the Hall. The voices of the solo performers in the musical part of the opening ceremony were audible with equal ease, and the general effect of the whole musical performance was exceedingly grand and beautiful. London now possesses a hall in which eight thousand persons can be addressed by a person of clear enunciation and good voice, and in which the full effect can be given to orchestral music. Such a hall is fitly named after the Arts and Sciences. It is itself an example of artistic and scientific architecture; and we hope that its acoustic success may cause architects who erect buildings for any purpose in which the human voice has to be employed, to take some account of their use in forming their designs. A building which is really adapted to the purpose for which it is erected is quite sufficiently an architectural novelty for that particular point to be worthy of note. Whether two thousand people thinly scattered over the Hall will hear as well as eight thousand did yesterday may be doubtful. But if not, the management must be liberal, and draw the people in, so that it shall be always full. The hall is sure to be useful; and, in its utility as an instrument of popular art education and art amusement, will be a far better memorial to Prince Albert than the gaudy structure on the other side of the road."

Accompanying the official programme and book of words, was an interesting account of the Hall, written by Mr. Gilbert R. Redgrave. Most of the information has been given from time to time in the *Journal;* the following, however, contains some details which may be added to the account given of the Hall at the time of laying the foundation stone and the record of its progress since:—

In the main outlines of the structure the architect (Colonel Scott) has adhered to the plans of the late Captain Fowke, R.E., under whose direction the earlier drawings of the building were prepared, and who had, after a long series of experiments, determined upon a somewhat similar form, as the one best suited to the objects for which the Hall was intended. The designs of Captain Fowke have been utilised, however, only so far as regards the main features of the plan. We owe to him the system of staircases, corridors, and exits, the form of the roof, and the main proportions of the building; but to Colonel Scott is due the precise form of the Hall, the architectural façade, the internal arrangements of the building generally, and the working out of the structural problems which necessarily arose in executing so novel a design. The plan of the late Captain Fowke had semicircular ends, with flattened sides. The present Hall is nearly a true ellipse; the balcony was first introduced by Colonel Scott, and he substituted the glass roof for the plaster ceiling originally contemplated. The porches and the frieze were added by the Colonel, and the elevation entirely remodelled.

The style of the building is Italian Renaissance, the materials of the façade being entirely red brick and terra cotta. On a massive base of the latter material, some 13 feet in height, is a plain, red brick storey, with deeply-recessed, square-headed windows. The principal floor has semi-circular headed windows, and is divided into bays by pilasters which support the main entablature, and a balcony having a projection of about 4 feet from the building. Above the balcony is another plain band of brickwork, pierced with occasional doorways, giving acess to it from the picture gallery, and above this again is a frieze in mosaic work, surrounding the building in one unbroken sweep; the cornice over the frieze is also of terra cotta, and is deep rather than projecting. This cornice and blocking course terminates the outer wall of the building; but 20 feet back is the main wall which supports the roof, and this, from being carried up much higher than the front wall, appears above it, and has been accordingly faced with red bricks, and enriched with some plain string courses of terra cotta. The side porches have a base and principal storey similar to the main buildings, but the ground floor is partly taken up with the great arches over the carriage drive. These buildings are surmounted by pediments, and terminate at the level of the balcony. The front porch, or Queen's entrance, has three large arches, with two niches for statues, and wide, square-headed openings on the principal storey. The roof is flat, at the same level as the balcony, affording a view of the Albert Memorial, and, on a clear day, of the park and gardens.

The general idea of the design may be described as a large hall or room, containing numerous tiers of seats, encircled by an outer shell of corridors and staircases, giving access to it at every different level of the seating with which it is filled. The flat central floor space of the hall, called the arena, is 102 feet by 68 feet. It is reached by six different staircases; and may either be used as a large open area, or be seated over with chairs so as to accommodate about 1,000 persons. Raised at its lower extremity about five feet above the floor of the arena, and entirely encircling it, is a tier of ten rows of steps called the amphitheatre, capable of seating 1,366 persons. The seats in this part of the building are called the stalls, and nearly half of them have been sold for £100 each for a period of 999 years. Above the stalls, and against the main wall of the hall, are three tiers of boxes, which seat in all 1,100 visitors. Those next the stalls are called the loggie. Above them is the grand tier, and above these again the second tier of boxes. The forty boxes on the grand tier, holding ten persons each, have all of them been sold for £1,000 apiece; and above 60 of the second tier of boxes, and several of the loggie, have already been purchased, the former for £500 each, and the latter for £800. These boxes seat five persons and eight persons respectively. Above the boxes, arranged in a gallery which projects out 21 feet from the wall of the hall, is another of eight rows of seats, capable of accommodating 1,800 people. This is the balcony, and above the balcony, outside the main hall, but communicating with it by means of 30 large arches, is the picture gallery, 20 feet wide, which entirely surrounds the building above the staircase and approaches to the lower floors. From the gallery, a striking view can be obtained of all that is going on in the house at a level of 60 feet above the arena. Four staircases and two lifts provide the means of reaching the gallery, and this is the highest point in the building accessible to the public. The picture gallery might, by means of temporary staging, be arranged, if necessary, to seat a couple of thousand spectators, but for the opening ceremony, only 350 visitors were seated, in two rows, in the arched openings looking into the hall. Altogether, it is estimated that about 8,000 persons can be comfortably accommodated with seat-room, which, on a pinch, might be increased to 10,000. A difficult problem in designing the hall was the construction of the iron roof required for so large a superficies. No building of a similar form, it is said, has been covered in, and the principle adopted has been the construction of a solid continuous curb or plate, which may be best described as a girder laid on its edge. This surrounds the building on the top of the wall, and receives thirty cast-iron shoes at the feet of the different ribs. In the centre of the roof another rigid curb is formed, to which the upper extremities of the ribs are attached, and the whole fabric is thus rendered perfectly strong and secure. The shape of the roof truss has been made use of in order to obtain a complete system of double glazing, an external one upon the upper flange of girders, and an inner one resting upon the lower flange, and on which a pattern in ochre and black is stencilled. Further, to moderate the light, and to prevent excessive reverberation, an awning of unbleached calico is suspended from the centre ring, and looped up round the cove. At the south-end of the arena, stands the organ, of which a full description was given in the *Journal*, No. 949, January 27, 1871.

The ventilation and warming of the hall is a matter which has received considerable attention. Two air-shafts, which have their apertures at some distance from the hall, convey the air to the building; in them the air is strained, by passing it through fine sieves, and washed by means of water-sprays. It is then driven into the main air-chambers by two fans working on the screw principle, each of which has four blades, and these fans are together capable of forcing into the building 3,500,000 cubic feet per hour. The air is warmed in heating-chambers filled with hot-water pipes, the water being heated to about 150 degrees by means of the steam generated in three 25-horse-power tubular boilers. Some conception of the magnitude of the work may be gleaned from the fact that no less than 27,000 feet of 4-inch hot-water piping have been used in the different heating chambers. By driving the air among the hot-water pipes, it may be heated to any extent, and, by means of flues in the walls, the heated air is conducted to every part of the building. By an arrangement of valves, the external air may be driven in by the fans without passing between the pipes, and thus it becomes practicable at all times to regulate to a nicety the temperature of the air entering the hall. To supplement the action of the fans, a powerful exhaust-shaft has been introduced into the centre of the ceiling, 130 feet in area, which is carried some feet above the highest part of the roof. In this shaft a very strong upward current is produced by the use of about 1,260 gas-jets, and owing to the form of the ceiling and the tendency of the heated air to rise, the exhausted air is rapidly sucked out and removed from the hall at this the highest level in it, 135 feet from the floor.

The lighting of the hall is by a ring of burners, 1,260 in number, situated in the centre of the ceiling, and round the lower cove by a second ring of chandeliers, having 3,150 burners. In each of the thirty arches of the picture-gallery are smaller chandeliers, of fifteen lights each; and there are over 2,000 burners between the two glass roofs.

To guard against fire, fifteen large tanks have been provided on the roof of the picture-gallery, each of which contains 1,400 gallons of water; these supply the lifts, and from them are down-pipes, with hydrants at every level. The water is pumped up from the artesian well made for the Royal Horticultural Society, which well is 450 feet deep, reaching 80 feet into the chalk. A set of three throw-pumps throw the water up on the picture-gallery roof.

The Hall is now open for the use of the public. The Society of Arts, having in view the establishment of a National Training School for Music, gives a series of Six Concerts in its aid, the first of which, on April 12th, will be the first public performance in the Hall.

PROCEEDINGS OF THE SOCIETY.

SEVENTEENTH ORDINARY MEETING.

Wednesday, 29th March, 1871; Francis Fuller, Esq., in the chair.

The following candidates were proposed for election as members of the Society:—

Biden, Lewis, 9, Victoria-chambers, Westminster, S.W.
Butt, Edward Northway, 13, Curzon-street, Mayfair, W.
Cotton, William James Richmond, Alderman, 47, St. Mary-axe, E.C.
Curtis, George, Limmer's Hotel, Conduit-street, W.
De Lacy, George, 38, Sekforde-street, Clerkenwell, E.C.
Hart, John, 10, New Bridge-street, Blackfriars, E.C.
Rawley, Samuel Henry, 2, Hart-street, Mark-lane, E.C.
Wright, Frank, 38, High-street, Kensington, W.

The following candidates were balloted for and duly elected members of the Society:—

Bamlett, A. C., Thirsk, Yorkshire.
Bogie, James, Queen Insurance-buildings, Liverpool.
Lockwood, B. C., 25, Highbury-grove, N.
Scott, James Renat, Coal-exchange, E.C.
Southwell, Charles, 44, Prince's-street, Leicester-square, W.C.
Spiller, William, F.C.S., The Chesnuts, Lower Clapton, N.E.

The Paper read was—

WOMAN'S WORK, WITH SPECIAL REFERENCE TO INDUSTRIAL EMPLOYMENT.

By Miss Emily Faithfull.

I have responded to the invitation to read a paper upon this well-worn subject, because, in spite of familiar facts and figures to which I shall presently refer, I believe that considerable misconception prevails, not only as to the real end and aim of those who are actively interested in what is generally called "the movement for women," but a misconception which extends to the *aison d'etre* of the movement itself. And, indeed, the divers claims which are put forth, sometimes as rights, and occasionally as duties, together with the loud and repeated cries for enfranchisement, which are starting up with singular rapidity on all sides of us, must sound more or less unmeaning, according to our ability to comprehend the central necessity from which they all really emanate. In whatever spirit we approach the subject, either as an antagonist or as an advocate, a calm and impartial inquiry cannot fail to be useful to us all; and I certainly venture to hope that the few statements which I have to make—the result of some years' work in this direction—will elicit a discussion, without fear or favour, which may tend to throw some new light upon a very difficult and perplexing problem. I am quite aware that to many people this topic is utterly distasteful; but in addressing the members of the Society of Arts, I feel I am not speaking to persons who tremble at the "lightest rustle among the leaves of their prejudice," but to thoughtful men and women, clear sighted enough to see the necessity of dropping theories and ideals however pleasant, and the absolute importance of looking at things as they really are,—men and women who are able and willing to help in overcoming that moral panic which is often sufficiently powerful to retard a new suggestion from even undergoing an experimental test.

Without further preface, I shall therefore proceed with the subject of my paper. But, that we may start with a thorough understanding, permit me at once to say, that I do not for one moment seek to remove women from those household duties which seem so naturally to come within their special sphere. I have, I may say, in common with most sensible persons, some very strong opinions respecting the thorough performance of domestic work; I will yield to no one in my belief of what a woman can and ought to make a home; but it must be remembered that I have undertaken this evening to deal with those who have, so to speak, no domestic duties, and no household, but such as they can maintain by personal labour. That this class is at least large enough to demand our solicitude, will be proved by a glance at some statistics, drawn up from the census of 1861, by the Secretary of the Society for the Employment of Women, a society which was set on foot some years ago, and which has now received Her Majesty's sanction and support.

In 1861, 6,727,697 Englishwomen over 15 were returned, of whom 3,249,872 were working for wages.

These are distributed in the following manner:—

I. Professional Class.	
Women engaged in the general or local government of the country	3,914
Women engaged in learned professions, or in literature, art, and science	92,698
II. Domestic Class.	
Women engaged in entertaining or performing personal offices for man	1,156,999
III. Commercial Class.	
Women who buy, sell, let, or lend money, houses, or goods of various kinds	29,409
Women engaged in the conveyance of men, animals, goods and messages	8,881
IV. Agricultural Class.	
Women possessing or working the land, engaged in growing grain, fruits, grasses and other products	387,443
Women engaged about animals	359
V. Industrial Class.	
Women engaged in art and machine production, in which matters of various kinds are employed in combination	60,067
Women working or dealing in the textile fabrics and in dress	1,341,194
Women engaged in dealing in food or drinks	82,606
Women engaged in dealing in animal substances	6,835
Women engaged in dealing in vegetable substances	18,874
Women engaged in working or dealing in minerals	56,313
VI. Indefinite Class.	
Labourers and others, branch of labour undefined	13,281
Total............	3,249,872

When the census is taken in April, I believe that this total will be considerably enlarged; anyhow, in the face of these startling figures, it is impossible to maintain that those who are trying to open new paths for female industry are suddenly transplanting women from quiet domestic offices, and bringing about a social revolution fraught with danger to the whole community.

The simple fact of the case is, that the women of what we term the labouring class have always had a certain share in the occupations of their fathers, husbands, and brothers. There is no deeply-rooted dislike to their admission into industrial pursuits, although there is a considerable difficulty in securing for them a fair chance of rising to situations of responsibility and consequent importance. It is true, that you find women in our various chemical works, glass-houses, rope works, paper mills, glue works, and earthenware factories, but there you find them employed in the lowest and worst-paid departments. You will find women in the blowing rooms of our cotton mills, for example, where, to accommodate themselves to the high temperature, they usually work in a half-naked condition. Closely allied to the cotton manufactory, though not exactly forming part of it, is the occupation called waste-cleaning. The refuse of cotton mills—the sweepings—full of dust and filth, are bought up by certain dealers, and put through machinery in the process of cleaning. The women and girls employed in this have to work in such fearful clouds of dust, that they are forced to fill their mouths and nostrils with rags and cotton to avoid suffocation; and when they leave work they are literally covered with a layer of greasy dirt and dust. In hundreds of factories where women are employed, there is work going on of a lighter and less unsuitable kind than what they are actually doing.

When I proposed, in 1859, to open a printing-office for women, I was told that setting up type would degrade and injure them, and that I could scarcely suggest a more unsuitable employment; yet, even while these warnings were being given me, girls were extensively employed, in an inferior capacity, in printing establishments as machine feeders, a branch of the business which appeared to me so unsuitable, that I never allowed it to be undertaken by girls in the office I eventually started for female compositors.

I said just now, that while women were widely admitted to these industrial pursuits, they seldom obtained positions of trust and management; but I am glad to make an honourable exception of the Birmingham button manufactories, in which they are frequently to be found as overseers, and where they are, consequently, in receipt of high weekly wages. The reason for the rule is not, I think, hard to find. The exclusion of women from the higher departments of trade must be traced, in a measure, to the same feeling which compelled Dr. Elizabeth Garrett to seek in Paris the qualification to practise as a physician, which, in spite of her manifest ability to do so, was denied her by the London College of Physicians. The same mistaken policy sends us to Switzerland for so many of our watches; and by it our women are also prevented (or were so up to a very recent period) from pasting patterns of floss silk upon cards, and forbidden in the porcelain potteries in Staffordshire to use the hand-rest.

But the exclusion of women from the most remunerative branches of labour is also due to the absence of special training. I have been told repeatedly, when commenting on the unsuitable work executed by women in comparison with the lighter and more feminine occupations engaged in by men in the same factories, that the work could be done by women, but that as it required an apprenticeship, women were never permitted to undertake it. Now however we may view apprenticeships, it is clear that no skilled work can be done without definite training of some kind, and as women seldom if ever secure anything deserving the name, they are naturally excluded from skilled work and its advantages, and it is difficult to estimate the depressing effects of a system which deprives the working woman of a stimulus found of value even to the most conscientious and cultivated man in the kingdom. It is not marvellous that women so often perform work mechanically, as a matter of routine, without intelligence or spirit. I shall abstain from entering at any length on one very serious consequence of this restriction of women to the inferior branches of industry, but I feel it right to say, in passing, that as it deprives the younger workers of the supervision of their own sex, I cannot but regard it as a great evil. If girls saw older women in positions of trust and authority, they would not only be encouraged to develop that business-like capacity and those qualities of character without which they must remain socially and individually in the lowest scale, but they would feel themselves far more protected than they can do at present, while they have no other safeguard than their own prudence.

The points I wish to establish in relation to this portion of my subject are, in short, as follows:—1. That as women are so extensively employed in industrial pursuits, they ought not to be deprived of the advantages of systematic training, nor excluded from the most lucrative branches of the various occupations in which they engage. 2. That we are not justified in drawing upon their physical strength, and ignoring their mental capacity to the extent which at present obtains amongst us. 3. That it is a mistake to regard women as mere machines—hands without heads. And, lastly, that while society is loud in objecting to the gnat, it has long since quietly swallowed the camel.

We have, however, to view the matter from another point. The working women of whom we have been speaking have at any rate been able to follow, after a humble fashion, the avocations (once entirely carried on by women in separate households) into the huge manufactories into which they have been transplanted, by the application of masculine science to what was once only feminine work. But the introduction of machinery has affected the fortunes of another and higher class in a still more disastrous manner. As long as the sound of the spinning wheel was heard in every home, there was profitable work to be done by every member of each household, and our "redundant involuntary celibates," as Mr. W. R. Greg calls them, could find shelter with their kith and kin, without the uncomfortable conviction that they were either useless burdens or idle drones. This class is a large and ever-increasing one, and seems to have dropped altogether out of the great onward march of humanity.

Owing to the change which has taken so much feminine work into our large centres of industry, the women who belong to it are left to provide for themselves, and society has at present taken but little trouble to enable them to do so, either by education or by opening the doors to salaried employment. The one means of self-support which has been open to the destitute gentlewoman has been the profession of the teacher, and into that all the unmarried and fortuneless daughters of clergymen, merchants, doctors, military and naval men, all rush, as the only channel of which their social prejudices admit, or in which their utter incapacity gives them any chance of success. For thirteen years, I have had an office which brings me into communication with ladies of this description, and I seldom receive applicants for remunerative employments without hearing their apologies "for being compelled to teach," in consequence of a bank failure, a father's death, or some unexpected circumstance, while some do not hesitate to tell me that "they hate teaching," but prefer to become governesses rather than lose status by taking part in some industrial pursuit. But even this "status" appears to me entirely imaginary, for the majority of those who employ them have still an unpleasant habit of looking down upon a lady in this capacity, as "only a governess." To prove that I am not singular in this opinion, allow me to quote the following passage from one of Mr. Ruskin's well-known lectures:—"What reverence do you show to the teachers you have chosen? Is a girl likely to think her own conduct or her own intellect of much importance, when you trust the entire formation of her character, moral and intellectual, to a person whom you let your servants treat with less respect than they do your housekeeper (as if the soul of your child were a less charge than jams and groceries), and whom you yourself think you confer an honour upon by letting her sometimes sit in the drawing-room in the evening?"

I need not point out the injury inflicted on the whole profession, which not unnaturally suffers from the faults of the mass of its numbers, for nearly everyone is now aware that it has been little honoured and ill-remunerated, because numbers enter it who are utterly unfit to discharge its duties. The incompetent person cannot be excluded until the public has learned to require certificates of ability. They have long been in use on the Continent, and I hope the day will shortly come when they will be indispensable to every English teacher. But, in the meantime, we must try to open less thronged and footworn tracks to meet the pressure of the present state of things. During the last few years, efforts have been made in various directions with more or less success. With regard to the experiment of printing, to which I have already referred, I am glad to find, from a recent number of the *Press News*, a recognised trade-journal, that the "idea is extending," and "that it cannot be denied that we have by far many more female printers, both earning their bread by wages, and investing their capital as employers, than ever we had." The Post-office now employs about 1,000 women as telegraph clerks; and as an earnest of Mr. Scudamore's intention to increase this number, I may mention that he has organised a class of instructresses, an office unknown under the companies. In Telegraph-street alone, 485 young women are employed, and the heads of the department bear high testimony to their admirable industry, quickness, and intelligence; the ordinary payments made to them range from 10s. to 22s., according to proficiency, and as clerks in charge they receive from 25s. to 40s. The central office is at present rather too crowded, owing to want of space, but the general arrangements evince a very thoughtful consideration on the part of the managers. Candidates for telegraphy must be between the ages of 14 and 20, must write a good legible hand, spell and read quickly, and thoroughly understand the first four rules of arithmetic; they must possess good eyesight; and the knowledge of a foreign language is a great advantage, but by no means requisite.

Hair-dressing is another business steadily opening to women. I well remember, in the summer of 1858, asking several London hairdressers to teach women to cut and dress hair, but I was told it was quite impossible, and various plausible reasons were assigned for this opinion, and among them the threatened strike of the men, should women ever be introduced into the trade. A strike, however, happened from another cause, about three years ago, and Mr. Douglas, of Bond-street, turned it to a very good use. He took advantage of the opportunity, and at once engaged about a dozen women, and taught them the great art and mystery of hair-cutting! He is perfectly satisfied with the result of his experiment, and so are all his customers, and he has not only increased his own staff, but several London and country establishments are about to follow his example. Glass-engraving and photography also afford openings, and "though one swallow does not make a summer," a woman's capacity in photography can never be disputed after Mrs. Cameron's achievements. The Society for Promoting the Employment of Women has made successful trials in both directions. The committee state that the progress made by the glass-engraving pupils proves beyond dispute that there is nothing in the work itself which renders it unsuitable to women. All ordinary patterns can now be executed by them; they copy with accuracy, and have engraved glasses of various kinds to match sets, completely to the satisfaction of those who have furnished them with this work. At present, one of them is working on monograms, and when she has acquired skill in this branch she will begin to engrave crests. The law-copying office established by this society not only holds its own, but I understand that several women who have been thoroughly trained in it have been drafted off into regular law-stationers' firms. Finding that at least 30,000 men are employed in England in the sale of articles of female attire, and that owing to the ignorance of women in the higher branches of arithmetic, they are unable to obtain employment in this natural direction, the society has also opened a commercial school, in which girls are taught book-keeping; and the committee point with some satisfaction to the fact, that while the census for 1861 returned 274 women as commercial clerks, and 34 as accountants, no return whatever was made under either head before the existence of an organised movement for promoting the industry of educated women. The dispensing of medicine has been tried as a fitting occupation, and is one with which women in olden days were familiar. In a letter I received from Dr. Garrett Anderson, a fortnight since, in answer to a question I had put to her on this matter, she observes, "There is no reason why women should not be engaged in dispensing, both in charitable institutions, in shops, and in private practice, as assistants to general medical practitioners. As a matter of fact, hundreds of women so dispense, in an amateur way, for their husbands or fathers." She adds:—"We have trained four or five women as dispensers at St. Mary's Dispensary, and we have found them careful and apt pupils, and ready to submit themselves cheerfully to the necessary conditions imposed on them. Our first pupil held the situation of dispenser for the last four years at a salary of £40 a-year, and she gives me great satisfaction."

I believe that the objections generally raised against the employment of women in this direction chiefly refer to the laborious manipulation with pestle and mortar, the requisite accuracy and exactness for weighing and mixing, or the difficulty an ordinary chemist would experience in receiving women apprentices. It is certainly curious to observe the objections which suggest themselves respecting new employments, which are not even recognised as such under circumstances to which custom has previously reconciled us. Take the last, for example. Girls are continually apprenticed to stationers and drapers, and we all know that measuring ribbons and selling books and envelopes under a master's eye, and probably with male assistants, can be undertaken without this extraordinary difficulty which a novel proposal encounters. I think that pharmacy is a peculiarly suitable employment for women, and it is by no means an untried experiment, for in the last census 388 women were returned as chemists and druggists, and 243 as manufacturing chemists; and though most of those are probably only carrying on the business of a deceased father or husband by means of male assistants, some are, to my own knowledge, conducting the work themselves, and performing the part which usually falls to the head of the establishment. But I have never yet heard of a female tuner of pianofortes, though it has been suggested more than once; and since it was announced that I was to read a paper before your Society, I have received a request from one of your members to mention it on this occasion. I do so gladly, for I think the tuning of pianofortes would prove a very excellent employment, and I specially commend it to your attention.

But all such experiments are necessarily limited in their operations, and to find fresh channels for female industry will be a very slow and gradual process.

At present everyone who carefully considers this subject must admit that the contrast is peculiar and striking, between the employments which are open and the social position of the women most in need of remunerative work. I have not the least patience with that miserable, paltry pride which teaches women to look down upon all paid work, but I have considerable sympathy for those whose sense of the fitness of things is strong enough to induce them to wish their work to correspond in some degree with their education and social position. It is one thing to be impelled by the force of circumstances to take their place in the labour-market, but it is another to find themselves driven into callings which place them on an inferior footing to all their male relations.

I know that this part of my subject bristles with real difficulties. It is all very well to suggest that employments such as the Civil Service should be thrown open (and I have often heard this strenuously and generously urged by members of that service), but then what is to become of our young men? I do however venture to think, that as the government has availed itself of the unpaid services of women, the Educational Department at least ought to acknowledge practically that women are capable of doing good official work; and I hope that the election of women on our new school boards will be speedily followed by the appointment of women as paid inspectors of schools.

The truth is, that we need to enlarge our views as well as our practice; while we seek to open higher occupations, we must learn to respect work of all kinds more than we do at present. An admirable work has been published by Mr. Milne, of Aberdeen, which could be made with great advantage the text-book of this question, in which he shows how, until a comparatively recent period, all men of high degree reaped the fruits of industry in revenues and lordships, themselves remaining an aristocracy—warlike, ecclesiastical, political, and fashionable—according to their age and country, but alike despising industrial occupation, and strangers to its reaction on the character. But, as far as men are concerned, it is very different now; the social importance of industry has become the marked feature of the time. "In our most advanced communities," says Mr. Milne, "the middle classes have acquired the greatest political weight, and a large measure of personal culture; civilisation is no longer in the keeping of a limited aristocracy; it has permeated the masses, and owes both its recent progress and its future prospects to the elevation of the industrial ranks. Wherever we turn our view, social power and personal culture are found in other hands than once held them. . . . Our merchants are no longer of a proscribed and despised tribe; our lawyers, our scientific and literary men, no longer exclusively pursue their studies in the leisure hours of a clerical avocation; and our gentlemen are no longer only found in the ranks of a leisured aristocracy."

But with women the case is far otherwise; directly we leave the higher ranks, we find that this great change has produced a division in the minds and characters of the two sexes, as little beneficial to society at large as it is prejudicial to the happiness of woman herself. It has produced between the men and women of the middle class an incongruity of taste and a diversity of pursuit. "In the higher and lower ranks woman emphatically shares the lot of man, leading with him in the one a life of affluent leisure, and bearing with him in the other a share of the labour characteristic of their common station. But, in the middle classes, though man, in his estate, approaches more nearly the lot of the labourer, woman would be an aristocrat; must needs spend her time in visiting or receiving visits, or in equally vain makeshifts to kill time. Like the lady of rank, she is above engaging in industrial pursuits, and she even pities the fate of her sex in the labouring ranks, that women must share in these the lot of man; but she forgets that for a woman to find happiness in a life of ease, it is requisite that man in the same rank be equally exempt from toil. Unlike the lady of rank, the lady of the middle-classes is left alone during the day. Her husband, father, or brother, in place of accompanying her in her visits, or in her other efforts to occupy a day of leisure, is busy at his desk, engrossed in his industrial avocations. Herein lies the drawback at present characteristic of woman's position in the middle ranks. In place of conforming to the medium in which her lot is cast, she strains after a false station. Her education, ideas, and manners have reference to a condition different from that she really occupies. She is brought up, and demeans herself, as if she belonged to a different sphere from that of the man in her own rank; and, as a natural consequence, there can be little in common between them; the one trained for industry, the other for a life of fashion; the one for the world, the other for the drawing-room."

It has become absolutely necessary that we should learn to value at their proper worth the superficial accomplishments against which we have railed for some time past, and we really ought to adapt the education and pursuits of women to the sphere in which they are cast. I do not mean that every woman must necessarily participate in some industrial calling, but I think she ought to have some chance given her, besides the chance of finding a husband, in days when it is absolutely necessary to have some other protection. I not only regard it as a matter of vital importance that women should cease to despise industrial occupation, but I think that, wherever it is possible they should take their fair share in it. The experience gained would not be thrown away, even in the event of their marriage. I fancy the money expended in such a manner would prove a better dowry than a mere sum paid down on the wedding-day. As things now stand, women are not even trained in domestic economy; they even enter on the one province respecting which there is no dispute in total ignorance of almost all its requirements, and many a man's pocket and temper is over-taxed in consequence. The want of definite training and habits of precision and accuracy is really as disastrous in the household as in the world, and until we secure it little can be done for women who have to work.

We have all heard something of the technical schools which were established some twenty years since in France, and of the system which obtains in Germany; and I believe I am correct in saying that the Society of Arts sent out a number of persons to test the arrangement by which other governments expect to develop the intelligence of their workmen. It is now a well-known fact that English artisans have been placed at a disadvantage by the absence of similar institutions here. Mr. Lucraft, in speaking of competition between English and foreign workmen, did not hesitate to say that, owing to advantages obtained by the latter, thanks to the technical schools, which afford preliminary instruction bearing on their future pursuits, Englishmen were "nowhere in the race." This phrase very aptly describes the present position of women—they are nowhere in the race—and I see every reason for attributing this fact to a similar cause. It is not owing to any inherent deficiency, but the utter absence of special training. What was the first effect of the technical education in France? As the men alone received the full advantage of it, the women at once suffered. In 1848, there were 89 female designers in Paris. The author of "La Pauvre Femme" informs us that although there were still designers in 1868, there were no girl apprentices in the trade. In the last census of Paris, the number of women returned as painters on china was 438; in the previous census the number had been above 1,000, and while only three apprentices were returned to supply the place of 1,000 workwomen, the boy apprentices numbered 49. We learn from the same source, on the authority of a Paris shopkeeper, that owing to the technical instruction given to the men they far excel the women in dressing the shop windows, and that the want of this training prevents women from harmonising the colours, from working on canvas, and from embroidering as well as men. We frequently hear people say, when they wish to depreciate women, that whatever a man undertakes he does better than a woman, from the painting of a picture to the cooking of a dinner. I am quite willing to admit it. But as men have so many advantages, I cannot regard this fact with any very great astonishment, or credit them in consequence with such transcendently superior power. And allowing, with appropriate humility, the utter inferiority of a woman's capacity, it only strikes me as of still greater importance that we should develop to the utmost any power of which she is possessed. The advantageous effects on men of technical education made themselves so apparent in France that a Paris school for women was established in 1861. This proved so successful that Lyons, Dijon, and other towns followed suit; two schools, at least, are due to the Empress Eugenie, who personally attended on more than one occasion, and gave away the prizes to pupils who excelled in works of art. We need such an effort here; it is not sufficient for a few isolated individuals to work in this direction. A Society for Promoting the Employment of Women, however admirable, cannot really do what is wanted; a national effort, in the fullest sense of the word, will alone enable us to cope with the difficulties surrounding that large and increasing class of women forced to work, from whom we at present expect bricks though we refuse the straw. It is too late to discuss the question whether women ought to take on themselves the toils of existence, they are doing so already in large numbers, under the compulsion of necessity and under great disadvantages, and the simple fact that they are constantly thrown upon the world to earn their daily bread by their own exertions, is a sufficient answer to those who think that dependence upon man is a woman's proper position. I do not wish to gainsay for one moment those domestic duties which surround the women whose lines have fallen in pleasant places, but I assert from practical experience that thousands of women dare not in these days reckon on the protection and support of a father, husband, or brother, or some one standing in an equivalent position, and I cannot but regard the pretension to decide beforehand what women can or cannot do—when nature will decide it so much better for us by showing us their success or failure—as one of the worst fallacies of the old protective system. I do not even pretend at this moment to determine what women are likely to do, if they are allowed to do it, for this can only be ascertained by experience, but I do protest against those exclusive customs (founded chiefly on prejudice) which so often exclude women from the higher labour markets without giving them any trial at all.

I shall doubtless presently hear, as I have already indicated, that all the trades and professions are overcrowded already, that young men as well as young women are saying—

> What is it that I should turn to, lighting upon days like these;
> Every door is barred with gold, and opens but to golden keys.

It may be true, that for every clerkship, for example, we find 100 candidates, but I have never yet heard of a class of men, in any rank whatever, compelled to offer their services in return for food and shelter, but you all know that women are frequently reduced to this extremity. I constantly receive letters asking me to recommend ladies as companions or governesses, from people who do not scruple to demand the whole of a poor woman's time, and the possession of a vast number of accomplishments (which ought to have some market value as long as they are indispensable), and in return "a home, and to be treated as one of the family," is all the remuneration offered. There are plenty of women sufficiently distressed to accept this, and it is not difficult to guess what becomes of them when sickness and old age overtake them. We shall hear, too, that to admit women is to displace men and to reduce their wages, but I think a careful examination of the matter will show, with regard to the latter difficulty, that the real result would be an increase of the productive power of the country, and a slight re-adjustment of wages. Anyhow, it seems to me that one sex is as much entitled as the other to bread, and that is what wages mean; and many men are already engaged in occupations which seem to me essentially womanly. Let me give you a few more figures from the census of 1861:—

	Males.
Mercers, drapers, and linen drapers....	45,660
Hair dressers and wig makers	10,652
Haberdashers and hosiers	4,327
Straw hat and bonnet makers	1,687
Washermen and laundry keepers......	1,165
Stay and corset makers	884
Milliners and dress makers	803
Artificial flower makers..............	761
Berlin wool dealers..................	63
Artists in hair, hair workers..........	42
Baby linen makers	13
	66,057

Other speakers will, perhaps, agree with Mr. W. R. Greg, that the solution of our whole difficulty is to be found in emigration. I am quite ready to assist in any scheme for enabling women to seek in foreign lands the livelihood they cannot obtain in their own, and I think Miss Rye has rendered an immense service to this country by the wise and judicious system she inaugurated, but I really must protest against the idea of enforced transportion in a benevolent disguise. And certainly, before women are fit for colonial hardships, they must have very different views of life and its requirements than they possess at present, and a truer estimate of the value of appearances. But if there be any truth in the much-insisted on argument of the "home sphere," this notion of wholesale expatriation ought scarcely to receive the support it obtains in some quarters. It is all very well to say that homes will assuredly be offered to them by the adventerous men who have left the old country in the hope of better chances abroad, but surely the idea of a number of women setting off to the other side of the world with this expectation is far from pleasant. The quieter efforts of young ladies to settle themselves in marriage here deserve and obtain sufficient ridicule and censure to preclude their openly leading such a "forlorn hope," and if they quit England with any pretext of employment, what becomes of the "home sphere" argument? As far as my experience goes, I have always found that the people who treat the broad question of the employment of women as a revolution for mere "empty rights," or as an attempt at an "improper insubordination," are ready enough, while neglecting to aid in an effort to deal with a widespread distress, to ask our help for special and individual cases in which they are personally concerned. And yet it must be clear to every intelligent person, that all we can do is to call attention to the difficulties by which women are surrounded; we have no chance of giving them employment until the public has been aroused, and ceases to view our movement with indifference or dislike. When the facts of the case are really known, I do not hesitate to say that, even if practical help be still withheld, prejudice will be shamed out of active opposition, but we shall nevertheless be obliged to wait for hearty co-operation before we succeed in obtaining for our educated women fair chances of livelihood.

In conclusion, I can only say, that the experience gained from practical work, leads me to feel more strongly every day of my life, the necessity of trying to obtain this co-operation as quickly as possible. One of the essayists in a book recently published by Macmillan on this subject, did not scruple to say, that she believed "the women of this generation must be content to suffer as victims of a transitional period." I fear that this view of the case is as correct as it is melancholy, for what can be done with hundreds of women who come to us for employment, in the teeth of the two great difficulties which perpetually look us in the face—on the one hand, no openings; on the other no qualifications,—owing to an utter want of training? If people wish to save the coming generation from the miseries endured by the present, they must accept this new condition of things and make it a personal matter.

But for this hope, all effort would be paralyzed. We work on, conscious, indeed, of the small value of our individual exertions, supported by the firm conviction that when the mists of prejudice are dispersed, and the truth becomes generally known, the public will see the immediate necessity of helping us to solve one of the most painful and delicate problems of the 19th century.

DISCUSSION.

The Chairman, in inviting discussion on the interesting paper which had just been read, said the more this question was discussed and ventilated the better would it be for women in general, whom all wished to see in a better condition than they were at the present moment. Canon Liddon, speaking of the duty of society in this respect, in an address before the Judges at Oxford, said "Many a criminal may use the words of Christ in a different, yet in a most true and material sense, when he is placed at the bar for judgment, after having been found guilty of robbery or murder—'he who delivered me unto thee hath the greater sin'—not the policeman who arrested me, not the magistrate who committed me, not the witness whose evidence satisfied the jury of my guilt, but society, that vast abstraction, that most real, albeit complex agent. Society is the greater criminal; I am but the victim of its heartlessness, the fruit of its neglect, the product and result of its example." It seemed to him that society was the greater criminal in this case, and he hoped to hear some remarks by which society would be moved to better behaviour in this respect.

Mr. Alsager Hill said he felt great pleasure in seeing so many present, because it showed this question had been making steady, though slow, progress. When Miss Faithfull began this work, 15 years ago, the voice of public opinion was almost dumb, but he hoped that this meeting would give out a clear note, which would have a lasting effect. Previous to attending, he happened to pick up a little volume called "Words of Weight on the Woman's Question," and it seemed to him that the argument of that work, embodied in the language of several hundred writers, both male and female, was so conclusive that it was almost unnecessary for Miss Faithfull to say anything, or for anyone to follow her in this discussion. But being accustomed to the practice of the bar, and knowing how necessary it was to tell an English jury the same thing twelve times over before any impression was made, he knew the great difficulty which surrounded any movement of this sort, which was encumbered by clouds of prejudice which seemed at first almost impenetrable. He had listened with great pleasure to what had been said with regard to the new openings for female labour, but it seemed to him at present these were so slight and imperceptible that they were, to a certain extent, like taking a tithe of aniseed and cummin, and neglecting the weightier matters of the law. With regard to telegraphic work, and other departments of labour, women had a perfect right to aspire to them if they chose; but there were in all quarters most deplorable statements with regard to the incompetency of women for domestic work. It was almost impossible at the present time to feel perfectly certain of being able in a few days to secure competent servants; and although he admitted that the present most unwholesome relations between mistresses and maids, and masters and men, were at the root, in all probability, of this incompetence, still there ought to be proper domestic training before woman's labour was attempted to be introduced in other branches. What was the position advanced by Miss Faithfull? That the persons who came to her office were, in almost every case, more or less incompetent. He had had some experience in examining the waifs and strays of female society, and he must say there was a certain incompetence, a want of training, a want of those finer industrial elements of character, which lie at the root of the whole difficulty. Here, therefore, he joined with the Chairman in saying that they ought to impeach society, and not to throw stones at one another, or at one sex. No doubt men were the most miserable sinners, but they were not the only sinners. It appeared to him that the root of the whole matter was in the want of a proper national system of education, and until there was a sufficient permeating elementary education throughout the whole country, neither men nor women would be fit to fill their respective positions. What Miss Faithfull had said with regard to the middle classes was peculiarly significant, viz., that although ladies in this class of life had plenty of time, still they did not undertake industrial employment. For instance, with regard to artistic matters, it was wonderful what peculiar forms of art were introduced and found favour with the middle classes; this could be attested by anyone who was unfortunate enough to spend half-an-hour in a suburban drawing-room. If the technical education alluded to were introduced into all schools instead of the latitude and longitude of the Dead Sea and other matters of that kind, not only would there be workmen and workwomen, but amongst the more leisurely classes there would be more adornment of a true kind than could now be found. There was but one basis for all this improvement, and that was a thoroughly great national system of education. Without this it was perfectly impossible to make progress in any one social direction, in fact, it was like attempting to drive in nails of progress at every stroke, which were beaten back by blocks of ignorance. With respect either to emigration, provident institutions, or any one branch of progressive labour, it was found that there was so much ignorance amongst the masses it was almost impossible to proceed. The social chemist had to wait months, if not years, before he could proceed with his processes. He collected a few facts, and noticed the way in which they pointed, but he had to wait and wait, until a larger knowledge and more evenly distributed education gave him the power of working upon a sufficiently large mass of persons to secure the result at which he aspired.

Mr. Pickstone said that in the north of England, Lancashire, and Yorkshire, men and women might be said to stand on an equality with regard to industrial employment. There was not that degree of prejudice as in other parts of the country, for there they laboured side by side, especially at the loom. The fabrics of Lancashire and Yorkshire were more than half woven by women, who earned often as much as the men, being handy with their fingers, and the employment being light. Many women in cotton mills earned as much as £1 a-week, the introduction of machinery having in this respect not altered the condition which formerly existed, when men and women wove side by side at their hand-looms. No doubt some employments which they followed were disagreeable, but it must be remembered that they went to them of their own accord; and although it was disagreeable to see a woman with her mouth filled with cotton to keep the dust out of her lungs, it would be still more disagreeable to see her starving out of doors It must be remembered, also, that the cotton trade itself could hardly be carried on at the present time if it were not for female labour. Half the cotton and half the wool was worked up by women, and in the spinning department, especially the throstle department, the greater part of the work was done by women. In connection with the cotton manufactories, access to almost all departments was now open to females, although it was not so a few years ago, and in some departments women might earn as much as the book-keeper who paid the wages and kept the accounts of the factory.

Dr. Waite remarked that a certain amount of applause had followed Miss Faithfull's statement that, on the whole, women knew very little on the subject of housekeeping or domestic management, but he believed that to be positively untrue, for in no country in the world did ladies devote so much attention to housekeeping pursuits as they did in England. He should like to ask whether, if it were put to the vote of the whole of the thinking women in England, if the ladies would come forward and advocate their rights, or whether on the whole they would not say the proper place for men was to come forward and do the speechifying and hard work, and that women ought to rule supreme at home in their houses. At any rate, in this matter the principal appeal ought to be made to the women rather than to the men, for they had the formation of the character of the rising generation. What was the kind of education a woman received from her mamma? She was told that her first duty in life was to get a husband, and the greater the fool the better for her; but, on the other hand, the boy was taught that if he wanted to be successful in life he ought to marry a beautiful fool with plenty of money, rather than a woman who could manage his household, and give him sound advice when he required it. He contended, however, that if a man was to go through life pleasantly and happily, it was better for him to find a woman who could give him that consolation and encouragement which he required, rather than one who would meet him in argumentative disputation. He was not one who advocated the supremacy of the male sex, and thought honours of every kind should be open to women if they could attain to them. The Universities set a very good example by offering degrees to women who showed a certain amount of intellectuality and education, but he must say that the ladies who competed for these distinctions were conspicuous by their absence. The matter lay simply in the hands of women. Let them train up their children to understand fully what their duty in life was, both as men and women, and then the woman of the future would know perhaps better how to fill her proper position at the head of a household.

Mr. Gillard said it had been stated that the lower orders were employed in the factories in Lancashire, but the great difficulty was to find employment for ladies of a somewhat higher class, who, by some misfortune, were deprived of the means of gaining a living. It appeared to him that employment, in a general sense, was a question of demand and supply, and that if women were fully qualified they would be able to compete with the sterner sex. With regard to artistic matters, he had found ladies able and willing to carry out work of that description to a high degree of perfection, and he had in his employment from 50 to 60 young persons whom he selected as being those most requiring such employment. Miss Faithfull had said something about mercers and that class of tradesmen, who employed men where women might be profitably employed, but though that might be true, he had heard such employers say that if they engaged females, they would not do half so much trade, for that ladies would rather be served by men than by their own sex. He must say that Miss Faithfull's scheme was worthy of all sympathy, as it was brought forward on behalf of a helpless class; not ladies who frequently had positions found for them, but for those who had no opportunity of exercising those domestic duties which some people seemed to think formed their only proper sphere of action.

Mr. Hilton said he had been a member for 14 or 15 years, but the present was the most interesting paper he had ever heard; and though this was the first time he had had the pleasure of hearing a lady lecturer, he hoped it would not be the last. It was certainly itself a convincing proof that ladies were capable of performing what were considered some of the higher functions of society; and to any person who questioned the powers of women to fit themselves for any employment, he would point to the paper they had just heard as an answer. He hoped that some ladies present would join in the discussion, and he would add that, from practical experience which he had had recently, in waiting upon a government inspector while examining a parochial school, he was convinced that it would be very desirable for ladies to be appointed school inspectors, at any rate in the case of girls' schools. He happened to be warden of one of the oldest parishes, and one of his duties was to administer several charities, and in this capacity it had come within his knowledge that the applicants were in the proportion of at least fifty women to five men. Only the previous day he had paid twenty-eight pensioners, of whom twenty-six were women and only two were men. This showed the importance of the subject, and that it was not only the present time which required to be looked to, but that when time advanced it was of the utmost importance that ladies should have something to depend upon in case of misfortune overtaking them.

Mr. Laurent de Lara said this was quite as much a man's question as a woman's, for nothing gave a man more anxiety than to know what to do with his daughters when they came home from school, especially if there were several of them, and his means were not very ample. If more situations of an honourable character were open to women, they would be educated to fill them properly. In the highest walks of life, art, science, and literature, women had forced their way to the front, in spite of obstacles; but it was in the medium ranks between those employments and domestic duties that want of lucrative employment was most felt, and where it was most required.

Madame Noel, in reply to objections which she had heard raised, that ladies educated to earn their living in various ways would not pay proper attention to home duties, begged to draw attention to Switzerland, where she ventured to say that homes of the middle classes were as clean and well kept as those in any other country where the ladies did nothing. Here ladies were employed as telegraph officers, and in almost all professions, but she had never found that they were in any degree less fitted for home duties; on the contrary, a woman properly educated, not half educated, or badly educated, must be the best woman, and must understand best how to perform her duties of whatever character.

Mr. Yapp, having spent a considerable time in France, where women were employed much more extensively than in England, desired to state the result of his experience. He would first say, however, that the crowded state of the room showed that men and women in England were not indifferent on this great subject, and he believed that in no country would the solution of the question be worked out so quickly. One gentleman had alluded to the case of Lancashire, where females were largely employed in factories; but, to his mind, that was one of the most difficult phases of the question. True, the women earned good wages, but in connection with that there were the worst domestic arrangements that could be found in the United Kingdom, the worst cooking, and the most slovenly households, and, he feared he must add, the most immorality. In France, both the good and the bad sides of the question were seen. In the first place, they had the best female cooks and domestic servants of all classes in the world, which was an advantage to the whole community, but, besides that, women competed with men in shopkeeping, in public offices, and in almost all other employments, and he did not hesitate to say on the whole this was a great evil. It was felt less in France than it would be here, in consequence of the large number and good character of the domestic servants; but he was convinced that in England, if women generally were taken away from specially feminine avocations, and put to compete with men in the general labour market, a great evil would be done to their whole moral character and to the country at large. There was no legislative enactment against the employment of women's powers in any way they thought best, but the great thing was to take care that each one followed that employment which was most suited to them, so that the two should not be in competition, but that each should help the other in their own sphere. While our cooking was the worst in the world, and our domestic servants in general anything but perfect in his opinion, ladies like Miss Faithfull had better turn their attention, not to employing women in printing and such like businesses, but in teaching them to properly fulfil those duties of which they were at present so ignorant.

Mr. Cassels wished to say, from some 20 years' knowledge of Lancashire, that it was quite inaccurate to hold it up as a type of slovenly households and immorality. There was, unfortunately, much more immorality in agricultural than in manufacturing districts.

Mr. Newcome said this subject was of the greatest possible importance. The first woman was named by the Almighty, "Eve," which was a Sanskrit word signifying the completeness of life. He was convinced that a great proportion of man's miseries and misfortunes had come upon him in consequence of trying to govern the world without taking to his counsels the helpmate whom God had provided for him. With reference to the industrial employment of women, he thought it was a question which would settle itself. If he wanted his hair cut, or to have anything else done for him, he did not want to know whether the person who did it was of the male or female persuasion, any more than he did whether they were Protestant or Roman Catholic, but simply how it was done, and he should pay accordingly. He had a much higher idea of woman than to suppose she would be content with merely engaging in trade, and thought they would take their place in the highest professions. He first learned that women were likely to make the best doctors when in Germany. He was so much engaged that he had not time to learn a word of German, and was suddenly taken aback when his fellow traveller was taken seriously ill with gout. They called in a lady doctor, who saw the patient, but he could not make out what she said except "*Nichts*," and that he could not understand. On obtaining an interpreter, however, he found that her meaning was, that in cases of gout no doctors or medicines were required, but only sympathy. That set him thinking, and convinced him of the aptitude of ladies, from their sympathetic natures, to follow the healing art; for he believed that, in the general way, the doctor's share of a cure was only one-tenth and the nurse's nine-tenths. He hoped, therefore, before long, to see women practising as doctors, lawyers, and religious teachers.

Miss Wallington ventured to dissent from the opinion of Mr. Yapp, that the competition of the two sexes in one employment was a great evil. As far as her experience went, there was a great benefit arising from men and women following the same occupation. The more chances men had of becoming elevated, the better it would be for mankind in general, and this could best be brought about by companionship with women in work as well as in other things. It was a matter of notoriety, that the labour of the medical staff in the Crimea were far more efficiently performed after Miss Nightingale and her noble band of nurses went to their assistance; and she had been informed that in commercial houses, where both sexes were employed, a much higher moral tone prevailed, each being benefited by the association with the other. Again, a remark had been made that care should be taken that each sex should be put only to that occupation for which it was best fitted, but, in her opinion, nature had most emphatically drawn the limit of each woman's capacity. The proper sphere of each human being was the highest which he or she was capable of attaining.

Dr. Heinemann said the great woman question presented itself in a two-fold aspect, viz., industrial and social or political. The paper which they had heard with so much pleasure, addressed itself to the first, and that, therefore, he would chiefly consider. Now, in a matter of so much importance, it was as well to follow the advice of Lord Bacon, not to laugh, nor to weep, but to understand, in other words, to look at the question apart from any prejudice or feeling of sentimentality, for in that way only could the true solution be arrived at. On looking to the history of the past, it became abundantly clear that the position of women had been vastly ameliorated since the introduction of Christianity, and the appearance on the world's stage of the Teutonic nations. She then ceased to be considered a slave, and became more of a companion and helpmate to man. At the same time, it must be remembered that in those early days society was very differently constituted, and industrial work was not so much esteemed as it was now, and therefore women were not allowed to work. Now, happily, views were changed, and it was thoroughly understood that to gain an honest livelihood was one of the greatest pleasures of life. There were some who, from special circumstances, did not require to work, but these must always form the minority; and now that it was acknowledged that women might and ought to work, the question arose, was it just or proper to deny them a market for their talents? It was evident that if women must work—and the conclusion seemed unavoidable that in many cases they must do so—they ought to have a fair field for their energies; and he believed society would soon learn to respect and esteem those ladies who spent their time and talents in some useful occupation. It followed, of course, that if to women was conceded the right to work, the duty would also be demanded of them of properly qualifying themselves, and there came in the question of education, technical and otherwise, which had before been referred to. With regard to the social and political aspect of the question, if women, by their labour, increased the amount of capital in the country, they ought also to share in the administration of affairs, and to fill those public offices for which they were fitted.

Miss Faithfull, in replying to the various remarks which had been made, said some of the speakers seemed rather to imply that she had been advocating what were called "woman's rights," but in doing so they must have forgotten her especial disclaimer of any such intention, having confined herself strictly to the one topic which gave a title to the paper, "Woman's Work with reference to Industrial Pursuits." Mr. Alsager Hill was quite right in saying that this was not a class movement, or one affecting one sex only; but one to be treated from a broad educational and national point of view. With regard to female employment in the North of England, her statements that women were employed in different factories had been confirmed, and she did not doubt the correctness of the assertion that, in some cases, they earned wages equal to those of men on the average; but the great point she insisted upon was, that they did not occupy the higher positions of overseers, or similar offices of trust, and consequently they lost the benefit of proper stimulus to their endeavours, and the young female workers in the factory were less protected than they would be if supervised by members of their own sex. She was somewhat at a loss to know how to deal with Dr. Waite's observations, inasmuch as he commenced his statement by saying women were good domestic housekeepers, and in conclusion he said that they educated their children very foolishly, and did not train them to manage their households properly. Although she did not wish to cast any slight upon the women of this country with regard to household duties, it was impossible for anyone to close their ears to the complaints which came from all sides on this matter. The answer which they often met with, when advocating the right of women to employment was, that they ought to do their domestic work better before seeking other employment; and no doubt there was a good deal in this objection. Women ought to know more about domestic duties than too many of them did, and she did not think any true woman would be afraid of saying so. Another speaker had, however, used a fallacious argument when he said that women ought to be trained exclusively for this kind of work, since the women she had principally in view had no homes of their own, and consequently no domestic duties. She was in a position to confirm most fully Miss Wallington's statement of the beneficial results of men and women working together, and, did time permit, could quote figures to bear it out. Only a few days ago, she had inquired of a large employer of labour what was the effect of introducing females into a somewhat novel trade, and his reply was that the men used much less bad language, and the tone was altogether higher and better. Madame Noel's statement also could be fully supported; the women who were the most cultivated, as a general rule, paid most attention to their homes; they knew the value of order and cleanliness, and their refinement was quickened in every way. Even their artistic faculties were so cultivated that they would not tolerate the atrocities which Mr. Hill had spoken of as the quasi-ornamention of suburban drawing-rooms. To give an instance, Mrs. Somerville, who stood almost pre-eminent in her own line of literature, was a most excellent cook, and the most intelligent woman she had ever met with, and knew as much about serving up a dinner for a large party as any professed cook. In conclusion, she wished distinctly to repeat that she had not entered on any branch of the "Woman's Question," save only that of industrial employment.

The Chairman said it was his pleasing duty to propose a vote of thanks to Miss Faithfull. Before doing so, he would say that Madame Noel had made some very important observations, which bore very deeply on the question before them, and he could fully confirm that which she had so well described, namely, that well-to-do people throughout Switzerland of every class, and especially amongst the middle and poorer classes, not only outside, but inside their houses, were a pattern of neatness, good order, and economy; and, so far was this carried, that it had led to the prevention of pauperism entirely. Both poor-rates and poor-houses were unknown, all who were in distress being cared for by their own friends or relatives. With respect to the question of ladies reading papers in that room, he thought the Society would have to seriously consider, if this were adopted, whether it would not be necessary to enlarge the room, judging by the crowded and attentive audience they had had that evening. He would conclude by quoting a short extract from a report issued by a society, of which he had the honour to be secretary, called the Industrial Employment Association. That society had looked into the question of female employment a good deal, and alluding to the large class of young girls to be found about the streets, they said a girl who had drifted, possibly without any fault of her own, from destitution into depravity, and from depravity into crime, was a centre of corruption far more dangerous than a boy, for a bad girl would corrupt a score of boys. The great Duke of Wellington's constant cry in the Upper House used to be, "My Lords, take care of the old soldier;" and in the same spirit they said, take care of the future lives of neglected children. This was a social sore which must be probed with no flinching hand. The shame was that such things should be, not that they should be spoken about. There were wretched female children in the streets, who, unfortunately, were prostitutes before they were women, and who united the ignorance of childhood with the depravity of maturer years. Those who looked askant at the expense of keeping girls from the street were invited to consider what they would have to pay one day for county gaols, convict yards, and similar institutions, which these young girls would take good care to fill, unless society did its duty by them.

The vote of thanks was then passed unanimously, and the meeting separated.

INDIA COMMITTEE.

A Conference on "The Claims of India Cotton," was held on Friday, March 10th. Sir THOMAS BAZLEY, Bart., M.P., opened the subject, and Mr. JOHN CHEETHAM, presided.

Sir Thomas Bazley, M.P., said they were met to discuss a most important question affecting the welfare of two hundred millions of people. From the British public Indian affairs were receiving more public attention than they had done for many previous years. Certainly, the Society of Arts had done more to make the British people acquainted with the affairs of India than any other institution. It was a duty he owed the Society, to acknowledge his sense of gratitude at their course of action with reference to Indian affairs. Many meetings had been held in that room on these subjects. But a few days ago an important meeting had been held, and it seemed to him, that the very accents which fell from the lips of gentlemen on that occasion had scarcely ceased to reverberate, when they were again called upon to discuss the question which, if properly treated, would do much to promote the welfare of India. He had had the honour of addressing an overwhelming meeting in that room twenty years ago, when the late Prince Consort did him the honour of presiding, upon the question which was just then dawning upon public attention. Perhaps the first great question to which he might with propriety call their attention was, the lack of public works in India. We find that canals have scarcely been formed; that only of late years have railways been called into existence; and that roads, as they are known in Europe, do not exist. With reference to railways, it must be a matter of deep annoyance that in the race of progress, within the last two years, America had in one line approximately formed a length of railway nearly equal to the whole of that to be found in British India. Within the last year, the Californian railway, some two to three thousand miles long, had been called into successful operation. In India we have something like 5,000 miles of railway; in this country we have, approximately, 14,000; in America it is, approximately, 50,000. Unless India avails herself of a knowledge of the best agents for progress, the best agents for cultivation, the best agents for the distribution of European knowledge and civilisation, India will remain comparatively a darkened country. But he referred with very great satisfaction to the fact that the natives had become more intelligent, and received facts as the basis of truth; and nothing, he was sure, could more promote the acquisition of knowledge than this readiness to receive facts as the foundations of truth. In that room he had heard Mr. Dadabhai Naoroji speak, whose purity of tone and grace of expression really adorned our language, and there was no doubt that the native Hindoo was thoroughly capable of doing such things as would raise him as high in the competitive progress of mankind as any race that exists in Europe. Perhaps he was one of those who are of a somewhat sanguine temperament, but he based his belief upon the maintenance of peace and order, without which there can be no solid prosperity. In India, happily, they are now prevailing. If we look at India we find that everything is conducive to a course of industry, and we must congratulate ourselves on such a juncture. Industry must be the visible material agent of progress for every part of the world. Without industry we are really a barbarous race; with industry, well directed, we are promoting the employment of the people and increasing their knowledge of the comforts of life. Perhaps it was because the wants of the Indian people were few, because they lacked in their men an elevated taste, and in their women that desire for decorative clothing that existed in Europe, that no great progress had been made there in industry. Perhaps, too, their prejudices may have had something to do with keeping them in the state their fathers had existed in for more than two thousand years. Sometimes, when he thought of India, he could not help referring to that date when Alexander ran over India, and left no solid mark of the conquest he achieved. The Alexandria Greeks seemed to be somewhat confident and content in the prowess of arms. But contrast their conduct with that of the Romans, who, whenever they placed themselves in any part of the world, introduced the arts of industry, and so gave the impress of their conquest. They knew that to properly foster industry there must be communications between the various parts of a country, and thus it is that, in England, we have roads directed north, south, east, and west, to all parts of the country. We have remains even of the ordinary implements they used in various kinds of industry, and they grafted upon this country a system so truly beneficial as to make our forefathers regret their necessary and indispensable departure. And when he contrasted the policy of the Romans towards their conquered provinces with the policy we had pursued towards India, he looked in vain for the results of a beneficent governing power during three hundred years. No doubt within the last twenty-five years there had been a great advance, and it was but doing justice to the government to remind them that probably during that period more progress had been made than in any previous century in which we had held India. We had a better Indian administration now, both at home and in India, than at any former time. But he did not mention these facts to make them content with things as they were at present. Much more needs to be done. He apprehended one of the great objects of their meeting that evening was to co-operate for the purpose of promoting, if possible, a more rapid progress in British India. He was glad to say that he had been one of the party that had obtained from the government the appointment, made last evening, of a committee to examine into the state of India. It was called a Finance Committee, but in reality it would embrace all important questions connected with India, and if any gentleman present were in a position to offer evidence to the committee, the record of the facts they would present would be most valuable, as it would enable the committee to attain a clear arrival at the means best fitted to ensure the more rapid progress of British India. Well, when he had last addressed them, he had spoken of the establishment of a Board of Agriculture in India. Many of his friends had very consistently urged the establishment of such a board, and the government at length had determined to establish an Agricultural and Commercial Board. Such a Board would be a Board of industry. Though it was quite true that we had the example of such Boards, both in Europe and in America, and had seen the benefits to be derived from them, yet such agents of progress in India had been altogether overlooked. He hoped the time was come when obstacles to progress would be removed, and that, first of all, the necessary better cultivation of the soil would be effected in India. The great error had been committed both by the people of India and by the people of this country, in neglecting to give sufficient nutriment to the soil. His friends had advocated the great importance of irrigation. He entirely conceded that it was important, but it was not all important. It was indispensable that the land should be more deeply pierced, and by that he meant that there should be more ploughing and deeper ploughing than there had been, and then, when the soil had been so disturbed, it should be given some dressing of manure, treated with water as a solvent, and which would give a greater nutriment than merely passing water over the land. Some of his friends had thought that water itself was a great source of nutriment. It was not so; watering the soil would act as a solvent, but would not give nutriment; and what was wanted were sources that would at once pulverise, break up, and give a greater quantity of nutriment to the soil. The soil of India required a great amount of nutriment to produce from it those heavy and abundant crops that might be produced if the cultivation of the soil was well directed. We had the evidence that where a coffee-planter has had the soil loosened, a little nutriment applied and water given to it, that the crop had been double or treble the usual bulk, and that the favoured product had been very greatly enlarged. If the same principle were applied to sugar, to tea, to everything that India produces—for it was a prolific soil, it gave us not only food but the fibres for our garments, and, what we could not obtain in this country, medicinal plants to cure the failings and ailings of human nature—what might not be the products that India would bring forth? It had been a great reproach to us that so little had been done in this direction in the course of the long time we had possessed British India. The time had now arrived when we should do something more than only seek to extend our territory. Up to the date of Lord Dalhousie's government, it was true that we had expended all our powers in that direction, failing to see that if that which we possessed was properly cultivated its productions would be quadrupled, and that it would possess a much greater measurement than that to which it was now limited, a few million acres; *i.e.*, if the yield of productions was four times what it was before, the value of the land would be four times as great, and therefore that the land would be practically increased fourfold. That was a fair calculation, and one that, being founded on common sense, would recommend itself to everyone. But while an intelligent public at home appreciated these facts, the governing power of India had not thought the first necessities of mankind worthy of their attention. They had thought of the native army; they had thought of the home army; they had thought of state; but they had not thought of the comforts of the people, and they had neglected the first element of progress, they had not given them common sense education nor the knowledge of civilisation. We must not shield ourselves by saying that we had an inferior intellect to deal with. Perhaps the Hindoos are a more timid race than ourselves, but they were our equals in intellect, and we who had the development of India in our hands were bound to spread information among the great masses of the people. There could be no doubt that if we could get rid of the remains of savage life in India we should secure increased fertility of the soil and prosperity to those who tilled it. It was a fact connected with the savage animals that they occupied a large part of the country. The tigers took considerable numbers of the Hindoos from their villages, and the people had become so much alarmed that they had not the courage to destroy their enemy. If we recollected that the devastation of such animals extended over a large portion of productive soil, we should see that if they were destroyed there would be, where they had had their prowling haunts, greatly increased means for obtaining crops of every kind. It might be not two hundred years since the last wolf was destroyed in England, and they were still to be found on the Continent, but in India it was very different. There, in addition to the tiger, the leopard, and the lion, were wild hordes of elephants that swept the country, and before whom all inferior animals must give way. Now, if we could exclude these wild animals, we should have an abundant territory that might be improved by cultivation. His friend, the Chairman, had a great experience connected with the native cotton industry of the north, and he knew quite well that we could, in our great cotton manufacture, receive, with benefit to that manufacture and to the people of India, large supplies of cotton. The cotton first used in this country came probably from the Mediterranean, from the neighbourhood of Smyrna, and there were various cotton supplies before we received the American cotton. But it was a very singular fact that, while Watt was completing his improvement of the steam-engine, Hargreaves and Arkwright were succeeding in inventing machinery which has so greatly increased the consumption of cotton, and which has made its manufacture one of the greatest, if not the greatest, achievements of the age. The first record of cotton imported from the East Indies was in 1806, when we received 7,787 bags. In 1815, we received 22,357 bags. In 1830, we had got up to 35,000 bags. One could appreciate the great increase that had taken place by knowing that, at the present time, this quantity would serve the trade for only three or four days. By 1840, very great progress had been made, 216,400 bags been received in that year. In 1850, the imports became 807,900 bags; and by 1860 they had risen to 563,000 bags. Then he would just bring forward an intervening year, 1865, because that was the year in which the largest quantity of cotton was imported, the amount in that year being 1,840,770 bags; and he thought it worth while for him to explain that he introduced this particular import because it arrived most opportunely, at the height of the distress the cotton famine inflicted on this country, and though this amount was only equal to about half the consumption of Great Britain, it was a great boon. Coming to the last year, 1870, the import was 1,065,540 bags only, so that from 1865 there has been a very great falling off in the supply of Indian cotton. During the American civil war we paid to the ryots probably in cash over and above the ordinary value £100,000 sterling more than we should have had to pay if the supply of cotton from the Southern States of America had been uninterrupted. In all probability the year 1864 was the heaviest year. He was glad to see in that room the gentleman who had complained of the cost of England to India. That would be some set-off, and he only hoped that by a due cultivation of the soil, and therefore larger exports, England would yet pay many millions to the cultivators of the soil of India. Necessity was said to be a great teacher, and he must say that the cotton trade, finding the position it was placed in by the great American war, had made great efforts to improve Indian cotton. It was very much better than formerly, though not equal to New Orleans. It was quite equal to what was called middling cotton, and the price may be as 6d. to 7½d. for the American. That was a proportion that did not exist even half a century ago, and which shows the capability of India to grow a better quality of cotton, which bore an improved and higher price for the labour that had been bestowed. Looking at the specimens grown under favourable circumstances in India, he was quite a believer in the capability of India to grow products equal to those of America for all common purposes of use, though of course India could not hope to vie with America for the long, silky cotton which the latter grew on the Sea Islands. Under the care of Mr. Rivett Carnac, great things had been done in the production of cotton. His friends in that room were aware that the proportion of cotton to the acre in India used to be from 40 to 50 lbs., whereas, under the care of Mr. Carnac and others, as much as 250 lbs. to the acre had been obtained. The produce of 40 or 50 lbs. at 3d., was, say, a pound sterling; that of 250 lbs., say at 6d., was about £6 5s. per acre, which amount in this country was not deemed to be a bad agricultural return. The first great duty was, that we should encourage throughout India Agricultural Boards, and a better system of cultivation. Without the aid of the Royal Agricultural Society, he doubted whether we should have our green grass crops, or our heavy yearly crops of wheat, oats, and barley. By the intelligent cultivation of the soil of England there had been a vast increase in its products from what they were a century ago; and if the great products of the country can be increased in extent, and improved in quality, so as to become of much greater value by that means, the comforts of life, from the better building to the better clothing, are so much improved. And so would it be with the people of India if their soil was better cultivated. Their soil would be richer in produce, their means of export would be greater, and they would secure comforts to themselves of which they are comparative strangers. The people of India are at this moment important customers to this country, and if they cultivated more closely their soil, and raised a better quality of their favoured products, they would not only be increasing their means of living, but would be helping to raise the condition of the great family of man in every country. Industry recoups itself and benefits the whole of the great family of man. The great industry of England is not merely beneficial to the people of this country but to everyone, as by them we carry our products for the exchange of comforts to every part of the known world. By the exchange of the growth of products we enrich ourselves. He hoped the legislature would act in a proper direction, and would enable them to fight the battle of industry, to increase the comforts of life, and to diminish the burdens which bore—aye, so heavily—upon the shoulders of our people. And if the people of India could increase their products and exports, the expense of government would become a much smaller amount in proportion to the receipt of products in this country. At the present moment we remit from 10 to 12 millions sterling to meet charges on the Indian Exchequer, and we receive in imports 50 to 60 millions sterling, so that the sum we have to remit is one-fifth of the whole of what we receive. But if the Indian exports were doubled, if they were 120 instead of 50 or 60 millions, then the sum we have to remit would be but one-tenth of the imports, and the burden would be so much lessened. He could only repeat what he mentioned almost at the outset, that he believed that, on the well-known principles of modern cultivation, the produce of India might be greatly increased. There was scope within bounds for action, and from it what riches would flow. Therefore he used the old fable of the farmer, who said to his sons that he left them no fortune, but something in the earth, and, if they would dig, they would discover it, and they must spread the seed in the soil they dug. And so the farmer's sons went to work. They sowed the seed, and in due time dug the earth, but though they found no golden treasure, by the gift of Providence the fortune was given in the shape of abundant crops. That, in practice, is one of Æsop's fables, 2,500 years old. We require only common-sense efforts. Providence has not given us mysteries as obstacles to industry. Obstacles are put in our way to invigorate our efforts, to give us strength to work on, and at last we get the charm of the reward of our labour. We must govern India faithfully; we must so govern it to, if possible, make the people understand their own true interests; we must put them in positions of responsibility—he had every confidence in their capacity—and if the time should come when they were prepared to rival us, when they should say we can govern ourselves better than you can, our successors will have the satisfaction of seeing the fruit of beneficent government, and the severed people will prove to each other a greater source of prosperity than when they were in alliance with us. The United States, as a distinct nation, was more beneficial to us than if it remained a part of the empire. And it is evident that when a people have energy and responsibility combined, they will enjoy prosperity to an extent they never could have attained under the mildest tyranny of a foreign government. He hoped that by the means to which he had referred, by the investigations of the committee just appointed, by the creation of the new Board of Commerce and Agriculture, with a due regard for industry and the great sources of the nation's wealth, that India would make great strides, and be enabled to give information to the great masses of the people, so as to teach them to obtain the rewards of their toils out of the superabundance of the fruits which labour well directed would give them.

The Chairman introduced to the meeting one of the most able agents of the Cotton Supply Association (Major Trevor Clark), who had made close investigations into the growth of cotton in every part of the world, and who had been making various experiments, some of which promised the most important results.

Sir Thomas Bazley, interposing, said he ought to have referred to an invention for the better preparation of cotton, the McCarthy gin, which had been imported from the United States into this country, where it was approved of, and from whence it had been sent out largely to India. In many parts of India, the saw gin was used, which tore some of the fibres of the cotton in its preparation, but he might add that the McCarthy gin was being well applied. Sir Thomas said, in explanation, when he used the term "bags" he spoke of a quantity of cotton weighing 400 lbs. The chairman, he thought, would bear him out that in Lancashire "bags" and "bales" were synonymous terms.

Major Trevor Clark had only two days ago received an invitation from Mr. P. Le Neve Foster, on the part of the Society, to attend a meeting on "The Claims of Cotton." The chairman and many of his Manchester friends were aware that, for the last ten or a dozen years, he had turned his attention very strongly—being a horticulturalist and possessing a smattering of botany—to the examination and, if possible, the improvement of the cotton plant, which he had examined in all its various forms, which are legion, in every part of the world. Being an horticulturalist and a gardener rather than an orator, he had thought it wise to jot down a few facts to read to the meeting, rather than to launch out on to the sea of elocution, for he feared that if he did so, the many facts which he had collected—as any man must, who devotes a long number of years to any one object—would come out, and he should find himself delivering a lecture on cotton. He had, however, brought a few specimens, which any friends would be at liberty to examine. (Major Trevor Clarke then read a statement, in the course of which he referred to the specimens on the table, to contrast the small native Indian plant with the big American uplands.)

Dr. Campbell supposed that everyone would be best pleased with that portion of Sir Thomas Bazley's speech which most accorded with their own experience, and therefore the portions to which he proposed to refer were those on the Finance Committee of Parliament about to assemble, and the creation of the Board of Industry, which was of immense importance. The Finance Committee, as Sir Thomas Bazley had told them, might be extended to almost any subject, and he trusted that if that were so, the committee would show whether the obstacles to, or delays in, the completion of the railway referred to were financial or political, or were caused by the *vis inertiæ* of the government, or from any other cause. If it were simply a financial difficulty, it could be proved to be a matter of economy to complete this line. Nothing could be more expensive than the maintenance of the British army in India, owing to the unhealthiness of the climate, the inability of the men to take exercise during the day, and the serious expense of sending home invalided persons after a short term of service. Deaths caused by exposure in the plains might be saved, to a very great extent, by quartering the troops in the hills; but it would be impossible to lock up the greater portion of your army in cantonments, where they would be unavailable at a moment's notice, and without railway communication your troops could never be removed from the interior, however desirable or almost necessary the change might be. Therefore, it would be very important to ascertain why this access to the hills was denied. And there are other reasons why the communication with the hill country should be opened up. In every large town of British India a large body of British subjects, such as small tradesmen, well to-do-artizans, and retired soldiers, who could not afford even for the sake of health to go up to the hills in the luxurious fashion prevalent, but who would gladly do so if they could use the cheap conveyance of the railway. A railway would be welcomed by the trading population of the hills, who are now compelled to hold their products in hand, at great loss to themselves, till the month of December. Of the large quantity of tea exported, not a grain would leave the hills till that time. The manufacturing season commenced in March and April, and yet for want of a railway nothing could be done till the month of December, when the rains had ceased and the cold weather set in. Thus, these men who got their advances on their products at the beginning of the manufacturing season, had to wait several months before they could recoup themselves, having in the interval to pay interest on borrowed capital. The next subject to which he wished to refer was the appointment of the Board of Industry. Nearly two years had elapsed since they went in deputation from this Society on the subject to the Secretary of State for India, who then said the matter was under serious consideration, but through the circumlocution of office, nothing had been done. He believed that if an order had then gone out, appointing Mr. Carnac commissioner, everything would have settled itself in three months. He would have had a secretary for each presidency, and if they could not agree upon any point, that then it should be referred for settlement to the Governor-general. The thing might have been in operation for the last two years. Connected with that was what Sir Thomas Bazley had pointed out, the greater amount of production that might be obtained from the land by careful cultivation. Although the cultivator did not manure the land for cereals he did manure it for opium, for tea, coffee, sugar, and all the richer crops. In Nepaul they manured for every crop, and the production of this small province, teeming with a closely-packed and industrious people, was very great. There could be no doubt that, by manuring, the production of the land might be quadrupled, and he believed that greater attention to this subject, and to that of imigration, would make the produce from the land more than it was now.

Mr. Ward had not intended to speak that evening, because the native industry in which he was interested was not before them; but as Dr. Campbell had referred to it, he might say it was one in which the Society had taken very great interest. It was one of the first questions discussed in these Indian conferences, and, as far as memory served him, he believed he was the only person then in that room who was able to take a cheerful view of tea in India; but it was a satisfaction for Indians to know, that it was now in a position of confirmed success. And, in addition to the fact that this year 20,000 tons of tea would come to England, he might add, that a great many private gardens were springing up, and he did not think that gentlemen who had the benefit of experience, would be starting these gardens if they were not certain they would be successful. It would be a very great advantage if the tea could be sent down as it was manufactured. It was always a bad thing to have to draw against growing crops, and it would enable people with smaller capitals than are now employed to take the matter up. With regard to the question of ploughing, he had known cases in the hills where it had been over done, and where it had been dug so deep that it had been washed away by the rains. He thought a man should know what he was about before he dug up the soil, so as to prevent its being loosened to be merely washed away.

Mr. Andrew Cassels supposed that the *Pall-mall Gazette* would consider all who were present as suffering from cotton on the brain. That might be so, but seeing what cotton had done for India he was content to be one of those incurables. He was happy to have taken a part, though a very humble one, in some of the efforts made by Manchester of late years to induce the government of India to promote, by all legitimate means, the cultivation of cotton in India. Sir Thomas Bazley was so well known for the practical good sense and earnestness which he had brought to bear on the question, that his words needed no confirmation to attract attention to them. Still, he thought it might be well that those who had handled Indian cotton for many years back should step forward to support him. When he first went out to India, in 1843, nothing could be more unsatisfactory than the position of the growers of cotton, or the state of the cotton trade in general. The ryot was burdened with debt, and was therefore held in bondage by the middleman. The annual exports of cotton from India to all parts of the world did not amount to 400,000 bales. How great was the difference now. The ryot, of Western India at any rate, was a prosperous man, and the exports of India had, he believed, exceeded even what Sir Thomas Bazley had stated. In 1866, they amounted, according to official returns, to 2,059,360 bales, of 390 lbs. each; and in 1868, he fancied they were even more. As regards the improvement in quality, he could have no hesitation in saying that it could not be less than 35 to 40 per cent. During the period he was alluding to, the fluctuations in price had been extraordinary. He had himself shipped cotton from Bombay in 1843 or 1844, at a cost of less than 3d. per lb. Twenty years afterwards, he had sold East India cotton in Liverpool at 27d. per lb. It was not wonderful that the natives, seeing these great fluctuations, looked upon cotton with a certain degree of awe. The question before them now was this—Can India, in the face of the great fall that has taken place in prices, and of the increased production of the Southern States of America, still grow cotton with advantage to herself? That, as regards this country, it was desirable that she should continue to do so, in order that English manufacturers should not trust to one source of supply only, would, he presumed, be conceded; and that, for the sake of the revenue of the State, she should be able to cultivate so great an article of commerce, would also be acknowledged. He believed she could and would, but in order to arrive at that result, it would be necessary that the government of India should earnestly help those who were honestly striving to help themselves. He thought there must be scientific education in India, as there had been in England, if they were to see an increased production of the land. In England, science had taught the farmer to get 25 per cent. more out of the soil than he did twenty years ago; would science not do more for India, seeing that improvement there would begin from a lower level? In the olden time, an acre of land in India produced about 50 lb. of clean cotton in good years. Now, they heard of land yielding so large an increase upon that quantity that he hesitated to quote the figures. He thought that by a proper selection of seed, by deeper ploughing, by a system of irrigation, and by greater care in picking, much might be done. He did think they might congratulate themselves upon the approaching formation of the long talked-about Board of Commerce and Agriculture in India. He had read the dispatches on this subject—as far as they were public—and from that of the government of India, dated the 6th April last—in which, by-the-bye, the government, in terms quite as forcible as any ever used by Manchester, admitted that much had been left undone that ought to have been done—he gathered that at last their rulers were becoming alive to the importance of developing the agricultural resources of the empire. If the government of India would only act up to the spirit of that dispatch, a new era of prosperity would dawn for India. At the same time, he feared that the new Department would have duties assigned to it which would be conflicting. He could not see how the direction of revenue, commerce, and agriculture could be left in the same hands. He thought it would have been better if they had had a Board of Agriculture only. He did not believe that the agricultural interests of the empire would be so well cared for by a great department having numerous duties to perform, as they would be by a much smaller department devoted entirely to them.

Mr. Pickstone wished to make two or three observations on this cotton question. In the first place, he thought the plan would have to be proceeded on in India as had been proceeded on in the Southern States of America, in the year preceding the civil war, when the Southern States produced over five million bales of cotton. We know that the States which produced this large quantity of cotton produced food almost entirely for the people who occupied them. We know that there was only four to four and-a-half millions of negro population in those States, and that the cotton and food generally were produced by the able-bodied portion of that population. When we consider that India has two hundred millions of inhabitants, it seems a marvellous thing that this amount of labour cannot be utilised. In America every labourer is looked upon as a gain to the State. Every man entering from abroad is considered to be so many dollars coming into the country. If, in India, the same plan of cultivation had been pursued, great good would have come from it. A resident and intelligent proprietary is essential to the carrying out of such a system. The Southern planters, in great part, before the civil war, lived either throughout or for a portion of the year on their own plantations, and with intelligent, well-selected negroes, cultivated their lands and obtained, as we all know, their large results. The cotton crop in that year was worth 50 millions sterling, and this was produced from a territory covered only by 4½ millions of inhabitants, men, women, and children included—cotton equal in value to the whole revenues of India, a country taxed so heavily in proportion to its inhabitants. The improvement in Indian cotton had been very great since 1843. Surat cotton was then looked upon as a most undesirable subject to touch, save for very coarse numbers, and the natives of Lancashire hated it as much as they hated anything. "There, Surat cotton we don't want it; we can't earn our money by it; we can't produce the articles you spinners want produced, and we would rather not have it." Indeed, the feeling was so strong that in some places they refused to work with such cotton. How far the Manchester Cotton Supply Association had helped on this Indian cotton, which, to-day, to quote Sir Thomas Bazley's figures, was 6d. against 7½d. for American, was known quite well, and it was equally well known that without help it would not be equal to or nearly the same as American cotton. This had been brought about by the European influence that had been brought to bear upon the natives, and by the Manchester Cotton Supply Association sending out better seed, and, in many cases, distributing that seed free of cost. He believed that if some plan could be adopted by which Europeans—intelligent Europeans—could be induced to go out to India to superintend and take charge of cotton, tea, or any other plantations, there would be great results, and that, too, within a few years. There was one thing more that he wished to say, and that was with reference to Upland cotton. He was concerned in a plantation for the growth of Upland cotton, and he must tell the meeting that, in his opinion, it cannot be offered to be sold at the price at which it was marketed to-day, and that Manchester must look forward to an increased price or a diminished production, which happened during the last year. He believed that on the plantation in which he was concerned the able-bodied negroes had been paid 150 dollars wages in money, and that they had taken rations from the plantation, both pork and wheat, more than sufficient to keep the labourer. The little boys who carried the water had had water to drink, they had had the rations of full able-bodied men, and wages besides. How it was possible, when the labourers received in wages and food a value equal to the entire production of many plantations, was not to be conceived, and his impression was that this cotton could not be much longer sold at the price it was now marketed.

Mr. Hyde Clarke (late Cotton Commissioner in Turkey) had hoped that the remarks just made by Mr. Pickston would have been anticipated by Dr. Campbell. The application of European intelligence in India was certainly one of the means of the many important agencies at command for the cultivation of it, and we should see that many Europeans would be able satisfactorily to repay their labour in such application if they had easy access to an occasional change of climate. It must be recollected that the American planter had not such a bad climate to cope with, that he was able to take advantage of easy access by railways to other parts of the country for the benefit of his health, and that in many cases he was able to place his family away from the inconvenience and unhealthiness of the plantation. If we could possess the same access to the healthy as we did to the unhealthy parts of India, we should soon have the advantage of the assistance of many of the friends of the cotton movement. Our friends might then be induced to acquire information on the spot, for the purpose of communicating their information to those at home. There was one point to which he wished to allude, and to which Mr. Cassels had adverted, whether cotton can be grown in India at the reduced prices. He thought that was answered by the fact that whereas Indian cotton was raised at 3d. before the efforts of the Cotton Supply Association began, it was now at a much higher figure; and he thought there was every reason, when the disturbance in the rate of wages, and the discouragement caused in the fall of prices, had passed, that we should look forward to a great increase in the supply of cotton from India. There ought to be a proper organisation, and a proper instruction in agricultural science. He thought this was sufficiently clear, if only in reference to the facts which had been brought before them this evening. Sir Thomas Bazley had naturally advocated deep ploughing; and Mr. Ward told them that many of the natives engaged in cultivation had considerable diffidence in the value of deep ploughing and irrigation. In order to arrive at a right decision, and to impart sound scientific information, it was most essential that a course of experiments should be carried out, and this could only be done under a department perfectly and regularly organised. It was absurd to expect the ignorant, timid, and poor cultivators of India to carry out that which at the best was hazardous and uncertain, for it was of as great importance that an experiment should fail as that it should succeed, because it ensured our working in the right way. We could, indeed, only get proper assistance in such a matter from the government.

Mr. Maitland, who had been a merchant in India, and who was still interested in Indian affairs, wished to express his thanks for the speech of Sir Thomas Bazley. India had made great progress of late years. He took occasion a few days ago to say what his own experience was, and he would only now repeat that during the last fifteen or twenty years—and he called upon every merchant in India to confirm what he was saying—a great progress had taken place, and most of all in the introduction of railways, in the support of which some of the native princes had come forward. The Rajah of Putteala had lent £400,000 to government for railways, and the Nizam was making, at his own expense, a line from his capital of Hyderabad to a point on the great Indian Peninsular Line, and the Mahratta Prince Holkar had lent one million. As regards the use of manure in India he did not know much; but he could say that in Ceylon such a thing as manure was at one time unknown, but that now it was used to a very great extent, and the result was a great increase of produce. He agreed with what Mr. Cassels had said with reference to this new department of agriculture and commerce, and there was a danger of the department taking up too much. He held in his hand a copy of the despatch of the Government of India in reference to it. The despatch came to this, that a department should be formed, that a minister should be appointed, and that the duties of that minister should be to watch over the agriculture and commerce of the country. And then it refers—and it is a most interesting passage—to the care to be taken of the minerals of the country. He should almost fear that however able a minister they might appoint, with such a multiplicity of duties, he would be rather overdone. With reference to the question before them, that of cotton, as far as his experience went, and it was not so great as his friend Mr. Cassels', he having been in a part of the country, Calcutta, where there was not so much cotton as from Bombay, he had shipped cotton at 4d. per lb., with a profit, and though expenses of every kind had increased, they had reason to expect that India would be able to go on growing cotton. The prices of American cotton had fallen so low that it was a little doubtful whether they could go on growing to the same extent as the four million crop expected this year. With reference to tea cultivation, in which he was interested, he had reason to hope that it was improving. It would do so still more if means of communication were opened up from the hills to the sea. The produce had to remain where it was grown for a long time, and the producer lost money in interest on advances and insurance. If they could have a railway to Calcutta it would be a very great advantage.

The Chairman said that the subject on which his honourable friend had addressed them, and which the meeting had come together to consider, was the claims of cotton; but if he took up a Bombay newspaper, it appeared that it had no claims at all. In those newspapers he invariably found the people of Lancashire represented as a selfish and sordid body of men, for forcing the government to pay so much attention to cotton. The only reflection he had to make on these statements was, that if his fellow-countrymen in India believed what those papers said, he had a very poor opinion of their intelligence. The question to be answered was this—had the cultivation during the last eight or ten years done anything for India, or had it done it harm; for that was the charge that was made against Lancashire. Well, at the time the attention of England was turned to India it was a time of most peculiar distress in the county of Lancashire. The cotton trade had been subjected to a course of distress not equalled in the whole history of commerce; that great trade had been working short time during ten years; the cotton consumed in 1870 was not equal to that consumed in 1860, and even still some large establishments in the county of Lancashire are unemployed. With regard to the last year, it was necessary to remark that one-fourth of the quantity raised was still in India, and had not come forward. The result of these figures was, that the average value of the cotton imported from India during each of the eight years preceding the American war was three and a half millions, while the average value of the cotton imported from India during the last eight years had been 23 millions, so that there had been an aggregate increase in the trade of upwards of 150 millions sterling. He thought the gentleman who had addressed them on two previous occasions must take some consolation, and more so if he added—

Mr. Dadabhai Naoroji had done full justice to every farthing of English capital that had been spent on India from the first day that England conquered it to the present time.

The Chairman—Some 80 millions of capital had been spent in India upon railways. Some gentlemen had spoken with surprise at a deputation having gone to the India Office from the Society of Arts two years ago, with reference to the formation of a board of agriculture, and nothing had yet been done; but the men of Lancashire could look back for the last dozen years, knocking at the India-office for reforms in the administration of that country. He could recollect he was once told there — "Mr. Cheetham, if your views were carried out we should lose India." "Better that it was lost," he had replied, "than that it should be governed as it now is." He had met with a remark in the *Times* which bore very closely upon the views of the association. It was an article referring to the present fallen and depressed state of France, and what the people of France must do to retrieve its position. Well now, in the year 1857, that was the very ground we took. From our very first efforts we found, to our surprise, that instead of its being a mere agricultural question it was also a political question. We found, in the first place, we must get to the ryots. We urged that there must be roads. Then, when we found that the cotton had to be dragged some five or six hundred miles to the port, we urged canals, and, as time advanced, railways; and the only part of our programme that has not been carried out is this: We urged that there should be in each presidency a Board of Public Works, and for such purposes a sum of money, say 20 millions, should be borrowed over a term of five years, so that they should not be dependant upon whether there was a surplus in the revenue. Occasionally an order went out to build a road, but it was generally a sham, and the moment there was a fall in the revenue the order was withdrawn. This was lately the case with a road commenced in Darwhar to bring cotton to the sea, and for no other reason than what he had mentioned the road had been stopped, and, what was more, all the money that had been laid out on it would be lost. This was constantly the system adopted by the government. Then we found that the ryot had no secure tenure in his land; he was only a holder from year to year. The official collector came round once a year and valued the land. We told the India-office there could be no farming nor agriculture under such a tenure. "What would you do?" we were asked. We advised the Secretary of State that he should sell them the land. This he wouldn't do, but he did carry out what we agreed to, namely, a thirty years' tenure, which had, he believed, proved very satisfactory to the ryots in the Bombay Presidency, who regarded it almost as perpetuity. Yet this was only granted when Lord Stanley, the present Earl of Derby, was in office; and some dozen years after it was first pressed upon the notice of the India-office. Though this has been granted, the public works department was not attended to, and that was a very unsatisfactory state of things. With regard to the agricultural department which they had been urging for some years past, he would have preferred a simple minister of agriculture. He had not much faith in boards, and he quite agreed with Mr. Andrew Cassels, that the proposed scheme would be fatal to any real progress in agriculture. Agriculture would be forgotten in the multiplicity of affairs of an immense central department situated in Calcutta. They wanted one of those boards in every department of India, for it was a question of detail. The Manchester Cotton Supply Association, noticing the inferior sample of Indian cotton, had made great efforts to introduce a better class of seed, and they had been very successful in Darwhar, but not elsewhere. But at last attention was suggested to the indigenous seed, which might, it was thought, be very much improved, and which might do all they required. They accordingly waited upon Sir Charles Wood, who said, "Send some one out from Lancashire." "Sir Charles, how absurd," he replied, "you must have some one who can speak the language, which no gentleman in Lancashire could do, and he must, to command the respect of the ryots, be clothed with an official position." We could make nothing out of Sir Charles Wood, but the moment the present Earl de Grey and Ripon came into office he acceded to our petition to appoint a commissioner. He selected Mr. Carnac. We urged the better selection of seed, and the result was shown in whole districts, which previously produced inferior cotton, now growing native indigenous seed, and cultivated by natives, under the control of government officers. We have got collectors in each of these districts endowed with ample powers; these collectors have several native assistants, and they have secured, by a more careful selection of seed, by a greater use of agricultural implements, by deeper cultivation, and by a more careful weeding, an increase in the productive power of the land. In some places, where 60 lbs. an acre was the yield, 200 lbs. had been produced. If we can use this seed so as to raise the yield generally to 120 lbs. an acre, the question will be solved, as the additional 60 lbs. could be raised without much additional cost. We want no additional land, but simply that a stimulus might be applied to the ryots themselves. Before Sir John Lawrence went to India, he had a long conversation with him, to interest him in this question. And he asked Sir John, "Is the ryot a man capable of understanding his own interest?" "No one more so," was the reply. "But there are some men who do not?" "But he does." "Then," said he (the Chairman), "we can do something with him." When we entered upon our work we found the ryot the slave of the village banker. The ryot borrowed money to raise the crop, and the banker bought it at a round sum, say 1d. or 2d. a pound, without any regard to quality. That is all past, and the ryot, instead of being the slave is the master of his banker, and demands a fair price for his crop; but yet, from want of knowledge of the price it fetches elsewhere, not what it is worth. A gentleman had told him that he was some time ago in the presidency of Madras inspecting cotton. He saw a tall man passing from farm to farm, and he asked who he was. "Oh, he was a Mahommedan, come to buy their cotton." "And what price was he buying it at?" "At about 7d. a pound." "What!" cried the gentleman, "do you know that this very cotton is fetching in Liverpool, 17d. a pound." Why, he might ask, did not the government of Madras publish in the papers of the province the price of cotton in the various markets, so that the natives might get the full benefit of their labours. From this same backwardness to give information, the ryots failed to get the benefit of the cotton famine till it had lasted for two or three years. He could not understand why the government could not see the real object and principle of a government of India, which was to lift up the great mass of the people. Sir John Lawrence had admitted that if we ruled India by the sword only we could not hold it long, for the reign of the sword is always a very short day, but that we must raise the social condition of the people by exchange of the products of their industry. The great thing was to improve the cultivation of India. The very arguments used in support of the appointment of this Agriculture and Commerce Department admit that it is the duty of the government of India to take this up thoroughly. To see the ease with which Lord Mayo admitted all they had been struggling for was almost ludicrous, and he was very glad that this Society had promoted discussions on Indian matters, for you would never do any good in India unless you brought public opinion to bear upon the government at home. He was sadly disappointed with Sir John Lawrence. Sir John had promised to do all he could for cotton, and he had done nothing; nay, more, he had done one or two things against it. There was a line planned—he believed it was the Bombay and Baroda Railway—to open up the communication of cotton for some forty miles to Guzerat; the directors were ready to commence operations, and the native princes were ready to carry it, at their own cost, another forty miles. But Sir John Lawrence said, no. There was a great military line wanted to Peshawur, which must be made first. That was two years ago, and yet this great line still stood in the way. Sir Thomas Bazley looked forward to better and more cheerful days. He only hoped it might be so. Unless English opinion could be brought to bear upon the subject, he did not expect very much from the Indian headquarters. They claimed three things—first, the establishment of this public works department in each presidency; secondly, the establishment of an agricultural department in each presidency—and he hoped they would oppose the proposed scheme; and thirdly, they wanted commercial representatives on the Indian Council. When they had got these they might see better days. He had very great pleasure in asking them to pass a unanimous vote of thanks to Sir Thomas Bazley, for his interesting and excellent speech.

This was carried, as was also one to the chairman, and the meeting separated.

Mr. Briggs writes that he is quite agreed with Sir Thomas Bazley in his opinion as to the meeting having "met to discuss a most important question, viz., the welfare of probably 200,000,000 of people," but thought it not very reassuring to find him admitting the fact that these discussions commenced under the auspices of "himself and the late Prince Consort" 20 years ago, yet, such was the utter want of progress, that we had only constructed in India during that period 5,000 miles of railways, whilst the United States had constructed not less than 50,000 miles. This, in his opinion, was a great reproach to the statesmen who had in hand the work of governing India; and, indeed, Sir Thomas admitted it most frankly. Whenever this fact was brought before the official mind, the answer was invariably, "Oh, but look at the quality of the American lines compared with those made in India." Is there anything more fallacious than this? Let us assume, for the sake of argument, that the American lines will only last ten years, whilst the Indian lines, with the same amount of expense in repairs, would last 20 years. This is double the time of the American line; but now we have to consider what the ten-fold number of miles open is doing to develop the resources of the country during this ten years. These, with the ten-fold number of miles of steam-boat canals and rivers, may be taken as one main reason why America has out-run India in the race of progress in agriculture. Indeed, according to Sir Thomas's figures, India is not progressing, but very seriously going the other way; for instance, since "1865, she has gradually fallen off from 1,847,727 bales in that year, to 1,065,540 bales in 1870," and this in the teeth of having received during the five previous years no less than £100,000,000 over and above the ordinary normal price. We are told that parties, in order to be qualified to give evidence before the new commissioners, must have been in India. Judging from the results I have just pointed out, I should have thought that America could furnish information much superior to India. The great mistake which Sir Thomas Bazley makes is in not recognising the system of land laws which has enabled the Americans to carve out of the prairie and wilderness 60,000 homesteads per annum, and in not adopting the same system of alienating the waste lands of India. If Sir Thomas Bazley and his committee would only do this, they would soon witness "a more rapid improvement in agricultural progress." Until this is done, agricultural and commercial boards will prove a curse (by adding another weight to the already over-burdened taxation of the masses) in place of a blessing. Another grave mistake in the system of governing in India, is that the people are to do nothing for themselves, but that all must be done for them by government. This is the reason things have gone on so unsatisfactorily for the last 20 years in India. "You cannot educate an unwilling pupil; you may take a steed to water, but you cannot make him drink." This system of doing all for the people is utterly and fundamentally wrong, and incompatible with sound principles of political economy. Agricultural exhibitions and colleges, and government supervision and protection can have no general beneficial effect until free trade in land be established on a sound footing. Before this is done, it would be an insult to tell the ryot how he must cultivate his field, and this is what he has felt for a long time, but under the policy of the sword he dares not speak out. Again, assuming that the ryot was universally willing to be taught by others (not to be self-taught), how is such an operation to be accomplished on such a vast scale? By way of illustration, let us suppose that Major Trevor Clarke undertakes to lecture to them, as he has to-night lectured us, on the propagation of a better quality of cotton; and suppose we say he gets to listen to him about the same number as he has here, and that he lectured 300 nights out of 365 in every year, how many years will it take to educate the 200,000,000 ryots or cultivators of India. It will take a fraction over 20,000 years. I am quite aware that this is an extreme way of putting it, and may seem absurd, but it cannot possibly exceed in absurdity the suggestion involving the principle of government doing all for the people. It might, for example, be said that the 200,000,000 are not all adult agriculturists; it might also be suggested that government might multiply their Major Trevor Clarke's indefinitely. True, but suppose we take one in every twenty to be ryots or cultivators, there still remains 1,000 years before the Major could complete the task; and in the event of the latter alternative, viz., multiplying indefinitely officers under government for such a purpose, would involve so much additional expense to the State as to render the burden of taxation still more intolerable and dangerous. With regard to the middle-men, spoken of by the chairman, I would submit that they are not half so dangerous or inconvenient to society as those men who prevent the legislature passing a sound code of laws for alienating the soil from the possession of "those savage animals" referred to by Sir Thomas Bazley. Emancipate the soil, and, under free trade, the people will appreciate their English fellow-subjects (who would settle down amongst them), and follow their example in cultivating it. As matters stand, how is it possible the ryots can manure the land when that best of all manures, the droppings from their cattle, is obliged to be taken for fuel, in the absence of coal or wood? Under free trade this would right itself, inasmuch as ships would go out from England with coal as ballast, and, means of transit, either in the shape of steam-ship canals, or rivers, or railways being cheap, the coal would reach the agriculturist at such a rate as to enable him to buy, and give in exchange, a cargo of cotton, corn, jute, rice, hemp, linseed, sugar, tea, coffee, to any extent. This coal would also enable him to preserve his natural manure, and thereby be another element of profit to him in the shape of increasing the abundance of his crops. Finally, I beg to assure Sir Thomas Bazley that such a policy, in regard to the land laws, is the only one whereby we may hope to secure peace and prosperity, and to pay the national debts both of India and England. Agricultural associations would rise spontaneously under the guidance, not of government, but of society at large, just as they did when free trade in corn was accomplished in England.

A Conference was held on Friday evening, March 24th, at Eight o'clock, "On the Establishment in England of an Oriental Congress." The proceedings were opened by Mr. HYDE CLARKE. A report will appear in a future *Journal*.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.—NOTICE.

Members who have not yet exchanged their receipts for the tickets for the six concerts to be given by the Society of Arts, at the Royal Albert Hall, under the direction of Sir Michael Costa, and the first of which will take place on Wednesday evening, April 12th, at 8 o'clock, are requested to do so at as early a date as possible. The ticket office closes at 4, on Saturdays at 2.

The members are informed that the whole of the boxes holding five persons have been subscribed for, and that only a limited number of the amphitheatre stalls remain unappropriated.

Boxes to hold ten persons, for the six concerts, can still be obtained, price	£30	0	0
Amphitheatre Boxes, to hold eight persons, for the six concerts	25	0	0
Amphitheatre Seat (reserved), for the six concerts	3	3	0
Balcony Seat (reserved), for the six concerts	2	2	0
Arena Seat (reserved), for the six concerts..	2	2	0
Gallery Seat (reserved), for the six concerts	0	15	0

Tickets to be obtained at the House of the Society of Arts, John-street, Adelphi, W.C.; at the Royal Albert Hall, Kensington-gore; at the Royal Horticultural Society's Offices, Exhibition-road; at the ticket-office, Exeter-hall; the City Box-office, 4, Royal Exchange buildings, E.C.; Messrs. Keith, Prowse, and Co., 48, Cheapside; Messrs. Chappell, 50, New Bond-street, W.; Mitchell's Library, Old Bond-street; Austin's Ticket-offices, St. James's-hall and 28, Piccadilly; S. M. and A. Warren's Ticket-office, 1, Edwardes-terrace, Kensington.

CANTOR LECTURES.

The third course of Cantor Lectures for the Session will be delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will consist of Five Lectures, commencing on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. (now Sir) W. Fothergill Cooke and Professor (now Sir) Charles Wheatstone, F.R.S., in "recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Council invite members of the Society to forward to the Secretary, on or before the 22nd of April, the names of such men of high distinction as they may think worthy of this honour.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

The Aim of the Exhibitions.—On Tuesday evening, in the hall of the Society, Mr. Edward Hall, F.S.A., delivered the first of a series of lectures explanatory of the aim and scope of these proposed exhibitions, in their relation to the development of art, science, and industry. He began by referring to the establishment of museums under the First Napoleon, and the passing of the late Mr. Ewart's Museums and Libraries Act, and then proceeded to remark upon the spasmodic character which had distinguished all our international efforts in the same direction. The building of 1851 was insufficient to meet the demands made upon its space; so was that of 1862; and the same inconvenience was also experienced in the Palais de l'Industrie at Paris, in 1867; and in order to avert in future the confusion resulting from similar defects, it had been resolved to have annual exhibitions, in which there could be "a posting up" of the yearly progress in arts, science, and industry. The lecturer next dwelt upon the national and international benefits that must flow from these periodical reckonings, and glanced at some of the improvements already made in the tastes and habits of the people by former exhibitions, the last being held at the Agricultural Hall, Islington. No one could look now into the shop windows of our large towns without being reminded of what the Exhibitions of 1851 and 1862 had done for domestic art, nor could anyone over-estimate the still further advance in taste and civilisation these annual exhibitions were destined to accomplish. Mr. Hall furnished his audience with a description of the new buildings adjoining the Horticultural-gardens at Kensington, where the objects of art, science, and manufactures are now in course of arrangement, specifying the various classes into which they will be distributed, and accompanying his details with a brief glance at the interior of the new Albert-hall. Lord Lyttelton, who presided, endorsed the views of the lecturer as to the influence of these exhibition upon the tastes, habits, and feelings of the people; and, after some discussion, the meeting closed with the customary vote of thanks.

The Musical Arrangements for the opening of the Exhibition, on the 1st of May, are nearly completed, and new compositions, representative of France, Italy, Germany, and England respectively will be produced for the occasion, by M. Gounod, Chevalier Pinsuti, Dr. Ferdinand Hiller, and Mr. Arthur Sullivan. M. Gounod will produce a psalm, Chevalier Pinsuti a chorale to English words, Dr. Hiller a march, and Mr. Arthur Sullivan a cantata.

INSTITUTION OF NAVAL ARCHITECTS.

The first meeting of the twelfth session of this Institution was held on Thursday morning, the 30th inst., in the Hall of the Society of Arts, by permission of the Council, the Right Hon. **Sir J. Pakington, Bart., M.P.**, President, in the chair.

The Honorary Secretary (C. W. Merrifield, Esq.) read the report of the Council and the balance-sheet of the Institution.

Report of the Council, 29th March, 1871.

"The Council of the Institution are glad to be able to report to the members and associates that the prospects of the Institution are more satisfactory than ever.

"Thanks to care and economy, the institution is now wholly out of debt. Since the preparation of the balance-sheet, every outstanding liability up to the present date has been actually discharged, with the exception of some trifling bills, which have not yet been sent in, but which do not amount in all to £10. The volume of last year has been paid for, and discount allowed for prompt payment, and there is at this moment £250 in the Treasurer's hands, besides a small balance in the hands of the Honorary Secretary.

"The Council desire to express to the members and associates their high sense of the valuable services rendered by Mr. Merrifield, as honorary secretary to the Institution, and trust that by the next Annual Meeting the finances of the Institution will enable them to attach a pecuniary compensation to the arduous duties of the secretaryship.

"This satisfactory condition of the finances, to which the Admiralty have again contributed £250, is mainly due to the great care that has been taken to keep down the working expenses. During the past year, the expenses have been kept within the income. The Institution possesses a stock of volumes of "Transactions" and a professional library, which is open for the consultation of members and associates.

"The Council are glad to be able to state that the Royal School of Naval Architecture and Marine Engineering is doing successful work. Many of the former students are now filling positions of trust and responsibility, both in the public service and in private employment. Details of their names and present occupations will be found in the "Annual" of the School, a professional magazine which has been originated by the students, and the first number of which is doubtless in the hands of many of the members and associates of the Institution.

"The Council directed the issue of a circular, pointing out certain subjects on which they desired to receive communications. A very large number were issued, but only produced a limited number of replies. This circular has, however, had the effect of giving a somewhat more varied character to the programme of papers to be read at the present meeting than it would probably otherwise have had."

Sir John Pakington, Bart. (President), said:—Gentlemen,—It now becomes my duty to commence the business of this annual meeting by addressing to you some few observations, as I have the honour to be your chairman, but I feel on this occasion, as I have on other occasions, that I should best perform that duty by compressing those observations within as narrow limits as I fairly can, in order that any address from me may not interfere with those more important proceedings which will occupy the remainder of our time. Many years have now slipped away since you first did me the honour of placing me in this chair; and I can only say that which I think every man would naturally feel, that I cannot have held this distinguished position so long without feeling a growing attachment, I may say growing interest, in the welfare and progress of this institution; and every year tends more and more to convince me that, looking to those great national objects which we have in view, the working and the operation of this institution has been most successful and most valuable, and it is a matter of legitimate congratulation, and upon which I do congratulate every member of this institution, whom I have now the honour of addressing, that the contents of the report are of that favourable character to which we have listened this morning. We find, from the contents of that report, not only that the usefulness of this institution continues, not only that its success is undoubted, but, for the first time, I am happy to say, you have received a most satisfactory report with regard to the financial prosperity of this institution. It is now fairly launched. There have been some difficulties in former days to contend with, but they have now been overcome, and we may, I think, with greater confidence than at any former period, congratulate ourselves upon the established success and the steady prosperity of this valuable institution. Not only are our finances in a prosperous condition, but our numbers are steadily increasing. And, gentlemen, there is another point in this report, on a subject by no means new to us, but which we have never been able before to advert to in the same terms as we now do. I allude to the continued success of the Royal School of Naval Architecture, which I may speak of, I think, as I have done before—as the child of this institution, and which has now been carrying on its work till we can speak in terms such as we never could before us—namely, those which you have heard from the report, that "many of the former students are now filling positions of trust and responsibility both in the public service and in private employment." I heartily congratulate you on this consummation of that part of our work. I have always regarded that part of our work with peculiar interest, because I have felt its national importance, and we are now reaping the first and real fruits of the success of that part of our institution. Gentlemen, there is another paragraph in the report to which I cannot help calling your special attention, and I feel it the more my duty to do so because I am sure you will not fail to have observed that, distinct as our secretary generally is in all that he says, he did not read this paragraph of the report with that emphasis and care with which he generally reads other paragraphs:—"The Council desire to express to the members and associates their high sense of the valuable services rendered by Mr. Merrifield as honorary secretary to the Institution, and trust that by the next annual meeting the finances of the institution will enable them to attach a pecuniary compensation to the arduous duties of the secretaryship." I am sure I do not say too much when I add that those duties have been discharged in a manner to entitle our friend Mr. Merrifield to the gratitude of everyone who takes an interest in this institution, and I hope, before we meet again another year, we shall be in a position, as that paragraph indicates, to afford him a more substantial and better proof of our feeling on that subject. There is one subject, gentlemen, to which I am obliged to advert in terms of regret—it is the circumstance which has compelled us to adopt what is, in one respect, a retrograde movement. It will be in the recollection of everyone here that last year, such was the growing interest of our institution, and so great was the amount and importance of the matter to be brought before us, that we extended our proceedings over four days instead of three, but this hall in which we are now assembled is, as you are aware, occupied on Wednesday in every week by the Society of Arts; and last year, on the first day of our meeting, we were kindly allowed the use of the theatre at South Kensington, by which we gained the Wednesday, so that we were able to hold our meetings on four successive days instead of three. This year it was intended to carry out that arrangement again, but we were obliged to abandon that intention in consequence of the public proceedings which took place yesterday, at Kensington, in connection with the opening of the Albert Hall. That compelled us to fall back again upon our old limit of three days; but I think, when you look at the business programme, and at the number of the papers that are to be read, it will afford abundant proof that if we could have occupied four days we should have had ample matter for doing so. I very much regret that we could not repeat the arrangements of last year, owing to the causes to which I have adverted; but I hope that next year we shall again return to the four days' meetings instead of three. Gentlemen, in these nautical matters, as in others, science does not stand still. We have abundant proof of that on every side, and we have the satisfaction of finding that while science is advancing in a variety of ways, this institution enables us to draw together the many proofs of those advances in science, and here to discuss and consider, and permanently to record the various changes that take place, and thus to fulfil the useful and valuable mission which I consider to be the function and immediate duty of this Association. It would not be for me, even if I were competent, which I am not, to enter into the various respects in which those various branches of science relating to our particular duties are progressing and advancing; but I cannot help briefly glancing at the changes which are taking place with regard, for instance, to improvements in steel, and the extent to which it seems probable that, at no distant day, steel, to a certain extent, at all events, will supersede the use of iron. Simultaneously with those changes with regard to steel, we find the manufacture of iron is also being greatly changed and greatly improved, and it is impossible to regard with indifference the improvements in these metals, bearing, as they inevitably will in an important degree, upon the construction of our ships in future days. Other great changes have taken place with regard to the manufacture of marine engines, and I am exceedingly glad that we made that change last year of admitting marine engineers as members, as they ought to be most fitly, of this Association. I think it was a most desirable and beneficial change, and that in many ways we are reaping the benefit of it; and, if I may believe and trust what I hear, I believe the marine engines of the present day are almost as different from the marine engines which were placed in vessels when they were first propelled by steam as those engines were from the unassisted canvas. Such is the progress of science, and that progress is continuous and uninterrupted. Gentlemen, there is another subject to which I think it my duty briefly to refer. It will be in the recollection of many who are here, that when I made my opening address at this institution last year, I adverted to several melancholy cases which had arisen of the loss of ships at sea. I remember stating to the meeting that having thought it my duty to put certain questions on the subject in the House of Commons, I had received from all parts of the country communications of such deep interest, and tending to excite such vague suspicions and doubt as to the state in which many of our merchant vessels are sent to sea, that I thought it my duty to consult this institution as to whether, in their judgment, the time had not arrived when it would be desirable to raise some question upon this subject in the House of Commons. The opinion of the meeting was that the subject did require parliamentary attention, and I think it my duty, therefore, to mention to the institution that, in furtherance of what I understood to be the wish and request of my brother members of the institution, I did call the attention of the House of Commons to the subject, and moved a resolution praying, in substance, that a commission should be issued to inquire into the cause of the great loss of life and property at sea during the last few years, and to inquire if any and what changes could be made with respect to collisions, over-loading, stowage of cargo, and other matters with a view of giving increased safety to passengers and merchant ships. That resolution I moved in the House of Commons, and a debate, I think I may say of considerable interest, took place, the result being that I did not find it desirable to divide the House on the subject, and in consequence of the turn which the debate took I withdrew the motion, but with an intimation that the subject would not be considered as beng at an end; and I am willing to hope that, even as matters now stand, that discussion was not altogether without satisfactory results and some fruits. This year the subject has been again mentioned in Parliament by another honourable member, and some little discussion upon the matter took place. We have again before us that huge Mercantile Marine Bill—a great volume, in fact—which was brought forward last year. I cannot say I have read all the numerous pages of that tremendous Bill, but I believe it is essentially much the same Bill as that of last year. I think the general impression last year in the House of Commons was, and I believe the general impression among those conversant with the subject was, that the provisions contained in that Bill for the correction of those evils to which I have now adverted were not altogether satisfactory. That is, I think, still the impression of those who have considered this subject, and it is satisfactory to be able to state that, in the discussion that took place, the present President of the Board of Trade was strongly pressed, in the event of the business of the session being such as not to allow a full discussion of the great Mercantile Marine Bill, to embody that particular portion of the Bill which relates to the safety of ships at sea in a separate measure, and bring it forward during the present session under such circumstances as to allow Parliament fairly to discuss a question so important to the lives of our sailors and the property of our shippers. That is the position in which the case now stands. Of course, it will be the duty of those who take an interest in this subject—and I am happy to see some gentlemen among us here who are members of Parliament—to remind the President of the Board of Trade of the promise which he has made, and I am sanguine enough to hope that the Session will not pass without the attention of the House being called to this subject. I cannot say, gentlemen, that I am familiar, at this moment with the statistics of our losses at sea during the time that has intervened since last year. Whenever I make myself master of these statistics, I think it very probable I may find that, at all events, those casualties which arise from blamable causes have not been so numerous as last year, because I think it probable that the discussions in Parliament last year would act as a warning to those who might have been in need of any such warning. I hope and trust we shall hear of no more *Sea Queens* in the present year, and I trust, however that may be, or whatever may be the statistics of last year, and however favourable they may appear — whether they are favourable or not I really do not know—that Parliament will not be diverted from giving serious attention to this subject, which I myself entirely and fully believe to be necessary. Gentlemen, I think I might here end the observations that I think it my duty to make to you to-day, were it not for one painful subject, which I feel it to be impossible for me to pass over in silence—I allude to that terrible event which cast a gloom over the whole of this country, the loss of her Majesty's ship *Captain*. Gentlemen, I, perhaps, more than most people, have peculiar reason for regarding that subject with the greatest interest. I was not only personally a sufferer, by the loss of a very near connection, who was as promising a young man as ever entered the naval profession, but the share which it was my official duty to take in the construction of that ship has also made me feel a peculiar interest in the subject, and of course has caused me to watch her short career with unusual care and with unusual interest. It so happened, that in point of form, rather than in point of fact, I think I may say, it devolved on me to order the construction of the ship. When I was appointed First Lord of the Admiralty, in the summer of 1866, the position of things which I found was this:—The public mind had been a long time anxiously attending to the suggestions of the unfortunate and ill-fated Captain Coles with regard to this subject. He was a very able man, as we all know, and he had invented what he thought, and I believe rightly thought, a very great invention — a great improvement in the construction of our war ships. He had pressed those views upon successive Boards of Admiralty, and in deference, I think I may say, to those views so urged by Captain Coles, Her Majesty's Government, through the Admiralty, presided over by the Duke of Somerset, had built the *Monarch* as a ship intended to meet the view of Captain Coles, and to solve the great practical problem which had been pressed so much by Captain Coles, namely, that a turret ship might be built as a cruiser. Nobody doubted the possibility of using turret ships for coast defence, but the real problem was whether a turret ship could be a cruising man of war. The *Monarch* was built to solve that problem. But Captain Coles would not accept the *Monarch* as a satisfactory solution of his problem. He took great objection (but I will not detain this meeting by dwelling on the points to which he objected) in several respects to the construction of the *Monarch*, and before the Duke of Somerset left office, he decided, and I venture to say wisely and rightly, to call upon Captain Coles to submit his views to the Admiralty, with an understanding that he might select one of our great ship-building firms and build a ship according to his own views; and I think out of a list of six (speaking from memory, I think it was before the Duke of Somerset left office), with the concurrence of the then Board of Admiralty, Captain Coles decided to entrust the building of that ship to the well-known and highly-respected firm of the Messrs. Laird, of Birkenhead. It then devolved upon me, after succeeding the Duke of Somerset, to carry out this intention, which I was most thoroughly disposed to do, because I thought it right that the great question raised by Captain Coles should be fairly solved; and in an interview with Captain Coles, in the name of the then existing Board of Admiralty, I told him to persevere, to build his ship, and I entirely approved of the selection of the Messrs. Laird, as being the best persons to whom he could entrust that duty, and I required that the designs and plans which he intended to adopt should be submitted to the then Board of Admiralty which was acting under me. Well, gentlemen, Captain Coles shortly afterwards brought his designs and his plans, and showed us a ship which was to be upwards of 300 feet in length, which was to be upwards of 4,000 tons in size, but which was to have a free-board of only 8 feet. In a private conversation in my room at the Admiralty with Captain Coles, I shrunk very much from this free-board of 8 feet. It will be in the recollection of most of you, after I brought forward that melancholy event, the loss of the *London*, that the Council of this Institution undertook, and in a manner which I have always thought greatly to their honour, carried out, an investigation into the various modes of constructing sea-going ships, and I think they arrived at the conclusion that 8 feet free-board was the very minimum which could be safely assigned to a ship of anything like the dimensions to which I have adverted; but considering the construction of a man-of-war, and considering the weights of various kinds that she has to carry, I confess it was with great reluctance that I consented to a free-board of 8 feet, but I did consent to it on this ground that the principle on which I was acting was that Captain Coles should solve his own problem, and that, as he pressed to have a ship with that free-board, it would not have been consistent with the principles on which I was acting to interfere further than to express my doubts and fears with regard to the success of so low a free-board. Gentlemen, you know the result—the ship was proceeded with, the ship was launched, and, to the astonishment of everyone, I think—and I confess I can never forget the dismay with which I heard it—instead of a free-board of 8 feet, the *Captain* was launched with a free-board of only six feet.

Mr. Merrifield—6 feet 5 inches.

The Chairman—My friend Mr. Merrifield says it was 6 feet 5 inches. I have intentionally dropped the five inches. I think the original free-board suggested to me was more than 8 feet; I fancy it was 8 feet 4 inches. I am taking the broad figures. The real distinction was between 8 feet and 6 feet, but there were odd inches, if I remember rightly, in both cases. The real distinction was a free-board of 8 feet proposed, a free-board of 6 feet really. Those were the facts. Gentlemen, you must all feel that this serious deviation from the design of the ship has led to many grave questions, and will lead probably to many more grave questions. Such questions as these have arisen, and must arise. What was the cause of the great deviation from the original design? Was that deviation from the original design the cause of the loss of the *Captain?* That is another question. A third question is—When that great deviation from the design was discovered, what steps were taken? Were proper steps taken to test the effect of that deviation on the stability of the ship? If no such steps were taken, why were they not taken, and who was to blame? Gentlemen, I have just mentioned some of the questions which have arisen, and which must arise in every mind, upon this most painful subject; but with regard to these questions which I have just suggested, it is not my intention to say one single word, and if I may take the liberty from this chair of offering advice to my brother members of this institution, I would venture strongly to counsel that we should not enter into discussions of any personal matters. I think that we should be travelling out of our way if we were to do so. We should be raising questions which we are not able to settle, and we might be giving pain in many quarters without being at all competent to decide how far or where that pain ought really to be inflicted. Above all, gentlemen, I would counsel you, if you will permit me to take the liberty of doing so, to bear in mind that these are questions still pending. They are questions which may, and, indeed, as far as I have the means of judging at this moment, probably will, become the subject of discussion in Parliament; therefore I would strongly urge that we should not introduce them upon this occasion. We cannot settle them; they are questions no doubt of extreme interest, but whether we discuss them or whether we do not, and whether they come before Parliament or whether they do not, I think we may console ourselves with this one only subject of consolation which a subject so painful can afford. Depend upon it the lesson we have had will not be thrown away, and, wherever the blame may rest, that blame will not be incurred again. I hope, gentlemen, I have not exceeded the limits of my duty in venturing to offer this advice. With regard to any scientific questions which may arise, or with regard to any scientific inferences which may be drawn from the construction of that ship, I hold that as a matter of naval architecture, as a matter of scientific inquiry, it is not at all desirable that we should exclude this subject, painful as it is, but that we, exercising our proper and legitimate functions, should endeavour to draw from that unhappy calamity whatever useful inferences and sources of instruction we may be enabled to do; but, gentlemen, I hope that you will subscribe to the propriety of my earnest advice, that we should abstain from the discussion of every question of a personal nature in connection with this very painful subject. Gentlemen, in conclusion, allow me to say this. I am very sorry to say that I do not think I have ever opened any of these annual meetings without being in such a position that I have been compelled to offer an apology for my own inability to attend, as I certainly ought to do, and should very much desire to do if it were possible, the whole of our meetings. I have always endeavoured to be present on the first day, and I think, without exception, I have always been present on the last day. But, gentlemen, I am sorry to say that I shall not be able to attend the meeting on the last day on this occasion, as I am obliged to be in Worcestershire on Saturday next, and must leave town to-morrow night. I must, therefore, express my hope that, with your usual consideration, you will excuse my attendance on that day. I regret to say, also, that the same thing will apply to the meeting this evening. This evening will be one of great interest in the House of Commons; therefore it will be my duty to be there. In consequence of the journey which I am about to take I shall be debarred from the pleasure of attending to-morrow evening. It affords me, however, much gratification to be present this morning, and I shall also be able to preside here to-morrow morning, and I trust that with your usual kindness, when I am not here, you will not attribute my absence to a desire to neglect the important duties which devolve upon me, but will attribute it to my inability to be present in consequence of having other duties to fulfil. It was a question arising in my mind whether a person so occupied was fit to be chairman of an institution of this kind, which has a claim to all our time. Gentlemen, I am obliged to you for the attention with which you have listened to the few observations I have made.

The following papers were then read and discussed:—

ON THE IMPROVED COMPOUND ENGINES AS FITTED ON BOARD H.M.S. "BRITON."*

By G. B. Rennie, Esq., M. Inst. C.E., Member.

The importance of economy of fuel is so great on board ships generally, and especially in a man-of-war, that the Admiralty were induced, I believe, through Mr. Reed's (late Chief-Constructor of the Navy) suggestion, to try an improved form of engine, adapted for using high pressure steam, combined with means of working it very expansively. The engines adopted were of the compound description, with the addition of an arrangement for re-heating the steam on its passage from one cylinder to the other, after Mr. Cowper's plan. They were fitted on board H.M.S. *Briton*, one of the improved *Amazon* class of corvettes, the nominal horse-power being 350, capable of working, with 60 pounds of steam in boilers to 2,100 horses.

The almost universal adoption for ship purposes of direct-action engines, which usually make at least some 50 revolutions per minute and frequently more, necessitates the valve for cutting off the steam to be of a sliding kind; hence, when it is desired to have great expansion, some such arrangement as that of compound engines must be employed, which permits the steam being first expanded to its utmost in a small cylinder, and then further expanded in a large one; thus, supposing it is required to expand the steam 15 times, this is accomplished by making one cylinder three times the capacity of the other, and applying a sliding-expansion valve on the small cylinder to cut off the steam at one-fifth of the stroke, which is to be afterwards expanded in the larger cylinder.

The engines of H.M.S. *Briton* are thus made. The smallest cylinder is 57 inches diameter, and the larger 100 inches diameter; the stroke of piston in both, 2 feet 9 inches. The smaller cylinder is fitted with a sliding-expansion valve, to cut off at from one-third to one-fifth of the length of stroke; but in order to have the advantage of the cranks of the two cylinders being at right angles to one another, the steam is not discharged direct from one cylinder into the other, but there is an intermediate chamber or reservoir between the two cylinders, into which the steam is received from the small cylinder and discharged into the large one. This chamber is made of copper and brass, and re-heats the steam within by means of a steam-jacket.

On the official trials of these engines, the pressure of steam in the boilers was about 60 pounds per square inch, and the vacuum in condenser from 27 to 28 inches. Under these conditions, it was found that the power developed by each of the two cylinders was practically identical, and the same pressures were exerted at half-stroke when working "full power." The power obtained at "full power" was 2,148 horses, giving a mean speed of ship of 13·128 knots on the measured mile at the Maplin.

The consumption of fuel for six hours was 24,000 pounds at full speed, indicated horse's power being 2,018, equal to 1·98 pounds per horse's power per hour. The consumption of a 10-knot speed was 1,100·4 horses' power, equal to 1·515 pounds per horse's power per hour; and 660 horses' power, 1·3 pound per horse's power per hour.

Thus, for an engine on the system of the *Briton*, the consumption of best coal may be taken at 2 pounds per horse's power per hour, when developing about six times the nominal power; at $1\frac{1}{2}$ pounds per hour, when developing three times the nominal power; at $1\frac{1}{3}$ pounds per hour, when developing twice the nominal power.

These results were obtained under the supervision of Mr. James Steil, Chief Inspector of Steam Machinery Afloat of the Navy. The coal in each case was carefully weighed in bags at the dockyards, the number of bags carefully counted, the stoke-hole cleared up before and after each trial, and the fires placed in the same state at the commencement and completion of the different runs; two sets of indicator figures were taken from both cylinders at each end every half-hour, and the revolutions of the engines were taken with a mechanical counter.

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* Received 9th March, 1871.

In order to make a comparison of the consumption of fuel per day, and the number of days' steaming with different classes of engines of the best description, I have made the following table, supposing the bunkers to be of the same capacity as the *Briton's*, namely, to contain 240 tons of coal.

I take the *Briton* engines at full power, at 2 pounds per horse's power per hour; the usual type, with 25 pounds steam pressure in boilers, and with surface condensers and super-heaters, at 3½ pounds per horse's power per hour; the injection condensing machine, at 4½ pounds per horse's power per hour; and the high pressure, as usually made, at 6 pounds per horse's power per hour. These several quantities are about the average amount of coal burnt in each case, and the following table is made out supposing that the same indicated power be developed with the tons weight of coal required per day of twenty-four hours, and the length of time it would take to empty the bunkers for each type of engine. Thus :—

Type of engine.	Per H.P. per hour.	Tons per diem.	Days and hours steaming with 240 tons of coal.	
			days.	hrs.
1. Improved compound..	2	43	5	14
2. Ordinary type, with surface condensers and super-heaters	3½	75	3	4
3. Ordinary injection ..	4½	97	2	11
4. High pressure	6	129	1	21

At the lower speed of 10 knots in the *Briton*, when the steam was expanded to its maximum extent of about fifteen times, the coal used per diem was at the rate of only 9¼ tons; this would allow for twenty-six days' steaming, which at 10 knots per hour would give 6,240 miles. This, of course, supposes the voyage to be made under the same favourable circumstances as the trial.

I will now take the comparative case of a mail steamer fitted with geared engines, injection condensers, and super-heaters, with a working pressure of 18 to 20 pounds per square inch in boilers, and of the same supposing it to be fitted with engines like the *Briton's*. The average amount of coal burnt in the former case on the voyage was from 43 to 44 tons per diem. The capacity of the coal bunkers is 570 tons, which, at the above rate, allows for thirteen days' steaming. The speed at measured mile was rather over 12½ knots, and at sea an average of 10¼ knots from port to port.

The latter case with the *Briton's* engines, the power developed would be sufficient to drive the ship over 13 knots mean speed, and the consumption of fuel at sea, according to the results obtained in one of the six hours' trials, giving a power equivalent to that obtained in the engines of the mail steamer at sea, was at the rate of 18 tons per *diem*; and allowing, say 20 per cent. additional, for a somewhat inferior description of coal and less efficient stoking, gives 21½ tons per *diem*, or just one half the present consumption.

The actual number of days' steaming of the mail steamer throughout the year is about 140, so that the quantity of coal required per annum would be diminished by about 3,000 tons; and in consequence of the *Briton's* machinery being of somewhat less weight, and occupying less space than the present engine, and from the coal capacity of bunkers being reduced one-half in bulk for containing the same number of days of coal, there would be about 300 tons additional space for cargo; and as the vessels on this particular line make on the average five voyages out and five home, there would be some 3,000 tons available for freight throughout the year by the adoption of the *Briton's* engines.

It may be considered that there are disadvantages attending the use of the higher pressures of steam and great expansion, and that the "wear and tear" is considerably increased by its adoption. My own experience does not lead me to think so; and I should say there is somewhat less wear and tear than with the ordinary engines, as the pressures and strains are more uniform and less liable to sudden shocks. It was remarked, during the trials of the *Briton*, how easily and uniformly the engines worked, causing less vibration to the ship than in similar classes of vessels with the ordinary engines; but it is a difficult matter to make a comparison, for so much depends on the relative workmanship of different machines and the care that has been taken of them by those in charge.

Perhaps it may be said that better workmanship and supervision in the working is desirable, in consequence of the steam pressure being so much above that of the atmosphere in the small cylinder, and always below it in the large one.

In conclusion, I think I may safely say that the "compound" system of engine has been a gradual but marked step in the improvement of steam-ship propulsion with respect to economy of fuel; as important as the "injection" condenser over the simple high pressure—discharging the used steam into the atmosphere, or the surface condenser over the injection, and may be compared to the progress of organisation in animal life, where the higher the organisation the more delicate is its nature.

ON STEEL AS APPLIED TO SHIPBUILDING.*

By J. B. Howell, Esq., Associate.

In the year 1853, I called the attention of shipbuilders and engineers generally to the value of mild cast-steel, as a material especially adapted for shipbuilding and kindred purposes, and for a long time I failed to make any valuable impression upon those I thought most likely to entertain the subject. I was not merely unsuccessful, but I found, in many instances, a positive aversion to the use of steel for constructive purposes. This aversion, I have no doubt, was caused by the habitual thought of public opinion respecting steel being synonymous with brittleness. Finding this objection so constantly occurring, it suggested to my mind the necessity of giving it another name, and after about two years of fruitless effort, I introduced it as "Howell's Homogeneous Metal." This was the origin of the successful application of steel for boilers, tubes, ships, and locomotive fire-boxes. Messrs. Laird, of Birkenhead, constructed the little vessel called the *Ma Robert*, for the Livingstone expedition. This is the first instance of the application of steel for shipbuilding; but since that time, mild cast-steel has been used very extensively for this and other purposes, where strength and lightness is a first consideration. We are now enabled to make steel suitable in the highest degree for shipbuilding, and I beg to call your attention to the samples exhibited. All these samples have been bent cold, which is a simple and safe test for steel plates; and some of them, before bending, have been heated to a red heat and plunged into cold water, which is a doubly sure test; these particular pieces are marked "A," but they do not appear to have suffered from the severe ordeal they have passed through. The samples are bent, to show the angles to which the various thicknesses of plates should be bent, as a proof of their suitability for ship plates. The extreme test of 180° is beyond the necessary test for plates of this character, but plates up to a ¼-inch in thickness should always bear bending to that degree. The steel may be easily sheared, punched, caulked, and welded, and is 50 per cent. more rigid than iron. The term steel can barely be applied to this metal, as the very small amount of carbon it contains would prevent its being put in the same category as steel. The samples on the table contain 0·2 per cent. of carbon. This, I consider should be the maximum quantity of carbon in steel intended for shipbuilding; for all plates containing this quantity of carbon never fail to give the required tests practically. We have discovered, in our long and extensive experience, certain irons as being the most suitable for the manufacture of these plates, and as there is no reasonable limit to the supply of these irons, there is no difficulty in turning out large quantities of these plates regular in their manufacture. The strength in tension of this steel is about 36 tons per square inch, and the limit of elasticity about 23 tons. From this, it can be seen that the rigidity of mild cast-steel is nearly two-thirds of its ultimate breaking strain. The limit of elasticity in iron is only one-half of the breaking strain. Steel is, beyond doubt, stronger than iron; it is much stiffer, and far more ductile; and I think, were it used only for the skeleton of ships plated with iron, it would be a great gain in strength and stiffness of the whole structure.

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* Received 4th March, 1871.

Steel plates of 1 inch and less in thickness will resist the impact of shot much better than iron. During the experiments at Shoeburyness, conducted by the Iron Plate Committee, and referred to by Sir William Fairbairn in the "Transactions" of the tenth session of this institution, steel plates ¼-inch thick were found to have a resistance equal to iron plates ½-inch thick, and steel plates ¾-inch thick were equal to iron 1 inch thick, and steel plates 1 inch thick had a resistance exceeding iron plates 1¼ inches thick, but not equalling iron plates 1½ inches thick. The steel plates 2½ inches and 3 inches thick had no value against the impact of shot, and the first shot in each instance shattered the plates. This result we were quite prepared to expect, as our mechanical appliances were not equal to the successful manufacture of large, thick plates. To ensure ductility in mild steel plates, we require a blow or squeeze sufficiently great to change the granular structure of the cast metal, so that, when broken by tension, it has a conchoidal fracture, or, as it is understood in the trade, knock fibre into it. The market price of these plates, also angles and bars. is from £25 to £30 per ton; a price, I think, sufficiently low to create a demand for them; for although it may seem a large price compared with ordinary ship-plate iron, it will be found economical to use it, not only in the durability of the ship and in repairs, but in the greater safety to life and cargo.

Many persons who have used steel for constructive purposes have even now a great objection to it. This has entirely arisen from inferior and irregular manufacture, due as much to the consumer as the maker, for the cupidity of both has in many instances induced the adoption of a low-priced article, which has failed to give satisfaction. Had manufacturers been careful to see that plates had what I consider the requisite characteristics for constructive purposes, and which are not difficult to determine, I believe the steel of to-day would not only be the future of iron, as Mr. Scott Russell has said on a former occasion, but had the proper precaution been taken in selecting the proper material, the steel of the past would have been the present of iron. It is desirable, where convenient, that the drill should be used instead of the punch in perforating the rivet-holes in all steel plates; and I would further advise that, as soon as possible after their manufacture, they should be well payed, and, where convenient, submerged in boiling linseed oil. I have found in my experience that plates thus coated, after three years' exposure to the weather, have not shown the slighest tendency to corrosion, though subjected to alternate wet and dry. I consider the life of the plates will be lengthened greatly by this process, and the plates will take the paint much better after it. It is most important that destructive oxidation should be avoided as much as possible. The newly-formed oxide arising from the heat of the furnace does not decay until exposed. The oxide formed on steel plates in the fire is much more tenacious than that formed on iron, and forms more completely part of the plate, being difficult to remove without exposure or abrasion.

I have carefully avoided drawing comparisons between different qualities and makes of steel, but have confined myself to a steel which I consider the most suitable for ship-building, taking into consideratlon the most suitable material, and keeping within the price that I conceive may be paid to make it commercially profitable. Where great strength is required, irrespective of cost, then I should recommend steel such as the armour-plates referred to earlier in my paper, the breaking strain of which, under tension, is 46 tons to the square inch. I would on no account, as far as my experience enables me to judge, use a steel of higher tensile strength than this, as every ton gained in strength beyond this limit is at the cost of ductility, which is important in all structures that are liable to sudden concussion; not but that you can get steel of higher tension with great ductility, but 40 tons is within the limit of certainty. The limit of elasticity of this steel is 30 tons per square inch. This quality of plates is extensively used for locomotive fire-boxes, a great number of which are now in use on the Scottish Central Railway, giving the fullest satisfaction; some, indeed, have been working upwards of nine years. The market price of these plates is £40 per ton, a price which has always prevented shipbuilders from entertaining the idea of using them for shipbuilding.

ON A NEW METHOD OF TESTING METALS AND ALLOYS BY BISCHOF'S METALLOMETER.

By Lewis Olrick, Esq.

In introducing to this Institution the new method of testing metals and alloys, and the apparatus for same, invented by Mr. Gustav Bischof, of Bonn, I wish to state that, as the subject has only been introduced to me quite recently, I hope that the members of this Institution will forgive any short-comings on my part, as it may not be brought before you in so efficient a manner as I could have wished. As, however, the subject of being able to test metals and alloys in an efficient and simple manner, superior to the methods at present in use, is of the greatest importance to a great many members of this Institution, I have preferred bringing it at once before you, instead of delaying it to a future meeting, more particularly as I have been able to have the machine at work, which will at once show the system better than any explanation on my part, accompanied by drawings only.

Mr. Bischof's system of testing consists, first, in preparing test strips of certain fixed dimensions and weight of the materials to be experimented upon. These strips are fixed in a vice, and then subjected to a number of bendings through a given angle. The strips which can sustain the greatest number of bendings before fracture takes place, show that they are made of a material superior in quality to those strips, to which only a smaller number of bendings can be applied.

In preparing the samples for testing by this apparatus, Mr. Bischof gives the following description:—

"In testing the quality of metals or alloys, I distinguish between such as do not, or not materially, alter in quality through fusing, viz., zinc, tin, &c., and such as do alter in quality, viz., copper, brass, &c.

"In preparing metals or alloys which do not alter in quality through fusion for the test, they are fused under constant stirring with a porcelain spatula, and directly the fusion is completed, poured into upright iron moulds, which contain a rectangular cavity, 120 millimetres long, and have a section of 13 by 3 millimetres. For each sample of zinc and tin, 45 to 50 grammes, and for each sample of lead, about 60 grammes are required.

"The bars formed in these moulds are rolled at the ordinary temperature in the test-rolling mill, into strips 130 millimeters long and 7 millimeters wide, until such strips have a weight of 1,500 m. gr. in the case of zinc and tin, and of 2,500 m. gr. in the case of lead. I expressly add that also zinc, contrary to the common view, can be rolled at the ordinary temperature.

"These strips, 7 m.m. wide, which I term 'test-strips,' are cut out of the middle of the samples by means of the rollers hereafter described, after they have been rolled to nearly the required thickness. After cutting the test-strips, their rolling is continued until they have the required weight. The test-strips of the class of metals now under consideration are then exposed in a small metal box for five minutes, to a temperature of 115° to 120° Celsius. This annealing is necessary, as the metals, especially zinc, alter much in quality after rolling, and give higher test-marks, say after one hour, than when tested directly after rolling. Through the annealing, this is at least so far obviated, that within a reasonable time no change is perceptible.

"Finally, every test-strip is cut in two lengths of 65 m.m. each, to be used in the metallometer presently described."

The test-rolling mill which is used is placed on the table.

"The samples to be rolled, when leaving the rollers, pass over a little table, which very nearly touches the lower roller about 10 m.m. below its upper surface. A case of iron or zinc is fixed to this table at the side close to the rollers, its upper part coming close to the upper roller. The length of this box is about 60 m.m., and its height close to the rollers about 20; at the other end 10 m.m. This case serves to prevent the samples from bending after they leave the rollers.

"The central pinion actuates the two screws which press upon the upper roller, and regulates the gradual pressure upon the samples. It is provided with a dial-plate divided into eight divisions, each division having four subdivisions. The figures on the dial-plate are so arranged that 0 (or eight, as they coincide) corresponds with a mark at the back of the uppermost plate of the rolling-mill, when the rollers are firmly screwed together. If, then, the central handle be turned once round from the right to the left, the distance between the rollers is 1 m.m. Therefore, as all samples which are to be rolled have a thickness of 3 m.m., three such turns must be made before the sample first passes through the rollers.

"With the exception of steel and iron, mentioned presently, all medals and alloys are rolled in the same manner, viz., they pass twice through the rollers, each time changing the end which goes in first. Then the central handle is turned one division from the left to the right, the sample again passed twice through the rollers, and so on.

"In the case of iron and steel, the central handle is, after the second turn, only screwed on $\frac{1}{4}$ of a division each time the samples have passed twice through the rollers.

"It is not advisable to let metal strips during rolling become too long, but to cut them at stated intervals in such lengths as are sufficient for successively 3, 2, or 1 test-strip. It need hardly be mentioned that the best parts of samples must be selected for test-strips, and all parts which show flaws or the like are to be rejected.

"The cutting of the test strips to a width of 7 m.m. out of the middle of the samples, which usually are 13 m.m. wide, is effected by means of three small rollers. The lower roller has a width of 7 m.m., therefore a strip of metal being passed through the rollers will also be cut to this width.

"In the case of copper, brass, or other metals or alloys, which alter in quality through fusion, it is necessary to distinguish whether plates or ingots are to be tested. If the former, several strips, each of a width of 13 m.m., weighing about 4 gr., are cut out in the direction in which the plate has passed through the rollers. These strips are rolled as hereafter described. If ingots are to be tested, a sample, 13 m.m. wide, about 5 m.m. thick, and 80 m.m. long, is sawn out with a metal saw, or cut out by means of a chisel. The sample is then filed smooth until it has a thickness of 3 m.m. The tools, the use of which is intelligible without further description, serve to facilitate the shaping of such samples.

"The rolling of the samples thus prepared is effected in the same manner as described for zinc, &c., under repeated annealing, until the test-strips, 130 m.m. long, and 7 m.m. wide, weigh 1,700 m. gr. in the case of copper, and 1,600 m. gr. in the case of brass. The weight of the test-strips of iron and steel should be only 1,200 m. gr., on account of the strain upon the apparatus, hereafter described.

"The annealing must also be effected under the same conditions, if different samples of the same metal or alloy are to be compared. I prefer to use for annealing an iron tube of an internal diameter of about 25 m.m., which, for copper or brass, is coated internally with a thin copper plate, or a tube of fire-clay may be used. The tube is heated externally in a small oven about 500 m.m. long, 400 m.m. wide, and 350 m.m. high, built of fire-bricks, which may be loosely put together. The oven has a grate at the bottom, and is heated with coke.

"The heat in the tube is, in the case of copper, iron, and steel, rather a bright red; in the case of brass, a dull red. All samples should only remain in the tube until they have acquired the heat of the tube, and then at once be taken out. Samples of copper and brass are immersed in water when they come out of the tube.

"The annealing is repeated each time division 4 and 8 on the central pinion correspond with the mark on the rolling mill, and finally the test-strips, when being finished, are again annealed after encasing them in a sheet of the same respective metal. I make such cases by winding some sheet-metal round a piece of iron of the required size. After taking out the latter, the case is pressed together at one end, so as not to admit the air, provided with a metal stopper at the other, and then ready for the test-strips to be annealed."

To save the time of this Institution, I will merely give you a short description of the apparatus here on the table, and prepare hereafter a complete description and drawings for insertion in the "Transactions."

The metallometer consists of a case containing the clockwork, which gives a revolving motion to the crank, and from this an oscillating motion is imparted to the main axis through the slotted arm above the axis, which is supported at each end by two standards. To the main axis are fixed, close to the standards, two levers, which, at their extremities, support two weights which hang perpendicular during the oscillations, and thereby maintain the guide-bars through which the test-strips have to pass in a vertical position. Between the two levers are fixed five small vices, in each of which two test-stripes are fixed, and to the other end of each test-strip is attached a small weight. It must, however, here be particularly noticed that the bending takes place, not across the jaws of the vices, but across the edges of the guide-bars, as otherwise the different force with which the vices were screwed up in gripping the test-strips would make a material difference in the number of times the metal to be tested would stand the bending. There are two short standards containing set-screws, for the purpose of insuring that the bend is made each time through the proper angle, which is by preference $67\frac{1}{2}$ degrees. This can, however, be altered if required. The fly at the top of the clock is provided with discs for regulating the velocity of the revolutions, and in front two dials are provided, from which the number of oscillations can be read off.

Mr. Bischof has found, by a number of experiments, that the most suitable standard unit of comparison, to which all results can be referred, is that of chemically pure zinc, because the resistance of this metal to bending is extremely uniform. From the appended tables, it will be seen that Mr. Bischof's tests are exceedingly delicate, as 0·00001 per cent. of tin, or 0·0004 per cent. of cadmium on pure zinc can be detected, and the experiments would only last about an hour, whereas such minute traces would most likely escape the notice of the analytical chemist, even if he spent a fortnight on his analysis.

Before concluding, I wish to call attention to the application of this machine for testing copper. Good malleable copper ought to contain a certain amount of bi-oxide, and if it does not contain this "impurity" it is only fit for casting, unless it was re-toughened. If commercial copper, which has a high test-mark, be exposed to a current of pure hydrogen for a short time at a dull red-heat, and thus caused to lose more or less of its oxygen, its test-mark may fall as low as 25 from 100, proving clearly that a certain proportion of bi-oxide is essential to its malleability. Brass which cannot contain oxygen remains unaltered as to its test-mark, if exposed to the same current of pure hydrogen.

From the above, it will be clearly seen that this method of testing is thoroughly reliable, and far superior to the usual way of judging simply from the appearance of the fracture, which changes considerably with the temperature at which it is poured.

To sum up, in a few words, the new test shows at once the value of the material for practical purposes, without specifying the impurities which are absent or present, according to the high or low test-mark shown by the apparatus, whereas, the chemical analysis specifies the absence or presence of such impurities, without being able to indicate in which way the material may be affected in its application for practical purposes. And for most such purposes it will be admitted that the ready answer which this apparatus gives to practical men, as to the value of their material, is of far more use to them than a minute chemical analysis, which has only partly answered what they want to know, and then it must not be forgotten that this test will occupy about an hour, whereas a chemical analysis may occupy many days.

ON A PLAN FOR CONVEYING RAILWAY TRAINS ACROSS THE STRAITS OF DOVER.*

By Evan Leigh, Esq., Engineer, Associate.

The want of a better communication with France and the Continent generally has long been felt, and is growing more urgent every day, from the vast increase of commerce and passenger traffic. The present means of crossing in small steamers, besides being most disagreeable from sea-sickness, being totally inadequate to accommodate the existing demand, to say nothing of the loss of time in loading and unloading the vessels, and other inconveniences, it is, therefore, unnecessary to dilate further upon this point. There cannot be two opinions, that if a better means existed of crossing these dreaded Straits, the passenger traffic would soon become greatly increased, to the great profit of the railway companies on both sides of the Channel, as well as the public convenience; it is, therefore, a matter of the highest importance to railway shareholders, not only of those lines converging on the Straits, but indirectly to all parties interested in railways throughout both England, France, and the Continent generally. The present system has been aptly likened to a bandage tied round the neck of commerce, of which England is the head and the Continent the body; a bandage which is daily producing a greater degree of strangulation, and, like a throttled monster, is now making such desperate efforts to free itself, that nothing seems too wild and daring to effect this object, as will be seen from a short review of the various plans proposed.

First comes the plan I am about to exhibit in detail, and which occurred to me in the spring of the year 1861, when I was crossing the Atlantic in the *Great Eastern* steam-ship. The *Great Eastern* showed that if a boat was made long enough, there would be no pitching even in the roughest weather, and to overcome the rolling, my idea then was to build a vessel on pontoons. This plan I showed at the International Exhibition of 1862, and called public attention thereto, by distributing lithographs illustrating the principle, accompanied by a description. Before the opening of the Exhibition, I showed my models in London to the Lords of the Admiralty and other nautical gentlemen, but public opinion did not then seem to be ripe for such an undertaking.

When a subject of vast national interest and importance gets propounded, a number of aspirants arise to show various other ways of carrying it out than the plan proposed by the originator; and were it not for the evidence of priority furnished by the much-abused patent-laws, it would be impossible to ascertain amongst the numerous claimants who was the first inventor of anything. Lately, soundings and borings have been taken, with a view to drive a tunnel under the sea at all hazards. How great those hazards will be may be surmised by those who remember the vast expense and failures of the comparatively insignificant affair of the Thames-tunnel, originated by the late Mr. Brunel. Desperate, indeed, must be the necessity of effecting this communication, for such Utopian ideas to be entertained as are propounded even by men who have the reputation of being practical engineers. How could capital be found for making a tunnel that would probably take twenty years to accomplish, and even if ultimately successful, might be swamped any day? Another scheme, by a French engineer, is to fill up the Channel with islands at easy distances apart, so as to bridge them over by girders. To say nothing of the great length of time and enormous expense of this plan, the unstable foundation, exposed to the rough sea and currents of the Straits of Dover, renders it quite impracticable. Another plan, similar to the last, is to fix strong piers of iron and concrete, filled up about the base with stones and rubble to a certain height for greater stability, and bridge over from these. This plan is more practicable, but the expense would be enormous, and the time spent in construction considerable. Another, and very ingenious plan, is to tunnel the Channel by means of iron tubes cased with bricks; but the difficulties and risks to be encountered in this scheme are so obvious that it is very doubtful if capital could be found to make the attempt.

Suppose, however, for argument's sake, that any of the above-named plans could be practically carried out, it is clearly impossible that they could be commercially successful. The interest of the money expended, and the expense of keeping the works in repair would be so enormous, that they would not have the slightest chance of competing with the large ferry boats that can so easily be made to take the trains over in any weather, or at any state of the tide, as will be seen on reference to my diagrams, which show a general plan of steam ferry and a section of same, with harbour; a breakwater, about the same length as the ferry-boat; at the upper end of the harbour is a floating landing-stage, to which one end of the bridge is attached by strong hinges, the other being hinged on the land side. A double line of rails are laid on this bridge to correspond with the up and down rails. The centres of the bridge-hinges are in a line with the top of the rails, so that there will be no gaping of the rails when the tide is out. At half-tide, the rails on the bridge form a straight line with those on the boat and the rails on land. To compensate for the slight difference in distance, caused by the arc of the curve made by one end of the bridge moving up and down, the landing-stage, to which it is firmly hinged, will be thrust a little further out in the dock at half-tide, or drawn nearer to the shore at high and low water. This difference will only be about three inches. By this arrangement, an exact junction is effected with the rails on deck and those on the bridge, whatever be the state of the tide when the boat comes into harbour, and is seized by the catches *e e*, which hold it firmly up to the rails. To compensate for any inequality in the draft, caused by the boats sometimes being more heavily laden than at others, the following provision is made, admitting of as great a difference as 1,000 tons, if required. When the bow of the boat comes into the indent of the landing-stage, the rollers run up an incline, depressing the landing-stage while it is being raised itself, until seized by the catches, when the junction with the rails is effected, and is held firmly to the bridge and landing-stage, until again liberated by withdrawing the catches after another train has come on board. As the construction of the boat is the same at both ends, it is not required to be turned round. The bottom of the boat is provided with a keel, not reaching from end to end, but stopped off a sufficient length, so as not to interfere with the landing-stage. A rudder is fixed at each end of the keel.

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* Received 4th March, 1871.

Rudders.—The rudders are connected together, as shown in my plan of steering, so that one cannot move without the other moving in the opposite direction, thereby effecting an equilibrium more perfect, and, it is submitted, more mechanically correct, than any other plan that can be devised.

Paddles.—The paddle-wheels are each made of two cylinders, constructed of Bessemer steel or wrought-iron plates, the larger one being about 24 feet diameter, and the smaller one, which is fixed concentric within the other, is about 12 feet diameter; the ends are made up air-tight by boiler-plate, so as to form an angular space, strengthened internally in a suitable manner by ribs of iron or stays. The paddle-shafts are fitted inside by bosses and skeleton supports, similar to a water-wheel, as shown. The floats are (by preference) of wood, bolted to snugs, rivetted to the outer casing, as shown at Fig. . These snugs are made of T iron, and stretch from paddle to paddle, being bent up at each end, and bolted together through the float-boards, which are dished out to drop in flush with the iron snugs. The float-boards are 6 inches thick by 15 inches deep, and taken off to 2 inches thick at the top; they are only of sufficient length to stretch half across the paddle-wheel, being set at intervals between each other. As the floats are always working in dense water, it is only necessary to have them about 12 to 15 inches deep, and being tapered from 6 inches thick at the bottom to 2 inches at the top, will have no tendency to lift the back water. The floats will project below the bottom of the vessel about 12 inches, and the keel about 3 feet. The perforations through the bottom of the ship where the paddles work are the length of the diameter of the paddle-wheels, and sufficiently wide to admit of the paddle-wheels (without shafts) to be put in their places from below.

Engines.—These are four steam cylinders, of about 40-inch diameter and 15 feet stroke, two to each paddle. The engines are on the oscillating principle, and in making 30 strokes per minute, have a piston speed of 900 feet per minute. They are fitted with expansion valves, to cut off the steam at any part of the stroke, and have surface condensers.

Boilers.—These are on the water-tube, high-pressure principle, proved up to 500 pounds to the inch, and work at a pressure of about 70 pounds.

Cost.—Two of these ferry-boats, with a harbour and bridge on each side of the Channel, can be built complete at a cost not exceeding £1,250,000, which will allow a fair margin for contingencies. Interest of capital, at 5 per cent. per annum, on this sum, seamen and stokers' wages, fuel, &c., would not exceed £300 per diem. If each boat made five trips in and out per day (which would be twenty crossings altogether, ten from each side), the expense of each crossing would not exceed £15.

Results.—Taking the present estimate of passengers per day at 3s. each, and 100 tons of goods at 3s. per ton, or its equivalent, will leave a profit of 10 per cent. on the capital. Trains would run on the boat in the same manner as running into a railway station, and be despatched without a moment's delay, regardless of tides or weather, making passage in fifty minutes. Speed, comfort, safety, and frequency of passage cannot fail to increase the traffic enormously, far exceeding the above estimate, when a small additional outlay would enable boats to be dispatched to Ostend and Boulogne, as well as Calais, from the Dover Ferry Railways debouching on the coast, would be enriched to a greater extent than the cost of the whole scheme.

In this estimate nothing has been said about the conveyance of mails, parcels, &c., which are put down at an enormous sum in other estimates.

Comparison. — Supposing a tunnel or bridge were possible, the cost would probably be more than ten times greater, and the expense of keeping in repair and working order equally augmented, affecting the charge for transit of passengers and goods in the same ratio, therefore there can be no doubt whatever as to the superior economy of this system. Then, again, the comparatively short time required to put the ferry-system in operation is favourable, in about the same degree as the cost, not amounting probably to a tenth of the time required for either bridge or tunnel. A tunnel would also command a monopoly of the service, as all railway lines would be compelled to bear upon it, which would be very inconvenient; the same may be said of a bridge; whereas ferries could be established in other parts of the coast, ultimately, besides Dover, which would greatly tend to the public convenience.

ON THE EFFICIENCY OF JET PROPELLERS.[*]

By Cavaliere B. Brin.,

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1. Among the various plans for the propulsion of ships which have been proposed or tried, those in which the propelling force is produced by the reaction of one or more jets of water form a special category by themselves. Ruthven's hydraulic propeller, applied first to the *Nautilus* and afterwards to the *Waterwitch*, belongs to this class. The results obtained with it, so far as the amount of useful effect is concerned, were much more satisfactory in the latter vessel than in the former, but were, nevertheless, very inferior to those given by the screw or paddle-wheel. Hydraulic propellers, in certain respects, offer some advantages, and might, under certain given circumstances, be preferred to any other. It has, consequently, seemed to me that it might not be altogether useless to investigate the theory of these propellers, with a view to ascertain if the low amount of useful effect obtained ought to be altogether attributed to the inherent defects of the system, or if it might not be remedied by the adoption of suitable arrangements.

2. In hydraulic propellers, the force of propulsion, that is to say, the thrust necessary to cause the ship to advance, is obtained, as I have already remarked, by the reaction of one or more horizontal jets of water, in a fore and aft direction; in other words, the propelling force is due to the action of a mass of water in motion upon the bounding surfaces of the vessel in which it moves.

Let A A, B B be a receptacle in which a mass of liquid

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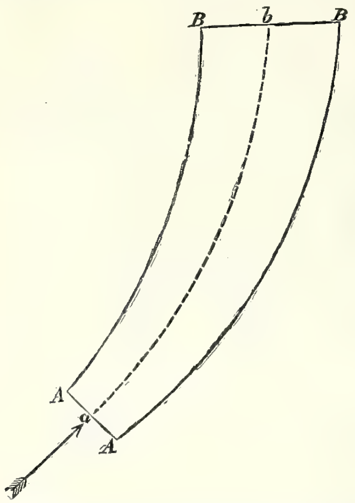
[*] Received 27th February, 1871.

is in motion, and let A A be the inlet section of the liquid and B B that of its exit. Let it be supposed, too, that the arrangements are such that we may assume all the small streams of water to have velocities which are equal and parallel both at their entrance and exit, and normal to the sections A A and B B; also that the motion has become uniform.



Let Ω_0 be the area of the section A A.
Ω_1 that of B B.
V_0 the velocity of the liquid at A A.
V_1 its velocity at B B.
$P_0 P_1$ the pressures on the extreme sections of the liquid at A A and B B.
$\alpha_0, \beta_0, \gamma_0$, the angles which a normal to the section A A would make with the three orthogonal axes, x, y, z, the last being the vertical one.
$\alpha_1, \beta_1, \gamma_1$ corresponding angles for the section B B.
X, the force impressed on the containing vessel in a horizontal direction and parallel to x.
Y, the corresponding force impressed in a direction parallel to y.
Z, the vertical force impressed on the vessel—that is, in a direction parallel to z.
π, the weight of the liquid contained in the receptacle A A, B B.
Q, the weight of a unit of volume of this liquid.
And g, the velocity impressed by gravity on heavy bodies in a unit of time.

By hydrodynamics, we have for the values of X, Y, Z:—

$$(1.)\quad X = -\frac{Q\,\Omega_0^2\,V_0^{\prime 2}}{g}\left(\frac{\cos.\,\alpha_1}{\Omega_1} - \frac{\cos.\,\alpha_0}{\Omega_0}\right)$$

$$(2.)\quad Y = -\frac{Q\,\Omega_0^2\,V_0^2}{g}\left(\frac{\cos.\,\beta_1}{\Omega_1} - \frac{\cos.\,\beta_0}{\beta_0}\right)$$

$$(3.)\quad Z = -\frac{Q\,\Omega_0^2\,V_0^2}{g}\left(\frac{\cos.\,V_1}{\Omega_1} - \frac{\cos.\,V_0}{\Omega_0}\right)$$

If the vessel, A A, B B, have a rectilinear and uniform motion, and this is the case of the propellers of ships, the values of X, Y and Z remain constant.

3. If the inlet section of the vessel, A A, be immersed in the liquid, P_0, is the pressure of the exterior liquid on the plane, A A. ? Now, as it is required to find the force impressed on the vessel in directions parallel to the three axes, x, y, and z, we may observe that the pressures exerted by the liquid on the exterior immersed portion of the vessel are zero in a horizontal direction, and that no account must therefore be taken of the components $P_0 \cos.\,\alpha_0$ and $P_0 \cos.\,\beta_0$ in the values of X and Y, given by the equations (1) and (2).

With regard to the pressure P_1 on the section B B, this cannot be exerted without causing an equal and directly opposite pressure, either on the sides of the vessel or on the fastenings (in our case on the ship) to which it is fixed. Suppose, for instance, that this pressure is caused by a plunger, the rod of which is merely a prolongation of the piston-rod of a steam cylinder, then on the end of this cylinder there will be produced a pressure, P_1, equal and directly opposite to the pressure, P_1, exerted on the section B B of the liquid. Thus, the pressure, P, will have no influence upon the horizontal thrusts exerted upon the system to which the vessel is fixed. Therefore, so far as concerns the horizontal thrusts produced by a mass of liquid in motion on the sides of a containing vessel, considered as propelling forces of the material system, of which this containing vessel forms a part, their value will be expressed by—

$$(4.)\quad X = -\frac{Q\,\Omega_0^2\,V_0^2}{g}\left(\frac{\cos.\,\alpha_1}{\Omega_1} - \frac{\cos.\,\alpha_0}{\Omega_0}\right)$$

$$(5.)\quad Y = -\frac{Q\,\Omega_0^2\,V_0^2}{g}\left(\frac{\cos.\,\beta_1}{\Omega_1} - \frac{\cos.\,\beta_0}{\Omega_0}\right)$$

4. This premised, let us consider an hydraulic propeller of the kind proposed by Mr. Ruthven. In this system, an hydraulic wheel or turbine, with its axis vertical, sucks in water from the sea through holes in the bottom of the ship, and this water is discharged through two horizontal pipes fixed on each side of the ship at the height of the load water-line. The openings in the bottom are so arranged that the water enters the ship from forward to aft, and in a horizontal direction.

We have thus a mass of water in motion in a vessel fixed in the ship, and the pressure, parallel to the direction of motion of the ship, sustained by the bounding surfaces of this vessel, will be the thrust that caused the propulsion.

If we take for the axis of x a horizontal line parallel to the middle line plane of the ship, and if we take for the positive direction that from the origin of co-ordinates to the bow of the ship the amount of this thrust will be given by equation (4), in which Ω_0 and Ω_1 will be the areas of the orifices of supply and discharge, and V_0 and V_1 the velocities of the water as it passes these orifices, we shall have in this case—

$\alpha_0 = 180°$, $\cos.\,\alpha_0 = -1$; $\alpha_1 = 180°$, $\cos.\,\alpha_1 = -1$.

We shall therefore have—

$$(6.)\quad X_1 = \frac{Q\,\Omega_0^2\,V_0^2}{g}\left(\frac{1}{\Omega_1} - \frac{1}{\Omega_0}\right);$$

And as the volume of water which enters the ship must be equal to that which leaves it, we have—

$$\Omega_1\,V_1 = \Omega_0\,V_0 \text{ and}$$

$$(7.)\quad X_1 = \frac{Q\,\Omega_0\,V_0}{g}\,(V_1 - V_0)$$

Calling M the unit of water discharged during a unit of time, we have—

$$(8.)\quad X_1 = \frac{Q\,M}{g}\,(V_1 - V_0)$$

Let us call U the speed of the ship. The outside water is at rest, and on entering the ship is met by the water at the inlet section with a relative velocity of $U - V_0$.

At the inlet section, besides the pressure due to the hydrostatic head at this depth, there is a further pressure corresponding to that necessary to impress in a unit of time a velocity $U - V_0$ on a mass $\frac{Q\,M}{g}$. This pressure can be expressed by $\frac{Q\,M}{g}(U - V_0)$; it is horizontal, and its direction is from forward to aft.

The final thrust sustained by the ship, and generated by the volume of water, M, which enters it in a unit of time, and leaves it by the discharge pipes, that is to say, the force of propulsion, F, will therefore have for value :

$$F = \frac{A\,M}{g}\left\{V_1 - V_0 - (U - V_0)\right\} \text{ or}$$

$$(9)\ F = \frac{A\,M}{g}(V_1 - U).$$

Calling R the resistance offered by the ship to its progress through the water, we have F = R, and the work necessary to overcome the resistance, or the useful work in a unit of time, will be—

$$(10)\ R\,U = \frac{A\,M}{g}(V_1 - U)\,U.$$

5. Let us now seek to ascertain what will be the amount of work necessary to obtain this propelling force, F, and this useful work, R U.

We will retain the notation of section 4 with the following additions :—

L_m, the work developed during a unit of time to produce the jets of water which serve to propel the ship.

V_a, the absolute velocity with which the water leaves the ship ; we shall have $V_a = V_1 - U$.

h, the height of the orifices of discharge above the water section of the ship.

During a unit of time, a mass of outer water, $\frac{Q\,M}{g}$, which was at rest, enters the ship and leaves it with an absolute velocity, V_a, at a height, h, above its original level. There will thus be a *vis viva* acquired of $\frac{Q\,M}{g}V_a^2$, and a work expended of $Q\,M\,h$.

On this mass of water there acts the force of reaction of the sides of the vessel, along the length of which this mass of water moves, a force of reaction whose value, as found above, is $\frac{Q\,M}{g}(V_1 - U)\,U$. The work exerted during a unit of time to put this mass of water in motion, that is to say the work of resistance, will therefore be :—

$$Q\,M\,h + \frac{Q\,M}{g}(V_1 - U)\,U.$$

During the same period of time there has been transferred to this mass of water in motion a motive work, L_m.

If we neglect friction, the motive work, conformably with the principle of the conservation of *vis viva* must be equal to the work of resistance $Q\,M\,h + \frac{Q\,M}{g}(V_1 - U)\,U$, *plus* half the *vis viva* acquired, *plus* half the loss of *vis viva* occasioned by the shock given to the water on its entrance into the ship. During a unit of time, in consequence of this shock, a mass of water $\frac{Q\,M}{g}$ changes its velocity suddenly from U to V_0; the velocity lost in this shock is therefore $U - V_0$, and the loss of *vis viva* is $\frac{Q\,M}{g}(U - V_0)^2$. The principle of the conservation of *vis viva* next gives us the following equation :—

$$L_m = Q\,M\,h + \frac{Q\,M}{g}(V_1 - U)\,U + \frac{Q\,M}{g}\frac{V_a^2}{2} + \frac{Q\,M}{g}\frac{(U - V_0)^2}{2}$$

But by equation (9) we know that

$$\frac{Q\,M}{g}(V_1 - U) = F = R$$

We therefore have—

$$(11.)\ L_m = R\,U + Q\,M\,h + \frac{Q\,M}{g}\frac{V_a^2}{2} + \frac{Q\,M}{g}\frac{(U - V_0)}{2}$$

The first term of the second number of this equation represents the work necessary to overcome the resistance of the ship, or the useful work. It therefore follows that the actual work expended in this hydraulic propeller must be equal to the useful work, *plus* the work necessary to raise the amount of water employed to the height of the discharge pipes above the water-line, *plus* one-half of the *vis viva* acquired by the water when it leaves the ship, *plus* one-half of the loss of *vis viva* arising from the shock encountered by the water on its entrance into the ship.

We might, therefore, have written down this equation at once from *a priori* considerations. The first term of the second member of this equation representing, as we have said, the useful work, all the other terms represent losses of work.

It will then be necessary so to arrange matters as to make these terms zero, or else to render them as small as possible.

The term $Q\,M\,h$ will be zero when $h = 0$, which shows us that it is of advantage to place the discharge pipes at the load water line or below it.

The term $\frac{Q\,M}{g}\frac{(U - V_0)^2}{2}$ will be zero, when $U = V_0$; while the term $\frac{Q\,M}{g}\frac{V_a^2}{2}$ will be zero, when $V_a = o$; that is, if the water left the ship without any velocity at all. But we must observe that $R = \frac{Q\,M}{g}V_a$, so that it is impossible to make $V_a = 0$, since in this case we should require an infinite amount of water, and inlets and outlets of infinite size. Take $V_a = \alpha\,U$, and suppose that the conditions pointed out above for rendering the other losses of work zero have been satisfied, we shall have

$$L\,m = R\,U + \frac{Q\,m}{g}\alpha^2\frac{U^2}{2}$$

and

$$R = \frac{A\,M}{g}\alpha\,U;$$

whence we obtain

$$L\,m = R\,U\left(1 + \frac{\alpha}{2}\right)$$

and the co-efficient of useful effect of the motive work will be

$$U_t = \frac{R\,U}{\alpha\,U} = \frac{2}{2 + \alpha}$$

If $\alpha = 1$ (as in the *Waterwitch*) we shall have $U_t = 0{\cdot}66$.

6. If the openings by which the water enters the ship, instead of being arranged as in the *Waterwitch*, were so contrived that the water came into the ship in a direction contained in a plane perpendicular to the middle line plane of the ship, the outside water, in that case, which is at rest when it enters the ship, would receive a shock with the velocity, U, of the ship; it would therefore produce an increase of resistance, of which the value would be $\frac{Q\,M}{g}U$, and there would be a loss of *vis viva* equal to $\frac{Q\,M}{g}\frac{V^2}{2}$.

The value of the horizontal thrust produced by the water in motion would be given by the equation (4) on making $\alpha_0 = 90°$, cos. $\alpha_0 = 0$; and $\alpha^1 = 180°$, cos. $\alpha_1 = -1$.

We should, therefore, have—

$$X = \frac{Q\,M}{g}V_1$$

This thrust ought to be equal to the resistance of the ship, *plus* the increase of resistance indicated above. We shall then have—

$$\frac{Q\ M}{g} V_1 = R + \frac{Q\ M}{g} U; \text{ whence we get}$$

$$R = \frac{Q\ M}{g} (V_1 - U)$$

$$= \frac{Q\ M}{g} V_a$$

The resisting work overcome, that is to say, the useful work, will be—

$$R\ U = \frac{Q\ M}{g} U\ (V_1 - U)_1$$

$$= \frac{Q\ M}{g} U\ V_a$$

The principle of conservation of *vis viva*, by considerations similar to those set forth in section 5, leads us directly to the following equation—

$$L\ m = R\ U + Q\ M\ h + \frac{Q\ M}{g}\frac{V_a^2}{2} + \frac{Q\ M}{g}\frac{U^2}{2}$$

We shall see immediately that we ought to make $h = 0$.

If we take $V_a = \alpha\ U$, we shall have—

$$L\ m = R\ U + \frac{O\ M}{g}\frac{\alpha^2\ U^2}{2} + \frac{Q\ M}{g}\frac{U_2}{2}$$

We have—

$$R = \frac{Q\ M}{g} \dot{V}_a \text{ which gives}$$

$L\ m = R\ U \left(1 + \frac{\alpha}{2} + \frac{1}{2\alpha}\right)$ and the co-efficient of useful effect of the motive work will be—

$$U_t = \frac{1}{1 + \frac{\alpha}{2} + \frac{1}{2\alpha}}$$

$$\text{If } \alpha = 1$$
$$U_t = 0{\cdot}50$$

We see, therefore, that this arrangement is less advantageous than the preceding. Such an arrangement was adopted in a steamboat constructed by Cockerill's Company, which was exhibited at the Paris Exhibition of 1867.

7. Let us suppose, now, that the openings in the bottom of the ship are arranged in such a manner that the water enters in a direction horizontal and parallel to the middle line plane, and from aft forward.

In this case, the thrust exerted by the body of water in motion will be given by equation (4) on making $\alpha_0 = 0$, cos. $\alpha_0 = 1$; $\alpha_1 = 180°$, cos. $\alpha_1 = -1$.

We shall then have—

$$(12.)\ X = \frac{Q\ \Omega_0^2\ V_0^2}{g}\left(\frac{1}{\Omega_1} + \frac{1}{\Omega_0}\right)$$

$$= \frac{Q\ M}{g}(V_1 + V_0)$$

This value of X represents the force of propulsion, F, and we shall have—

$$(13.)\ F = R = \frac{Q\ M}{g}(V_1 - V_0)$$

8. With regard to the work required in order to obtain this force of propulsion, it may be determined by considerations similar to those set forth in section 5.

We will use the same rotation as that adopted in the preceding sections.

In a unit of time—

The *vis viva* acquired will be $\frac{Q\ M}{g} V_a{}^2$,

The motive work developed, L_m,

The work of resistance due to gravity, $Q\ M\ h$,

The work of resistance due to the reaction of the surface of the channels along which the water moves, $X\ U = \frac{Q\ M}{g}(V_1 + V_0)\ U$.

We shall therefore have—

$$(14.)\ L_m = \frac{Q\ M}{g}\frac{V_a{}^2}{2} + Q\ M\ h + \frac{Q\ M}{g}(V\ - V_0)\ U.$$

$$\text{or as } R = \frac{Q\ M}{g}(V_1 - V_0)$$

$$(15.)\ L_m = R\ U + Q\ M\ h + \frac{Q\ M}{g}\frac{V_a{}^2}{2}$$

The first term of the second member of this equation represents the useful work; all the others injurious work.

We must therefore make—

$$h = 0$$
$$V_a = 0$$

Having satisfied these conditions, we shall have

$$L_m = R\ U$$

and the co-efficient of useful effect, $U_t = 1$. That is to say, the motive work will equal the work of resistance. This propeller should therefore be theoretically perfect.

9. It is now necessary to determine what conditions must be satisfied by the hydraulic machine which has to set the water in motion and discharge it from the ship, so as to utilise the motive power as perfectly as possible. For this purpose we may employ one of the numerous hydraulic machines for raising water. But as it is required to produce continuous jets, and to avoid intermission as well as to set in motion very considerable bodies of water, there can be no doubt that centrifugal pumps or turbines, constitute in this case the best form of hydraulic machine to employ.

Let us call

T, the moving force transmitted to the shaft of the turbine in a unit of time.

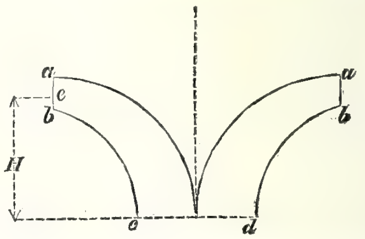
V, the velocity of the extremities of the vanes of the turbine (if u is the angular velocity).

R, the radius of the turbine.

N, the number of revolutions of the turbine in a unit of time; so that $V = R\ u = \frac{2\ \pi\ N\ R.}{60}$

H, the height of the centre, *e*, of the extremities of the vanes above the section, *c d*, of the inlet of water into the turbine.

H_1, the height of the orifices of discharge above the point *e*.



P, the height of the column of water which measures the pressure at the section, *c d*, of the inlet of the water into the turbine.

v, the velocity of the water at the section *c d*.

For the remainder we will adhere to the notation of the preceding sections.

If we disregard the friction and the losses of work due to throttling, sharp turns, and so forth, the work, T, ought to be equal to that necessary to raise the weight Q M to the height $H + H_1 - P$, *plus* the work corresponding to one-half the *vis viva* $\frac{Q\ M}{g}(V_1{}^2 - v^2)$ acquired by the water, from its entrance into the turbine until it leaves the orifices of discharge, *plus* also the work corresponding to one-half of the losses of *vis viva* that take place in this kind of hydraulic machine, and and which are:—

$\frac{Q\,M}{g}\,a^2$, on the entrance of the water into the turbine, where a is the velocity lost in the entering.

$\frac{Q\,M}{g}\,b^2$, on the exit of the water from the turbine, where h is the absolute velocity with which it leaves the turbine.

We shall therefore have

$$(16)\ T = Q\,M\,(H + H_1 - P) + \frac{Q\,M}{g}\frac{V_1{}^2}{2} - \frac{Q\,M}{g}\frac{v^2}{2} + \frac{Q\,M}{g}\frac{a^2}{2} + \frac{Q\,N}{g}\frac{b^2}{2}.$$

The loss of *vis viva* $\frac{Q\,M}{g}\frac{a^2}{2}$ on the entrance of the water into the turbine, may be almost entirely obviated by making the vanes of a suitable shape; we shall therefore neglect it.

Let us put

$$(17)\ H + H_1 - P + \frac{V_1{}^2}{2g} - \frac{v^2}{2g} = \frac{\mu^2}{2g}.$$

$\frac{\mu^2}{2g}$ will represent the column of water which the turbine has to take up, and $Q\,M\,\frac{\mu^2}{2g}$ the useful work in a unit of time.

We shall have

$$(18)\ T = Q\,M\,\frac{\mu^2}{2g} + \frac{Q\,M}{g}\frac{b^2}{2}.$$

The term $\frac{Q\,M}{g}\frac{b^2}{2}$ represents a loss of work, we ought, therefore, to diminish this term or the velocity, b, as much as possible.

Let us determine this velocity.

The relative motion of the water in the turbine is determined by the pressures at the inlet section, $c\,d$, and by those at the outlet, $a\,b$, by gravity and by the centrifugal force.

Let v_1 be the relative velocity acquired by the water on its exit from the turbine under the action of these forces. The work developed by these forces in a unit of time will be—

1st. That of the pressure at the entrance will be $Q\,P\,\omega\,U$, ω being the area of the section through which the water enters the turbine, and U the relative velocity of the water at this section.

Now we have $\omega\,U = M$, so that the work done by this force will be $Q\,P\,M$.

2nd. That of the pressure upon the orifices of discharge of the water from the vanes of the turbine will be $Q\,P_1\,M$.

3rd. The work done by gravity will be $Q\,M\,h$.

4th. With regard to the work done by the centrifugal force, we know that the work transmitted by this force to a body $\frac{Q\,M}{g}$ which, having a rotatory motion of which the angular velocity is ω, starting from rest, moves off from the axis to a distance, R, has for its expression

$$\frac{Q\,M}{g}\frac{\omega^2\,R^2}{2} = \frac{Q\,M}{g}\frac{V^2}{2}$$

The principle of the conservation of *vis viva* then leads to the following equation:—

$$Q\,P\,M - Q\,P_1\,M - Q\,M - + \frac{Q\,M}{g}\frac{V^2}{2} = \frac{Q\,M}{g}\frac{v_r{}^2}{2}$$

whence we have

$$P - P_1 - H + \frac{V^2}{2g} = \frac{v_r{}^2}{2g}$$

The velocity V_1 of the water at the orifices of discharge will be due to the height $P_1 - H_1$. We shall therefore have $\frac{V_1{}^2}{2\,g} = P_1 - H_1$ and $P_1 = \frac{V_1{}^2}{2\,g} + H_1$ which gives us $\frac{v_r{}^2}{2\,g} = P - \frac{V_1{}^2}{2\,g} - H_1 - H + \frac{V^2}{2\,g}$ that is to say $\frac{v_r{}^2}{2\,g} = \frac{V^2}{2\,g} - \frac{\mu^2}{2\,g}$

Whence we derive

$$v_r = \sqrt{V^2 - \mu^2}$$

The velocity of the water, v, which it will have when it quits the turbine will be the resultant of V, the velocity of the ends of the vanes, and of the relative velocity v_r of the water tangentially to the ends of the vanes.

Calling e the angle which the tangent to the ends of the vanes makes with the outer circumference of the turbine, we shall have—

$$(19)\ v^2 = v_r{}^2 \sin.^2 e + (V - v_r \cos. e)^2.$$

We have seen that it is necessary to endeavour to render v a minimum; with this object we must make $e = 0$.

We shall then have

$$b^2 = (V - v_r)^2 - (V - \sqrt{V^2 - \mu^2})^2$$

In order to get rid of the velocity v, it would be necessary to have $V = \infty$, whence we see that it is impossible to overcome the loss of momentum $\frac{Q\,M}{g}\,v^2{}_r$ and that it is an advantage to make the turbine revolve with a great velocity.

If we substitute the value of v^2 found above in the equation, which gives as the expression of the motive work, we shall obtain the following equation:—

$$(20.)\ T = Q\,M\,\frac{\mu^2}{2g} + Q\,M\,\frac{(V - \sqrt{V^2 - \mu^2})^2}{2g}$$

The term $Q\,M\,\frac{\mu^2}{2g}$ represents, as we have said, the useful work obtained by the turbine, so that the co-efficient of useful effect of the motive work will be—

$$U_t{}^1 = \frac{\mu^2}{\mu^2 + (V - \sqrt{V^2 - \mu^2})^2}$$

This co-efficient can only become unity when $V = \infty$.

If we make $V = \mu$, we shall have $U_t' = 0{\cdot}50$.
" $V = 1{\cdot}25\mu_1$ " $U_t' = 0{\cdot}80$.
" $V = 2\mu$ " $U_t' = 0{\cdot}93$.

But practically we cannot make the angle e vanish, that is to say, we cannot arrange the ends of the vanes tangentially to the outer circumference of the turbine, for if we did so, the water which leaves one vane would strike the following.

We cannot make $e = 20°$ as in good centrifugal pumps; then we shall have—

$$v^2 = v_r{}^2 \sin.^2 20° + (V - v_r \cos. 20°)^2$$

In this case, the co-efficient of useful effect will have for value—

$$(21.)\ U_t' = \frac{\mu^2}{\mu^2 + (V^2 - \eta^2)\,0{\cdot}12 + (V - V\,\overline{V^2 - \mu^2 + 0{\cdot}94})^2}$$

If we make $V = 2\mu$, we shall have $U_t' = 0{\cdot}71$.

This theoretical co-efficient of useful effect cannot be practically attained. It is impossible to make the term $\frac{Q\,M}{g}\frac{a^2}{2}$ zero in relation to the entrance of the water into the turbine. It is also necessary to take account of all the losses of *vis viva* arising from throttling angles and friction during the passage of the water, from its entrance into the ship to its exit.

Having regard to these different causes of loss of worth, the practical co-efficient of useful effect, U''_t, will be some fraction of the theoretical one.

We shall therefore have

$$U''_t = A\,U'_t,$$

A being a constant co-efficient, the mean value of which, judging from what is generally the case in hydraulic machines, may be taken at 0·85.

10. In order to obtain the final co-efficient of useful effect of this propeller, it will be necessary to multiply U_t, of which we have spoken in sections 5, 6, and 7, by the co-efficient of useful effect belonging to the hydraulic machine, so that this final co-efficient of useful effect will be

$$U'''_t = U_t \times U''_t = U_t \times A\,U''_t.$$

In each particular case we shall adopt for these values of U_t and and U'_t those found above.

If we adopt the arrangements referred to in section 5, which are those of the *Waterwitch*, and if the velocity of discharge V_1 of the water be double that of the ship, we shall have $U_t = 0{\cdot}66$, and if for the turbine we make such arrangements as to have the maximum of effect, and if we have $V = 2\,\mu$, we shall have a final co-efficient. $U''_t = 0{\cdot}66 \times 0{\cdot}85 \times 0{\cdot}81 = 0{\cdot}45$, which is a very low, useful effect, and inferior to that obtained with the screw and the paddle-wheel.

With the arrangement referred to in section 6, this co-efficient would be lower still.

The most favourable arrangement is that referred to in section 7. We can in this case obtain a useful effect $U_t = 1$, and a final useful effect (with $V = 2\,\mu$).

$$U''_t = 1 \times 0{\cdot}85 \times 0{\cdot}71 = 0{\cdot}60.$$

This co-efficient of useful effect is about the same as those realised by the screw-propeller and the paddle-wheel.

11. Recapitulating, we arrive at the following conclusions:—

In order that an hydraulic propeller may act under good conditions, it is necessary to arrange things so as to insure:—

a. 1st. That the water shall enter the ship in a horizontal direction, and parallel to the middle line plane, and from aft to forward.

2nd. That the orifices of discharge shall be situated either at the level of the load water line or below it.

3rd. That the water shall leave the orifices of discharge in a horizontal direction and parallel to the middle line plane of the ship, and shall have a relative velocity equal to that of the ship, that is to say, an absolute velocity equal to zero.

b. With regard to the hydraulic machine employed to draw the water from the sea and discharge it from the ship, that, if we make use of a turbine, the vanes shall have to be curved in such a manner that the water shall enter the turbine without shock, and that the ends of the vanes shall make a very acute angle (about 20°) with the outer circumference of the turbine.

It is necessary also that the turbine shall revolve rapidly, so as to have a very high velocity at its outer circumference.

These conditions being satisfied, we can obtain with hydraulic propellers a mean co-efficient of 0·60.

12. The *Waterwitch* has been fitted with an hydraulic propeller, of which we know the results.

We will proceed to examine if these accord with the theory set forth in the preceding sections.

In the *Waterwitch* we have:—*

Area of the orifices of discharge—

$$\Omega_1 = 6\text{ sq. feet} = \overset{m}{0}{\cdot}5538.$$

Velocity of discharge of the water—

$$V_1 = 30\text{ feet} = 9\overset{m}{\cdot}135.$$

Volume of water discharged in a second—
M = 5059 litres.

Area of immersed midship section—

$$B^2 = 31\overset{m}{\cdot}85.$$

Speed of ship—

$$U = 15\text{ feet} = 4\overset{m}{\cdot}57 = \frac{V_1}{2}.$$

$$V_a = V_1 - U = U = 4{\cdot}57.$$

Area of the openings admitting the water into the ship—

$$\Omega_o = 30\text{ sq. feet} = 2\overset{m}{\cdot}769.$$

Velocity of the water on its entrance into the ship—

$$V_o = \frac{V_1}{5} = \frac{2\,U}{5}.$$

In the *Waterwitch*, the openings by which the water is admitted into the ship open forward, and the water enters them horizontally.

This is the case considered in section 4; and we therefore have $R = \dfrac{Q\,M}{g}(V_1 - U)$, which gives us for the *Waterwitch*, R = 2,402 kilogrammes.*

The work required to propel the *Waterwitch* (independently of the losses of work due to the hydraulic machine itself), will be given by equation (11) of section 5. We shall therefore have

$$L_m = R\,U + Q\,M\,h + \frac{Q\,M}{g}\,\frac{V_a^2}{2} + \frac{Q\,M}{g}\,\frac{(V - V_o)^2}{2}$$

For the *Waterwitch*, we have

$h = 0$; $V_a = U$; $V_o = \frac{2}{5}U$, and as

$$R = \frac{Q\,M}{g}(V_1 - U)$$
$$= \frac{Q\,M}{g}U.$$

From which we get

$$\frac{Q\,M}{g} = \frac{R}{U}.$$

On substituting this value of $\dfrac{Q\,M}{g}$ in the above equation, we shall have

$$L_m = R\,U\,(1 + \tfrac{1}{2} + \tfrac{9}{50})$$
$$= R\,U \times 1{\cdot}76$$

The co-efficient of useful effect would therefore be $U_t = 1{\cdot}57$.

We see that the greater portion of the loss of work arises from the too great velocity of the water when it quits the ship. The above co-efficient is still further reduced by the losses of work due to the hydraulic machine or turbine.

In the *Waterwitch* the vanes of the turbine, instead of being curved and arranged so that the water shall quit them in a direction almost opposite to that of the rotation of their extremities, that is to say, with a very low absolute velocity, have their ends normal to the outer circumference of the turbine.

Under these conditions the absolute velocity (*b*) with which the water quits the turbine will be given by equation (19) when we make $e = 90°$. We shall then have

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* These data are taken from newspaper articles and engravings, and are perhaps not altogether exact. With more correct data we should be able to correct the calculations.

* Assuming that the resistance of ships is proportional to the immersed surface of the midship section, and to the square of the velocity, we shall have $R = K\,B^2\,V^2$, where K is a constant. If we make R = 2,402 kilogrammes for the *Waterwitch*, we find that K. = 361. This value of K agrees with the admitted value of this co-efficient in ships of the size and fineness of lines of the *Waterwitch*, which shows the correctness of our theory. It may be observed that, with this system of propulsion, it is very easy to determine the resistance of ships without having recourse to dynamometers.

$$b_2 = v_r{}^2 + V^2 \text{ and as}$$
$$v_r = \sqrt{V^2 - \mu_2}, \text{ we shall have}$$
$$b^2 = 2V^2 - \mu^2.$$

This value of b^2 being substituted in the equation (18) we shall have

$$T = \frac{QM}{2g} 2V^2$$

The useful work is $QM \frac{\mu_2}{2g}$ as we have observed in section 9.

The theoretical co-efficient of useful effect for this turbine will therefore be $U'_t = \frac{\mu^2}{2V^2}$.

In the *Waterwitch*, we have:—

D, the diameter of the turbine = 4·27*m.*
Number of revolutions per minute, N = 42.

We have therefore V = 9·50*m.*

The area of the sections of discharge through which the water quits the turbine is about 80 square feet. We have therefore $V_r = 0{\cdot}68m.$, and as we have $V_r{}^2 = V^2 - \mu^2$, we get $\mu^2 = 90$. We have therefore—

$$U'_t = \frac{u^2}{2V^2} = \frac{90}{2(9{\cdot}50)^2} = 0{\cdot}50.$$

The final co-efficient of useful effect in the *Waterwitch* would therefore be—

$U''_t = U_t \times A\ U'_t = 0{\cdot}57 \times 0{\cdot}85 \times 0{\cdot}50 = 0.24$, a very low co-efficient, and one which must be attributed to the arrangements adopted for their propeller itself, with which we have a useful effect of 0·57, and for the hydraulic machine, with which we have a useful effect of 0·50.

These theoretical results agree with those realised in practice.

In the trials of the *Waterwitch*, in which the above results have been obtained, an indicated horse-power of 828 was realised.

The resistance, R, of the *Waterwitch* being 2,402 kilogrammes, and the speed 4·57*m.* per second, the work developed by this resistance in horses of 75 kilogrammètres is 147.

The co-efficient of useful effect will therefore be $\frac{147}{828} = 0{\cdot}18$. By assuming the value 0.24, found above as the co-efficient of useful effect of the propeller, we should have as the co-efficient of useful effect of the engines $\frac{0{\cdot}18}{0{\cdot}24} = 0{\cdot}75$, which is a probable co-efficient for a marine steam-engine.

The results obtained in practice agree therefore with those deduced from theory.

13. Let us now endeavour to ascertain what results might be arrived at in the *Waterwitch*, by fitting this ship with a hydraulic propeller arranged as pointed out by theory.

The openings by which the water enters should be turned towards the stern of the ship; and we ought to have $V_a = V_1 - U = O$; that is, $V_1 = U = 4{\cdot}57$.

We have—

$$R = \frac{QM}{g}(V_o + U_1)$$
$$= \frac{QM}{g} V_1 \left(\frac{2}{5} + 1\right)$$

And

$$R = 2{,}402 \text{ kilogrammes.}$$

We shall find from this, that the amount of water to be discharged in a second, M, should equal 3,500 litres.

The area of the orifices of discharge must then be

$$\Omega_1 = \frac{3500}{4{\cdot}57} = \overset{m}{0{\cdot}76}.$$

With such arrangements we should have, as seen in section 5, a co-efficient of useful effect of the propeller equal to unity.

With regard to the hydraulic machine itself, by arranging it as explained in section 9, we are able to realise a co-efficient of useful effect $U_1 = 0{\cdot}71$, so that we should have a final co-efficient of useful effect of $0{\cdot}85 \times 0{\cdot}71 = 0{\cdot}60$, instead of 0·24, as in the *Waterwitch* with her present arrangements, that is, a useful effect exceeding that obtained in the *Waterwitch* in a ratio of 2·50 to 1.

Instead of having 828 horses' power indicated by the engines, it would be sufficient to realise 331. As we have already seen, this advantage may be obtained by making the area of the section of the orifices of discharge 0·55 instead of 0·76. But the quantity of water to pass through would be less, that is to say, 3,500 litres per second instead of 5,000; so that by using a higher velocity the turbine might be made smaller, and the machinery lighter.

EDUCATIONAL NOTES.

Infant Training.—Mr. G. C. T. Bartley (known as the author of "Schools for the People," and of a valuable report on the state of education at the East-end, prepared for the Council of the Society of Arts, and entitled "A Square Mile in the East of London"), in a paper on this subject, after touching upon the neglected state of a very large portion of the children of the poor between three and six years of age, points out that, as they do not generally earn wages for their parents, and are worse than useless at home, the great obstacles which have to be overcome before the elder children can be sent to school do not exist with infants. The parents generally wish to get rid of them during the day, and thus they are commonly sent to dame schools, where they learn little or nothing, but for which a comparatively high fee is paid. What an advantage it would be for these little children to be removed from their homes and the custody of the dames, and placed in efficient infant schools, where the foundation of a most valuable training might be laid by the age of six or seven years, and the teaching of the elementary school rendered doubly effective by that which has been previously imparted to the infant. Mr. Bartley thinks that "time, labour, and money will be expended in producing unsatisfactory results, so long as a million infants continue to waste the time which might be the most valuable part of their educational career. It is leaving a delicate and plastic clay to harden before any attempt is made to mould or prepare it for the purposes for which it will be ultimately required." He also expresses regret that the Elementary Education Act provides only for children of five years and upwards, as those of three could in many cases, with great advantage, be sent to school; and in this view he is strongly supported by Mr. Blanchard Jerrold, who, writing in support of such "cradle-schools" as have been established at Ratcliff, expresses his dissatisfaction that government gives no help to infant education. He thinks that thus the golden opportunity will have been lost. There will be seeds of evil rooted deep in the soft hearts of the neglected babes, and these will never be reached. "The moral value of a cradle school apart, it is a most praiseworthy institution. It is a babe's refuge from the street; a boy's salvation from bad companions in his most impressionable days. If so many cubic feet of pure air be necessary to the poor boy during school hours, after he has completed his fourth year, are they not, in the interest of the society of which he is a member, necessary to the infant of a few months? Refuse them, and the child becomes a weak man, perhaps an immediate pauper, not improbably a criminal."

Science College in the North.—At a large meeting of manufacturers, colliery owners, mining engineers, &c., held on Saturday last, at Newcastle-upon-Tyne, Sir W. G. Armstrong in the chair, it was determined to accept an offer made by the University of Durham, of £1,000 a-year for six years, with other collateral advantages, for the establishment of a college in Newcastle for the study of the physical sciences, provided the town and district raised an equal sum.

Science Teaching in Ordinary Schools.—A plan for teaching the natural sciences in ordinary schools has been submitted to the School Board for London by Mr. J. C. Morris. The following are the principal points of the proposed system:—Subjects—chemistry, heat, light, sound, electricity, magnetism, telegraphy, mechanics, hydrostatics, steam engine, &c.; geology, mineralogy, metallurgy, botany, zoology, animal physiology, health, &c. A committee should be formed to select, revise, and compile a complete set of suitable text books, which should bear their sanction, and be then published in the cheapest possible form. There should be a depôt to provide apparatus at a cheap rate, a complete set of which, sufficient to illustrate the sciences mentioned, would not cost more than £100, and should be divided into ten cases of £10 each, a case to be complete for one or two subjects. The teacher should be a visiting one. He could attend from two to three schools per day, and give from one to two hours' instruction in each, during two days in the week. The instruction to be given in a separate apartment, if there be one; or, if not, at such a time as would not interfere with ordinary school business. A single teacher could thus attend from six to nine schools weekly, if sufficiently near each other, and get through at least three or four subjects annually, so that in two or three years he would have completed the full course in each school. There should be an institution where teachers would have an opportunity of acquiring a practical knowledge of their profession, and affording a means of testing their qualifications. A more economical way, however, would be for each teacher to have an assistant, by which method a nucleus of teachers would soon multiply into a goodly number. In conclusion, Mr. Morris advocates periodical examinations, with a regular system of rewards; and, in reference to funds, he thinks that the teachers and inspectors might be supported either by government or subscription, the apparatus to be supplied by government at reduced rates. Schools could fix a small fee for attending the class, which would add to its importance, and help to defray expenses. Examination fees in like manner. Evening classes for adults could be managed under somewhat similar conditions.

School Buildings.—It will be remembered that a paragraph in the *Journal*, some time since, stated that the Education Department had prepared plans for school buildings, of various sizes, and was willing to permit their publication. It now appears, from an official letter in reply to inquiries on this subject, that "arrangements have been already made for the publication of selected plans, specifications, &c., and the Queen's printers are now preparing, for sale, diagrams with specifications and bills of quantities." This will no doubt be a great boon—School Boards or Committees will have ready provided a choice of approved plans from which to select at once such as may be suitable to the varying requirements of their several parishes.

The Work of the London School Board.—If there be any who still imagine that this Board has hitherto done little except talk, the following account of its proceedings, given by the *School Board Chronicle*, may serve to disabuse them of their error:—Besides the public meetings of the School Board, which are held every Wednesday, there are on the average six or seven committee meetings every week. Independently of the four standing committees for (1) Finance, (2) Statistical Inquiries, (3) Officers and Clerks, and (4) Works and General Purposes, which meet regularly once a fortnight, there are three special committees (1) on Industrial Schools, (2) on Compulsory Education, (3) on the Scheme of Education to be adopted in the Public Elementary Schools, which meet at least once a week. Some time has been devoted by the committees to hearing evidence from witnesses versed in the subjects under consideration. Whilst the various committees have been thus engaged, the Board has delegated to a member of its own body in each school division the task of obtaining the returns which must be sent in to the Education Department by the 15th of April; and this task has now so far been completed that returns have actually been received at head-quarters from six out of the ten divisions, accounting in all for about 2,000 schools.

CORRESPONDENCE.

POSTAL REFORM.

Sir,—The more the proposal of the Postmaster-General is considered, the more absurd and inconsistent it appears. Take the following cases:—

1. I want to send two presents into the country, the one being two pounds weight of books, and the other two pounds weight of tea. My books will go in one packet for eightpence, but my tea must be made up into four packets, and will be charged one shilling. Can anything be more absurd; and why is the bookseller to be thus favoured above all other trades whatsoever? It cannot be. Again:—

2. I want to send to Liverpool my ledger and a large number of vouchers. The ledger weighs 7 lbs., and can go for 2s. 4d.; the vouchers being loose papers, and weighing 6 lbs., I must make up into eight packets, all directed alike, and the postage will be 2s. 8d. There is no sense whatever in the clumsy and vexatious distinction made.

The only reasonable and simple plan is to put all on one footing—one-halfpenny for every two ounces, and that is what it must come to, sooner or later. And as to Post-office orders, one penny for every pound or fraction of a pound is the only fair scale. Are the public generally aware that the Postmaster-General proposes to charge 4d. in future for two pounds instead of threepence, as heretofore? I do not think this would be acceptable. Twopence for ten shillings, the same being threepence at present, is almost thank you for nothing.

There is no doubt the rates I have indicated above would yield a vast revenue, much larger than at present, while the convenience to private persons, and the impetus given to business would be immense.—I am, &c.,

L. H. Simms.

London, March 25, 1871.

OUR STANDARDS MENACED.

Sir,—A bill has been introduced into Parliament which proposes to render penal the employment in Great Britain of any other than French measures. Upon whom devolves the duty to resist these indomitable levellers, who, not content with freedom to use whatever measures they like, clamour for power to coerce everybody else? The contemptuous indifference wherewith, since we have lost the commercial leadership of Sir Wm. Brown and the scientific leadership of Professor de Morgan, these amiable propagandists of communism in matters of weight, measure, value, &c., are left to overturn our own institutions, is an indifference by no means justified by the zeal, position, and influence enlisted for promotion of this revolutionary bill.

In my last paper read before the Society (*vide Journal* 913 p. 589) on this subject, I had endeavoured to present a *resumé* of evidences and arguments which justify retention in our own hands of the integrity of our own standards. The somewhat tumultuous forces then arrayed in opposition to me, have since then betrayed a notable want of agreement among themselves.

As a recent meeting of the Statistical Society (at which I had the honour to be invited by the Council), it was gratifying so find my quondam antagonists occupied in exposing each other's heresies: the most formidable of their number confessing that our own coinage is the "envy of other nations," and virtually abandoning the device of "clipping" our coin as a means to supersede it.

The correspondent of the Chancellor of the Exchequer, Colonel Tomline was also there, and admitted that the Mint is free to coin his sterling gold bars into sovereigns without charge. He announced, however, the commencement of a suit by himself against the Mint authorities, who contumaciously persist in refusing to coin for him his five shillings worth of silver into five shillings and sixpence. He has not accepted my recent offer (*Journal* 943, p. 76) to supply silver money for labourers employable by him in redemption of land from the sea, whose wages he professes himself unable to discharge for want of such money.

Questions of weight ought not to be treated with levity, yet it is difficult to understand the apparent disregard of lessons taught by recent political experience, which admonish us to mind our own business, and eschew conventions with other people who are apt to take *ex-parte* views of the length, depth, area, weight, and value of international standards.—I am, &c.,

Jacob A. Franklin.

London Institution, Finsbury-circus, E.C.,
March 27th, 1871.

COMMERCE OF INDIA.

Sir,—Having been prevented from attending the meeting at the Society of Arts when Mr. Dadabai Naoroji read his able and interesting paper on "The Commerce of India,"[*] some comments on which I conceive to be requisite in the interests of India at large, and the bulk of its people, I trust the indulgence may be allowed me of doing so through the valuable columns of the *Journal of the Society of Arts.*

"Live and let live." This maxim is of far greater significance and of sounder policy than may by some be supposed, and, as a rule, works equally beneficially to all concerned, which a retrospect of past as well as passing events will show. The present economical, or "penny wise and pound foolish" system does in all ways, more particularly in the stoppage of public works, closing of manufactures, &c.—though they may lessen the actual amount of the budget, and look well when that ever-curious and mystifying document comes before Parliament and the people—mulct shillings instead of pennies from the pockets of the tax-payers, besides demoralising thousands, who, if wholesome work were provided for them, instead of a miserable, doled-out existence, in so-called charity, would have remained respectable, remunerative members of the commonwealth. Crime, too, is the certain follower of idleness, whether voluntary or enforced; therefore the government that does not make the employment of the working classes a first consideration, and succeed in this great desideratum, is unfit for office, and another should take its place.

It has been said, and there is no greater truism, that well-employed labouring classes are the grand prop and wealth of a nation, whilst unemployed ones are its greatest curse. This is so fully shown at the present time in this country, as to be the cause of much alarm; and lamentable is it, indeed, to see the little heed our legislators are giving to this national danger, replete with most ominous forebodings. Truly painful is it to see so much of the time of our administration frittered away, as is too often the case, in carrying some ridiculous party measure. "Rotten state of Denmark" used to be a common saying; this, in the present day, is very applicable to this country—and rotten state of Great Britain would, now-a-days, in no way be out of place. It is not England alone that is in this precarious state, it extends as well to her colonies; and even the greatest empire in the world, now under British rule, viz., India, is fast feeling the effects of the degenerate policy now adopted by the home government.

It may be asked, perhaps, what has all this to do with my proposed remarks on Mr. Naoroji's lecture on the "Commerce of India?" My answer is, that every word that I have mentioned is, either directly or indirectly, commenting on it, as, throughout his exposition on what he terms "the commerce of India," not once does he touch on its real and great source, viz., the agricultural classes and resources of the country, the absence of prosperity of which would speedily crush all commercial doings and enterprise. I am much grieved, though scarcely surprised, at Mr. Naoroji's reticence on this head, as I have long observed that the association in which he takes so leading a part has greatly deviated from the original intention and promises under which it was formed, viz., that of assisting in developing the resources, and in looking up the interests of all classes in India; whereas, it would now appear to be a mere mercantile-political institution for the few, and that those who are already well represented, and quite able to take care of themselves. Further, the antecedents of those whose whole life has been spent in commercial emporiums scarcely fit them to adjudge and dilate on so extensive a subject as that of the whole interests of so great an empire as India.

It is far from my intention to detract in any way from what is due to Mr. Dadabhai Naoroji, for his able paper in the advocacy of the interests he purposes to represent, but I cannot but grieve that such ill-advised views and sentiments should have appeared at the present moment, as I had looked forward with much confidence that some of the natives of India now in England might have been valuable witnesses on the "Select Committee of the House of Commons on India" about to meet.

I observe that Mr. Naoroji apparently treats the subject of high wages and prices as a sign of the prosperity of a country. In this he is decidedly not singular, as I fear that such is the prevailing opinion, though a more dangerous and fallacious one could not well be, as the present state of the working classes in this country ought to make manifest. India, too, is fast drifting into this unwholesome state of belief and practice. I have not time at present to go fully into this great matter of political economy; but suffice it to say, that if the grower or manufacturer has to pay high wages, he must of necessity get high prices; then where is the gain to the poor man? The same reasons that now prevent my continuance of this subject must plead my excuse for not prolonging my remarks at this time on the lecture by Mr. Naoroji, purporting to be on "The Commerce of India," which, however, with your kind permission, I shall take an early opportunity of doing.—I am, &c.,

George J. Haly, Colonel.

March 10th, 1871.

PATENT LAWS.

Sir,—With regard to the Patent-law question, so admirably placed before the Society and the public by Mr. Newton's paper, permit me to add the following to my statement at the meeting when his paper was read.

Agreeing, as I do, with Mr. Newton and Mr. Webster in favouring the retention of most of the main features of the Act of 1852, for the passing of which I worked as hard as any one, I am, nevertheless, convinced that in several important particulars, changes of momentous character are now required.

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[*] Which, however, it can scarcely be called.

1. There is the one I alluded to, although characterised by Mr. Newton as a matter of words, yet is, I must reaffirm, an important question of principle, namely, that patent grants should in future be asked for, and accorded, not as concessions by "grace and favour" of the Crown, but as a matter of simple justice, the object being to remove a prejudice which clings like a barnacle to the patent system, and causes all the ramifications of its structure to be injuriously affected. Indeed, the anti-patent law party make this the starting point of attack, so there must be more of substance in it than Mr. Newton seems to think is the case.

2. If the inventor have any claim to obtain a special property, unless invention, this claim should not be merely entered as being made by him, without receiving any real legal acknowledgment, as is now the law, but should be formally acknowledged, at all events *pro tanto*, whence it will follow that some measure of substantial preliminary examination must be adopted, not as regards the merit of the invention, but simply with reference to its novelty and patentability, and origination by the party claiming a patent, and these being all of them points more or less—the last mentioned being wholly—of a judicial character, the administration of the Patent-law must surely be proper work for a judicial tribunal or court, rather than for an executive board. Of course, I am aware that such a court, in order to be efficient, must be of peculiar construction; law and science, especially technical science, must be fully represented on its bench, or effectively aid its judgments. In point of fact, the Act of 1852, as it at present stands, contemplates the establishment of a sort of tribunal of limited powers, for by section 6 the law officer may call to his aid, on considering the provisional specification, some "scientific or other person;" and by general law it has always been deemed allowable for the Attorney or Solicitor General to advise with a scientific man in case of opposition, where he deems it desirable, and I see no reason why he should not do so in matters of disclaimer, the ill effects of the want of which aid on that head is so clearly shown by Mr. Newton. A court being established, many important desiderata could be secured, as for instance,

3. The patent should be a *bonâ-fide*, though possibly only a *prima-facie* assurance of a proprietary right in the invention, instead of as now, a mere title to go to law. Without preliminary examination of a strictly judicial character, and every facility for *bonâ-fide* opposition, this should not in fairness to the public be allowable.

4. Patent property must be more easily and effectually protected than is at present the case. On this head Mr. Newton asserts the expediency of creating what is essentially a judicial office, for the preliminary examination and settlement of the issues to be tried in actions or suits in patents. I consider this to embody a valuable idea; but it does not go far enough (according to my experience of thirty years, whether formerly as a patent agent, or now as a barrister), to meet all the requirements of the case.

5. The payments to the government in respect of patent grants ought to be reduced, so as to be as nearly as possible level with the expenses of patent administration; and the cost of the first step should be but small, for instance, ten shillings would be better than ten pounds, and for this reason that inventors are generally poor men (principally of the artisan class), and until they have had opportunity of providing themselves with the aid of the capitalist are unable to move even one step in developing their inventions; consequently provisional protection for sufficient time, say twelve months, or six months extendable to twelve months, should be allowed at a very cheap rate.

Subsequent payments accruing when the invention is likely to be got to work are not so objectionable, as they assume the nature of a tax on available property, although why inventions, which by the Patent-law are presumed to be specially encouraged, should be at the same time specially taxed, is more than I can understand. However, there are some important uses which periodical payments subserve, and hence, with a provision for delay upon payment of a fine, such as Mr. Newton suggests, I think they might be retained, but they should be postponed till the expiration of the fifth and the ninth years respectively, or else should be made annual. They should be reduced in amount throughout. Perhaps a practical reduction would be to replace the £5 payments by £3, the £50 by £30, and the £100 by £60.

As regards compulsory licenses, I am of opinion that such a measure should receive the most careful consideration before it is adopted, because patents attract capitalists principally by the prospect of large and illimitable profits—it being well known that they are most uncertain as commercial speculations. Moreover, manufacturers are by no means ready to adopt inventions until the market has been prepared for them, and this necessitates considerable expenditure and perseverance under most discouraging circumstances, which would never be practised except in the hope of a large, even a fabulous, return. Let it once be supposed that a government board has power to limit the profits of the patentee, and the cupidity of the capitalist will be checked at its source.

I am willing to admit that no man should be able to lock up an invention for 14 years, or to play the dog in the manger. But beyond this I do not see my way clear; therefore my suggestion on this head is that compulsory licenses should be granted in cases where inventions are not worked, or the patentee cannot possibly supply the public demand.

Like Mr. Webster, I am not disposed to join the outcry against the law officers of the Crown as useful patent officials. Nor do I think the Patent Commission needs anything more than competition, according to the original intention at its formation. As practical measures, I would suggest the following:—

1. That a competent legal man, and several scientific technical men, should be added to the present commissioners, as special commissioners at suitable salaries.

2. That they should have power to sit as a court for the purposes hereafter mentioned.

3. That on deposit of the petition, declaration, and provisional or complete specifications, the priority of date should be secured at a cost not greater than ten shillings, a further payment to be made when preliminary examination is entered upon.

4. This preliminary examination to be a real investigation into the novelty, patentability and origination, effected by proper examiners under the control of the law officers, as a sort of arbitrators between the examiners and the applicants for patents. Oppositions to be allowed, and to be triable by the law officers, with ultimate appeal to the Patent Commission Court. Provisional specifications to be allowed to be inspected seven days before the expiry of the twenty-one days of notice to proceed, so that opposition may thus be entered with the knowledge of the matter to be opposed. Fee for entering opposition to be five shillings. This improvement in the opposition system alone would do much to purify the patent list, especially if (in the absence of preliminary examination) every applicant for a patent had to make a declaration before the law officer, at the opposition stage, that he had searched the patent records and made every inquiry to ascertain the novelty of his invention.

5. Whenever in any case of infringement before any court the defence alleged is that the patent is invalid for want of novelty, or that what the defendant has done does not amount to an infringement of the patent, then those issues should be sent to be sifted and tried by the Patent Commission Court, which should certify the result, and unless the referring court should find reason to object (in which case they might order a fresh investigation by a new rota of commissioners), those issues

should be deemed to be thereby decided; and, further, if the validity of the patent should be disproved, then the law officers should have power to get the patent cancelled forthwith.

6. After a successful lawsuit, the patent should be deemed indisputably established, and at the end of three years, if no lawsuit had occurred, the patentee, having publicly used his invention, should have power to publicly call opposers before the Patent Commission Court and establish his patent right.

7. The Patent Commission Court should have jurisdiction (after the action of the law-officers) in disclaimers and precedent to the Privy Council in prolongations and confirmations, also as to certificates of addition, which should be allowable, and as to compulsory licenses in such cases as I have above referred to. Indexes and abridgments should be well made, and published so frequently as to keep on a tolerable level with the progress of patent business.—I am, &c.,

F. W. CAMPIN.

Gray's-inn, March 11, 1871.

SIR,—As a needy inventor, who has felt the shoe pinch, I advocate a continuance of the grant of patents, but I also advocate an alteration and an amelioration of the Patent-laws in the favour of inventors. Chief Justice Tindall remarked, "That a patent should not be taxed, and that the privilege of a patent was a reward, not only for the benefit conferred on the public, but also as a remuneration of the ingenuity of the first inventor."

I compare the meritorious inventor to some one who at his own expense (or perhaps assisted by friends, but not in the least by the State or the public) designed or erected a bridge where none had previously existed, thereby fulfilling a condition or grant for a patent, viz., novelty, and by which a particular object was more readily reached than before, and, unless he had done so, he would have failed to comply with another essential condition antecedent to the grant of a patent, viz., utility, I will assume a case, for illustration, in Waterloo-bridge; the parallel is not exact, but near enough, with variations, to serve as an exemplification. There was a time when, before the bridge was contemplated, there was no way of crossing the river at this particular point. This having been felt as an inconvenience—(1) an enterprising waterman obtains permission (a patent) to establish a ferry-boat here, and, of course, passengers paid the fare. This was so great a convenience, and customers became so numerous, that (2) a go-a-head steam-boat owner applied for leave (at his own risk, be it always observed) to improve the accommodation for the public, who, finding this more agreeable than the wherry, patronized it, and the ferryman soon found that the public would only patronize the best and most praiseworthy conveyance, and his occupation ceased. (3) A more adventurous speculator than No. 1 and No. 2 was bold enough to carry out a substantial bridge, which not only would carry foot-passengers, but also carriages and horses. This was a bold and hazardous undertaking, but without some such daring spirits the world of science might stand still, and it is to such, and not to mere followers of well-tried, but old-fashioned plans, that we owe our progress in arts, commerce, or manufactures. The bridge was a great convenience to the public, but, having been a very costly structure, was never a paying speculation to the projector until, by the facilities offered by it for passage of foot, horse, and carriage traffic from the densely-populated town to the sparsely-peopled and open suburb, manufactories and other industrial establishments sprung up to take advantage of its communicating facilities. These, again, induced a railway company to fix upon a spot adjacent to its approaches as the site of a great station. (4) Traffic increased so rapidly that a wide-awake 'busman started a conveyance to carry passengers across, and which he did at the same charge as the bridge toll, he having made an arrangement for a compromise of the tolls. The public, always alive to their own benefit, preferred riding to walking, and the 'busman prospered for a limited period, till a fresh improver (No. 5) catered for the public, and established a tramway over the bridge, and so, affording better carriage and a more speedy journey, he superseded No. 4, the 'busman.

I will not carry this out further than to indicate that possibly, at some future day, the railway company may find it necessary to cross the river, and this would only be done when demanded for the still greater accommodation of that most exacting master, the public.

In the foregoing illustration, sketch No. 1 is purposely drawn as a weak patent, and intended to exemplify a grant of a patent for the application of something already well known to a new use, and to show how easily it was superseded by No. 2, affording to the public the benefit of an improved accommodation; by No. 3 I wish to represent a good, sound, and decidedly meritorious invention, giving to the public hitherto unknown convenience. No. 4 I mention to point out how one invention often begets another, and brings into life new industries, also to show that No. 4 does not override No. 3, but, by assisting to benefit the public, comes in for a share of the profit, in conjunction with No. 3. Again, I extinguish No. 4 by No. 5, giving always to that avaricious public further improved transit, and also to demonstrate that patent grants are not all profit to the inventors, but, on the contrary, are most hazardous property, subject at any moment to annihilation so soon as again a fresh aspirant more successfully serves the public.

I trust that I have also shown that a patent is not a monopoly, as objectors constantly assert, or at any rate that it can be so only so long as it affords the public the newest, best-improved, and most acceptable facilities.

I think, also, that my fancy sketch is sufficiently truthful:—

1. The fact so frequently brought home to patentees, that they can only hold their rights whilst they afford the first and best value in the market.

2. That patents are not hindrances and obstacles—they do not prevent one of the public pursuing any way open to him before the grant. Let us imagine a passenger wishing to cross at Waterloo-bridge. All the old methods are still free and open to him. He may wade if he likes, swim (if he can), or go round by a circuitous route, toll-free, over Blackfriars or Westminster bridges. How, then, can it be said that he was hindered by my (1) wherry, (2) steamer), (3) bridge, (4) 'bus, or (5) tramway.

Depend upon it, this is not the true cause of complaint, which arises only from a certain section of the people, who have such a grasping, illiberal spirit, that they wish to take advantage of accommodation, provided at great cost, risk, and trouble by an inventor, and are mean enough to desire to do so without paying the fare or toll.

The public is well protected by the Patent-laws; and if it were not so, it is well able to take care of itself; its interests are the ground of a Patent-law far more than the interests of the inventor, who is pushed out of the way by the first improvement on his plans, so that it makes the tenure of his grant concurrent with his being still the chief benefactor to the public in the matter of his particular invention.

The public, for whose benefit inventors are striving, is a very hard taskmaster, and without a particle of sentiment, and only patronises a patented invention when it derives a direct benefit by using it; and this is equally applicable to the public, whether as users of patents, as manufacturers and licensees, or only as customers purchasing articles made under a patent.

The public may also, in reference to this subject, be divided into, firstly, those who are benefited by a particular patent; and secondly, those who are not so, viz.: —1. Those who are benefited by the use of it, either as licensees, or by the use of articles produced better nd cheaper by reason of the patent invention; and I contend that both these parties are rightly compelled to pay to the inventor for the use and advantage they derive; whereas I do not think that, secondly, those who do not derive any benefit should be called upon to contribute; hence I deduce that a State reward to inventors would not be equitable, as, in such case, users and non-users would both be compelled to contribute thereto, whereas, by leaving it to open trade competition, the inventor derives his reward from those whom he benefits; and it is certain they will no longer continue to remunerate him than they find their own advantage in doing so.

As up to this time it has been the custom for the State to derive a pecuniary advantage from grants of letters-patent by certain stamp fees, I do not propose to deprive it of these taxes, for such I undoubtedly consider them, but would like to see the time of their incidence altered, and think it just that they should only be drawn from the profits made by the inventor. I would suggest a plan something like the following:—Registration and examination fee, £5; 1st to 7th year, free; 8th year, £5; 9th year, £7 10s.; 10th year, £10; 11th year, £12 10s.; 12th year, £15; 13th year, £20; 14th year, £25—total, £100. Or, registration, 5s.; notice to proceed, 5s.; great seal, 10s.—total, £1. 1st year to 6th year, free; 7th year, £7; 8th year, £8; 9th year, £9; 10th year, £10; 11th year, £20; 12th year, £30; 13th year, £40; 14th year, £50—total, £175. Now paid:—Stamp, £25; 3rd year, £50; 5th year, £100—total, £175.

All mines in Germany belong to the State, and concessions are granted for working them to adventurers, who pay a royalty of ten per cent. of their profits to the State for the privilege, but it is only paid out of profits. Should a mine which has been yielding profits, from some cause, say extra expense of driving headings, or any other reason, not pay any profit, no royalty is demanded till the mine is again working to a profit. I have a disposition to treat the State, as regards patents, much in this way, and after the period of the grant of patent has expired, I would leave it open to the inventor to apply for a concession for a further term, on condition of paying such a share as should be determined for the use and benefit partly of the Exchequer and partly of the Patent Commissioners. I feel so strongly in favour of the inventor, and next of the Exchequer, that I could without remorse see the public compelled to pay to the profit of both the former before its turn should be considered, so sure am I that the public acts wholly and solely on the principle of self-interest, and that, as I have before said, they only patronise a patented article just so long as it is to their own benefit to do so. I would even go farther than the 14 years, and grant a concession, in contradistinction to the patent proper, which might expire, as now, at the end of that period, and allow an inventor to continue to charge royalty, but, instead of only paying to the State the £50 a-year as on the 14th, in my second scheme above, I would cause him to pay to the Commissioners of Patents an annual fee of much larger amount, and this, too, for a good number of years (say, as an illustration, 10), the proceeds to be applied by the Patent Commissioners to pay their expenses; and for other uses advantageous to inventors and their interests, such as having a staff of experts and a laboratory to undertake, at almost nominal charges, chemical or other investigations on behalf of struggling inventors, after they had provisionally registered their schemes, and which by my cheap scale anyone could do. I would also like to see the Council of the Society of Arts, or the Patent Commissioners, put themselves into communication with front-rank manufacturers having works in most branches of the trade, say collieries, iron and steel works, wool cotton, flax, and chemical factories, &c., who would be willing, as members of the Society of Arts and men of advanced ideas, and, perhaps, also with a view to early information of what was moving in their several branches of industry, to place at the disposal of the patent Commissioners their establishments for carrying out on a practical scale hopeful inventions recommended by the commissioners. And when the funds mentioned hereafter should have reached such a state that the commissioners might assist inventors with money, where necessary, to carry out projects, and also, if even it were attainable, a benevolent institution for unfortunate inventors.

I assume that the already accumulated monies derived from patentees should be applied for the use and benefit of inventors, and for their exclusive interests; and I also expect that eventually there will be an augmentation of them by my plan of paying stamp fees if later than as now arranged, and also by the suggested plan of a concession for prolonged terms for inventions which should be deemed meritorious and deserving of such extensions, for the joint benefit of inventors and Commissioners of Patents and of the Exchequer of the State.

The chief question at issue betwixt the inventors on the one hand, and the manufacturers on the other, is to find some simple method of preventing the former from placing impediments in the road, and of the latter "bilking the pikeman."

I do not uphold obstructive patents. Either a patent is valid or it is not; if the former, let the manufacturer using it pay his fee without grudging; if the latter, let it be cleared off the rolls, which anyone adopting it should be in a position to prove had been done prior to using it, and calling it obstructive. My plan of shifting the onus of proof from the patentee on to the presumed infringer, would give him the opportunity of having this determined, and, if right, to the extinction of the patent, and, if wrong, to its establishment.

About frivolous patents, the difficulty is, who shall decide beforehand what is one. A certain umbrella-fastener might have been thought such, but the inventor is said to have made a large fortune by a contrivance so simple as a pear-shaped piece of ivory with an elastic string through it, being passed over and caught in a piece of bent steel, as a clip; yet it was used in such vast numbers as to be highly remunerative. Often seemingly trivial inventions at first sight prove profitable, which is a certain indication of their having been found useful.

I do not advocate compulsory licenses. I think the patentee should be allowed to be the best judge of what is for his own interest; and, as profit is his object, he would require very sufficient reasons for refusing to allow his invention to be used by a *bonâ-fide* applicant.

Let the abridgment of the specifications be proceeded with as rapidly as practicable, but till this is completed I would take a given date, say 1850; and have first examined and abridged the specifications since that period, and those anterior to this date afterwards. My reason for this is, that the claims of patents which have left so little mark as not to be known to experts, cannot be very important, and might be allowed to rest undisturbed till any occasion should call for the necessity of searching more minutely into them, say, *e.g.*, in a case of infringement.

In all trials for infringement, I would hold the patentee, in virtue of his possession of a patent, after examination and grant of the Great Seal, to have a commissioner's (or, so to say, a parliamentary) title, and place the onus of justification for the infringement on the infringer, and keep the rights of the patentee secure till they had been disproved, imposing thus on the wrong-doer the expense and trouble of investigating, procuring evidence, and bringing forward forgotten specifications (if any) in justification of his acts.

I venture to suggest the following matters for consideration:—

(*a.*) That inventors are worthy of encouragement and assistance.

(*b.*) That patents are too costly, at any rate in their early, undeveloped and unremunerative stages.

(*c.*) That a period of grace should be allowed within which to pay the fees.

(*d.*) The patent agents are useful and necessary, but that they should, like attorneys, be amenable for damages, for gross blunders, and culpable negligence.

(*e.*) That there should be a preliminary examination of specifications, especially of the provisionals, by experts, but that their decision should not be binding, and that the inventor shall be at liberty to proceed to complete his patent at his own risk. That the opinion of the experts as to novelty, but not as to utility, shall be printed and published with the specification, stating on the fly-leaf thereof the numbers and titles of any other patents to which the specification under consideration shall have too close an affinity, in order to guide those intending to adopt and use the invention in question.

(*f.*) That a grant of the Great Seal should be cosidered a legal title, and held valid until it shall have been impeached and decided untenable by the judgment of a superior court of law.

(*g.*) That there should be a board of commissioners, with a competent staff of scientific assessors and assistants, who should be a kind of foster-fathers in counsel, and aid inventors and intending patentees with advice, and even with funds, if the invention were considered sufficiently meritorious to be deserving of such help.

(*h.*) That front-rank manufacturers, members of the Society of Arts and others, should be induced to place their works at the disposition of the Commissioners of Patents, with their scientific assistants to properly test inventions deemed worthy of such great beneficence.

(*i.*) That some inexpensive way of defending patent rights should be adopted. Juries are not generally experts on the subject under their investigation, and, therefore, being incompetent, some better tribunal is necessary. So that if a patentee made an affidavit that his rights were being infringed, the alleged infringer should be called upon to justify and prove that either he was not using the invention in question, or, if so, that the patent was impotent, and that, therefore, he had a right to use the process. I should thus transfer the burden of proof from the holder of the title under the Great Seal to the trespasser, costs to follow verdict. It is well known that many inventors have been harassed nearly out of their lives by infringers, and in one case, that of Heath, he was positively worried to ruin and death by a combination of infringers.

(*j.*) That the board of commissioners, with their scientific assessors, should as arbitrators be empowered to give an award in the first instance, but with a right of appeal by either suitor to a higher tribunal.

In conclusion, I consider it very hard on patentees that the policy of a patent law should be questioned, less from its being in the abstract inadvisable and unjust, than that the law is so faulty that it is considered to work disadvantageously even to the patentee himself. It is too bad that the clumsiness of our law makers, indicters, framers, or by whatsoever title those who formulate into clauses the enactments are properly described, should be visited on the unfortunate patentee.

I am, &c.,

A Needy Inventor.

MEETINGS.

Severn Fishery Board.—A meeting, by permission of the Council, was held on Wednesday, the 29th inst., in the Great Hall, to consider the provisions of the Bill introduced into Parliament by Mr. Dodd, "to amend the law relating to salmon fisheries in England and Wales," the object being to make the Bill as complete as possible, and for this purpose to appoint a committee to watch the progress of the Bill through Parliament, and to secure as far as possible uniformity of action in the matter.

GENERAL NOTES.

Thibet Trade.—The trade between Thibet and our hill-town of Darjeeling, in India, has been re-opened by the arrival of a caravan of one hundred horses, laden with produce.

United States Tobacco Trade.—The production of tobacco and cigars in the United States, from the 30th of September, 1862, to the 30th of June, 1869, amounted in the whole to 312,638,887 lbs. of tobacco, paying a revenue of 80,090,660 dols., and to 3,727,421,219 cigars, paying a revenue of 19,853,996 dols. The returns to the bureau of internal revenue for the year ending the 30th of June, 1870, gives the production of tobacco and snuff at 61,589,938 lbs., on which a tax of 32c. a pound was paid, and 28,698,142 lbs., on which a tax of 16c. was paid. The revenue from tobacco and cigars during that period was 31,350,707 dols., of which New York paid 7,922,396 dols. Between Michaelmas, 1862, and Midsummer, 1870, the United States Government derived from tobacco, snuff, and cigars, an aggregate revenue of 131,295,363 dols.

The Berars.—A comprehensive report by Mr. Saunders, the resident at Hyderabad, on the Berars and the territories of the Nizam, has just been made public, of which the following summary is taken from the *Pall Mall Gazette*:—The Berars were transferred to British management in the days of Lord Dalhousie, in order to provide the means of paying the military contingent which had been maintained for the protection of the Nizam's country since 1813. So long as this force had to look to the government of his highness for its pay, there were constant complaints about arrears, which tended greatly to sap the efficiency of all ranks. Not unfrequently advances had to be made from our own treasuries with the view of remedying discontent. The Hyderabad treasury was empty, and could not supply the requisite amount of money. The British government grudged lending its own officers any longer when there was no certainty that their salary would be forthcoming except from its own revenues. In the end, the Nizam assigned for the support of the force certain fertile districts, part of which he regained after the mutiny. In regard to what still remains under British management, the original condition still holds good, that its revenues shall be devoted to keeping up the contingent and to the cost of the general administration. The balance, if any, has to be placed to the credit of the Nizam. Since the assignment, a sum amounting to nearly a quarter of a million sterling has accrued as surplus to the Nizam, and in the interval much has been done for the improvement of the Berars. A great impetus to commerce was given in the time of the American war, when cotton, from being one only out of many other staples, became the one predominating product. What is now the extent of the trade may be best judged from the simple fact that in Khamgaon—the largest of the cotton marts—a million sterling changes hands in the course of the season. The effect of this trade and of the enhanced value of the land has been to increase the provincial revenues from £420,905, in 1862-63, to £704,500 in 1869-70. With a larger income, the government has been able to spend liberally on everything connected with the welfare of the people. Justice has been brought within the reach of the poorest; a settlement of the land revenue on a ryotwaree system akin to that which prevails in Bombay is approaching completion; attention is being paid to the preservation and extension of forests; the police have been gradually reorganised, so as more thoroughly to control the criminal classes; gaols have been constructed equal to any on British soil; sanitation and conservancy have not been lost sight of; railways and roads have been constructed; and, lastly, a good education is available to all classes of the people.

Herr Hagenbach, in a contribution to Poggendorf's "Annalen," says that when a leaden bullet strikes an iron target, by far the greater part of the force is transformed into heat. The target is not indented, the rebound is very small, and a large proportion of the lead is melted.

The Commerce of New York.—The annual statistics of the commerce of New York, just made up, show that the importations of foreign goods, during 1870, amounted to £63,000,000, being £1,700,000 in excess of those of the previous year, which, with the exception of 1866, were larger than on any former occasion. Of this total, which represents cost value exclusive of freight and duty, about one-third consisted of what are termed dry goods—manufactures of cotton, linen, silk, wool, &c., and the remainder of general merchandise, such as sugar, tea, coffee, spirits, spice, china, glass, metals, drugs, fruits, seeds, &c. The specie shipments from New York during the year were £11,600,000 against £6,600,000 in 1869. New York imports about two-thirds of all the goods landed in the United States, and exports about 40 per cent. of all that are shipped.

Biscayan Whales.—M. Fischer has sent a memoir to the Academy of Sciences on the whale of the Basque coast *(Balenea biscayensis)*. This variety, formerly very common on the coasts of Spain, has disappeared. It differed materially from the Greenland whale, judging from the types found at St. Sebastian. The Basque whale was formerly treated at Biarritz for its fat, and many vestiges of it have been discovered in houses there, and the backbone, the ribs, and other parts of the skeleton were used in construction, and for various implements. By collecting these specimens, M. Fischer has been able to exhibit the anatomical peculiarities of the Basque whale, which was a remarkable development of the ribs. M. Roulin observed to the Academy that the inhabitants of Biscayan coasts, finding no more whales in their waters, have sought them in the Bay of St. Lawrence, and have given to other species the name belonging to the lost variety. It was necessary, in the interest of zoological nomenclature, to guard against the designations which they employ. In like manner, stags have been called elans, and this confusion of terms creates great trouble in the researches of naturalists.

The Scaliger Tombs at Verona.—These tombs have a special interest at present, as being reported to have afforded suggestions for the two most important memorial structures at present in course of execution in this country—the Wellington monument in St. Paul's, and the Prince Consort memorial in Hyde-park. An engraving of them is to be found in Gally Knight's "Ecclesiastical Architecture of Italy," to which is appended the following description:—"The three celebrated tombs of the Scaligers stand in the old cemetery of Santa Maria Antica, which had been the family burial place of the Scaligers before they rose to power. The tombs were erected to the memory of Cangrande I., Martino II., and Consignorio. The tombs are all on the same plan, though of different dimensions and different degrees of magnificence. In each, the defunct prince appears reposing on an altar tomb, which is supported by pillars and surmounted by a canopy, on the summit of which is seen the equestrian statue of the same individual in the semblance of life, and arrayed in knightly armour. The style of all these tombs is a mixture of the pointed and the Romanesque. The tomb of Consignorio, which he built for himself, is much the largest, the highest, and the most magnificent, and is ornamented with numerous tabernacles, statues, and bas-reliefs. An inscription on the frieze records that the Milanese artist, Bononius de Campiliano, was the sculptor; and the execution of the work affords a proof that, in Italy, the arts had arrived to a considerable degree of excellence in the fourteenth century. All the tombs are in white marble, and combining together, as they do form a most splendid and picturesque architectural group."

Manchester Steam Users' Association.—From the annual report it seems that on the 31st of December last year there were 642 members; the number of boilers under inspection was 2,116, the revenue for the year amounting to £4,092 11s. 8d. The number of boilers under inspection, at the close of the year 1870, exceeded that of the corresponding period of 1869 by 81, whilst the amount of subscriptions is the highest yet realised, showing a growing tendency to appreciate the value of such an institution. It is an important fact—although no new circumstance—that no explosion has occurred to any boiler under the inspection during the past year. and consequently no item for compensation appears in the accounts. The number of boilers not under the care of the association, and which have exploded during the past year, is 51, by which 78 persons lost their lives and 106 others were injured. The association is working with a desire to protect steam-users from harassing governmental interference.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

April 5.—*Passion Week.*—No Meeting.

April 12.—On "Boiled Oil and Varnishes." By Charles W. Vincent, Esq.

April 19.—On "The Economical Construction of Workmen's Dwellings, and especially in reference to Improving the Health and Habits of the Class." By J. H. Stallard, M.D.

April 26.—"Photography in the Printing Press, being a description of the working of the Heliotype Process." By Ernest Edwards, Esq., B.A.

May 3.—"On the Production of Artificial Cold." By Professor John Gamgee.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Anthropological Institute, 8.
Entomological, 7.
Royal Colonial, 8½. Mr. Hyde Clarke, "On a Reporter on Trade Products from the Colonies."
Farmers' Club, 5½. Mr. Clement Cadle, "The Growth of Cabbage, and Kindred Crops."
Society of Engineers, 7½. Mr. Baldwin Latham, "The Ventilation of Sewers."
Social Science Association, 8. Report from the Executive Committee on Labour and Capital on the Trades' Union Bill.
Royal Institution, 2. General Monthly Meeting.
Victoria Institute, 8. Rev. C. Graham, "On some Scriptural Aspects of Man's Tripartite Nature."
Medical, 8.
London Institution, 4.
Royal United Service Institution, 8½. Captain P. H. Colomb, R.N., on "The Attack and Defence of Fleets."
Tues. ...Civil Engineers, 8. Mr. James Price, "On the Testing of Rails, with a description of a Machine for the purpose."
Pathological, 8.
Wed. ...Geological, 8. 1. Sir P. de Malpas Grey Egerton, Bart., M.P., "On a new Chimæroid Fish from the Lias of Lyme Regis." 2. Mr. Archibald Geikie, F.R.S., F.G.S., "On the Tertiary Volcanic Rocks of the British Islands." 3. Rev. T. G. Bonney, "On the Formation of 'Cirques,' and their bearing upon theories attributing the excavation of Alpine Valleys mainly to the action of Glaciers."
Microscopical, 8. 1. Mr. Wm. R. Parker, "On the Mode of Working Out the Morphology of the Skull." 2. Mr. Chas. Cubitt, "On Linear Projection, considered in its application to the Delineation of Objects under Microscopic Observation."
Pharmaceutical, 8.
Royal Society of Literature, 4¼.
Obstetrical, 8.
Thurs...London Institution, 7½.
Linnæan, 8. 1. Mr. George Bentham, "On the Stigmas of *Proteaccæ.*" 2. Mr. G. R. Crotch, "On the Generic Nomenclature of *Lepidoptera.*"
Chemical, 8.
Society for the Encouragement of the Fine Arts, 8. Mr. James Reddie, "Beauty."
Sat ......Royal Botanic, 3¾.
Royal School of Mines, 8. Dr, Cobbold, F.R.S., "Geology." (Swiney Course.)

Journal of the Society of Arts.

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FRIDAY, APRIL 7, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The First of the Society's Six Grand Miscellaneous Concerts at the Royal Albert Hall, conducted by Sir Michael Costa, in aid of a National Training School for Music, will take place on Wednesday Evening, **12th APRIL.**

The following is the Programme :—

PART I.

1.—Overture ...."Freischutz" ....*Weber.*
2.—Air........."Va dit elle" (Robert le Diable) ....*Meyerbeer.*
Madame LEMMENS-SHERRINGTON.
3.—Allegretto Agitato ...... (Hymn of Praise) ......*Mendelssohn.*
4.—Barcarolle..." O ma maitresse" (Ercolaneum)...*F. David.*
Mr. CUMMINGS.
5.—Piano Forte Concerto in E flat........................*Beethoven.*
Madame ARABELLA GODDARD.

PART II.

1.—Overture..............." Siege of Corinth"...............*Rossini.*
2.—Aria .... " Della Rosa il bel vermiglio" ....*Rossini.*
(Bianca e Falliere.)
Madame LEMMENS-SHERRINGTON.
3.—Adagio from No. 9 Concerto ....*Spohr.*
Monsieur SAINTON.
4.—Duo " Du Repos voici l'heure" (Philemon & Baucis) *Gounod.*
Madame LEMMENS-SHERRINGTON & Mr. CUMMINGS.
5.—March..................... " Tanhäuser".....................*Wagner.*

The Hall will be open at 7; performances will commence at 8 o'clock. Evening dress.

The prices for admission to Reserved Seats at these Concerts are as follows :—

For One Concert.

	£	s.	d.
Gallery	0	2	6
Arena	0	7	0
Balcony	0	7	0
Amphitheatre	0	10	6
A Box holding 5 persons	3	3	0
,, ,, 8 ,, ...	4	4	0
,, ,, 10 ,, ...	5	5	0

For the Six Concerts.

	£	s.	d.
Gallery	0	15	0
Arena	2	2	0
Balcony	2	2	0
Amphitheatre	3	3	0
A Box holding 5 persons	15	15	0
,, ,, 8 ,, ...	25	0	0
,, ,, 10 ,, ...	30	0	0

Tickets to be obtained at the House of the Society of Arts, John-street, Adelphi, W.C.; at the Royal Albert Hall, Kensington-gore; at the Royal Horticultural Society's Offices, Exhibition-road; at the ticket-office, Exeter-hall; of Alfred Hays, the City Box-office, 4, Royal Exchange-buildings, E.C.; Messrs. Keith, Prowse, and Co., 48, Cheapside; Mitchell's Library, Old Bond-street, W.; Messrs. Chappell, 50, New Bond-street, W.; Austin's Ticket-office, St. James's-hall; S. M. and A. Warren's Ticket-office, 1, Edwardes-terrace, Kensington, W.; and the usual agents.

The Second Concert will take place on Wednesday, the 19th April, at 8 o'clock.

CANTOR LECTURES.

The third course of Cantor Lectures for the Session will be delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will consist of Five Lectures, commencing on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed.

Lecture I.—Monday, April 17th.

General Structure and Affinities of Ruminants, and their importance as a Food-producing group.

Lecture II.—Monday, April 24th.

The Bovine Ruminants, more particularly in relation to the question of Parasitism.

Lecture III.—Monday, May 1st.

The Ovine Ruminants, especially in relation to the Mortality caused by Trematode Entozoa.

Lecture IV.—Monday, May 8th.

The Cervine, Antilopine, and Cameline Ruminants, with some account of their Parasites.

Lecture V.—Monday, May 15th.

The general question of the Parasitism of Ruminants in relation to Sewage and Public Health.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture, tickets for which purpose are forwarded with the present *Journal.*

INDIA CONFERENCE.

On Friday, March 24th, a Conference was held, Mr. John Cheetham in the chair, when Mr. Hyde Clarke introduced the following proposal for the establishment in England of an Oriental Congress :—

That an association shall be formed, to be called the Oriental Congress of Great Britain and Ireland, for promoting the development of the East, and for the discussion of all subjects, except those of a political or religious character, relating to India, the Transgangetic Peninsula, China, and Japan.

That the Congress shall be, so far as possible, based on the plan of the British Association for the Promotion of Science.

That it shall consist of subscribing members.

That it shall meet once a year in some town in the country.

Such towns may include Manchester, Liverpool, Glasgow, Bristol, Birmingham, Leeds, Sheffield, Belfast, Aberdeen, Dundee, Bradford, Huddersfield, Dublin, Edinburgh, Oxford, Cambridge, Bath, Cheltenham, Leamington.

That the Congress shall be divided into convenient sections. These may include :—

Geography, Geology, Mineralogy, and Mining.
Natural History and its Economic Applications.

Biology, with Ethnology.
Languages and Literature.
Archæology and Art.
Social Science.
Agriculture, Manufactures, and Commerce.
Statistics.

Meetings of sections may, if found convenient, be divided into subsections, for India, China, and Japan, separately.

As the great purpose is to enlist throughout the country the sympathy of all the various classes of persons interested in the development of the East, the places of meeting should be so arranged in successive years that the commerce, and statesmanship, and learning of the East may be severally represented.

Some distinguished statesman or man of learning should be invited to act as president each year.

The General Council, or the committees of sections or sub-sections, will become permanent organisations for the promotion of the various interests concerned.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INSTITUTION OF NAVAL ARCHITECTS.

By permission of the Council the meetings of this Institution, on Thursday, Friday, and Saturday, March 30th, 31st, and April 1st, were held in the Great Room of the Society. The following condensed report of the roceedings is continued from last week. The discussions which followed the reading of the various papers will appear in the "Transactions" of the Institute.

Thursday, March 30th.

The Right Hon. Sir John Pakington, Bart., M.P., G.C.B., *in the chair.*

ON THE IMPROVEMENT OF THE CHANNEL SERVICE BETWEEN FOLKSTONE AND BOULOGNE, AND THE VESSELS PROPOSED TO BE EMPLOYED.

By Michael Scott, Esq., M.Inst.C.E., Member.

On the present occasion the author proposes to confine his observations to the Folkstone and Boulogne route. It may reasonably be inferred that one effect of the recent disastrous war will be to postpone, perhaps for many years, the expenditure of large sums on local improvements in France. If so, it will be vain to expect that deep-water harbours should be constructed on the French coast, for the purpose of improving the communication with England. And it may be assumed that the formation of a deep-water harbour on the French coast would necessarily involve the construction of very costly fortifications for its defence; and, having regard to the present exigencies of the national exchequer, and to the financial condition which is likely to obtain for many a year, it does not seem probable that the French government would care to undertake such works.

Beyond this, the author holds that, even were the money forthcoming, the period is still distant when the traffic could be expected to yield an adequate return on a large additional outlay.

On the threshold of the inquiry it will be necessary to discuss the necessity or otherwise of such service being at fixed hours, independent of tide or weather. For the mails, fixed hours are no doubt essential, but Folkestone and Boulogne are not the mail ports, and it has been affirmed that a comparatively minor expenditure would render the mail service quite regular between Dover and Calais.

For passengers, it might be said that, being independent of tide, the most convenient hours might be fixed and adhered to, whereas, with a tidal service, passengers have to leave London and Paris at different hours, and sometimes to arrive inconveniently late.

No doubt change of hour is essential; but it is not alone because the service is tidal that passengers have occasionally and necessarily to arrive late, but partly because of the length of time occupied in the journey; and therefore if, as it will hereafter be shown it is, it were practicable to reduce the time from London to Paris from $9\frac{1}{2}$ hours to from $8\frac{1}{2}$ to 8 hours, whilst the time for starting might not be altered, the latest time for arriving, and that only for a few days per month, would be about 10.30 p.m.

There is something also in the fact that even assuming that an hour might be fixed which might prove most convenient for the majority of travellers, any one time would not necessarily be desirable for all. For example, to leave early in the morning might be most convenient for a business man, but it might not suit a delicate person or an invalid; and it is an advantage of the tidal system, that a choice of several different hours is offered.

As, however, so much has been said in commendation of fixity of service, especially as regards passenger traffic, let it be assumed that it would possess advantages, and let us proceed to consider what practical objections exist to the introduction of such a system. To go no further, it will be sufficient to advert to the want of the depth of water in the existing harbours, which precludes the possibility of a vessel sailing at or near a fixed hour. Hence the advocates of such a service state that, before their views can be carried out, well-sheltered harbours, with deep water, must be provided on both coasts, and thus a fixed service would involve great cost.

What is the value of fixity of service? Is it worth, and would it at present compensate for, an enormous additional expenditure of capital, not to mention augmented annual charges?

The author's proposals may be briefly summarised as follows:—

To provide for a tidal service between Folkestone and Boulogne, and taking care that the vessels, in size and cost of working, did not exceed the paying capacity of the trade, to quote Captain Tyler's recommendation, by "larger* vessels with less movement in rough weather, more shelter, and better accommodation generally;" and, in order to effect this, to carry out certain improvements in the harbour of Folkestone, leaving the French authorities to do the needful at Boulogne, which will probably only include the works now being executed for increasing the backwater, and the arrangements for the landing and embarkation of passengers at the west side of the harbour. The author has not had an opportunity of minutely examining the harbour of Boulogne, but, judging from general knowledge of the port, his strong impression is that little or nothing more would be necessary.

Before proceeding to describe the vessels recommended as suitable, it is important to draw attention to the fact that storms are the exception, not the rule; and it seems only reasonable, whilst not ignoring the exceptions, that the arrangements made should have regard chiefly to the conditions which constitute the rule.

Captain Tyler says, in his report, that Captain Boxer, R.N., calculates that there are out of the 365 days, 29 days of gales and storms with heavy seas; 102 days of good round sea and breezes; 144 days with moderate weather and sea; and 90 days of calm weather. Adding to the 90 days of calm weather 144 days of moderate weather and sea, we have 234 days, or about two-thirds of the whole year, during which it may be affirmed that on board moderately large vessels no inconvenience would be felt from either rolling or pitching, and during an additional 102 days such vessels would have but little motion. There are thus left 29 days of gales and storms during which it may be assumed there would be considerable motion, even in the largest ship. But it should be observed—

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* See that gentleman's valuable Report to Board of Trade.

1. That gales and storms occur principally during the winter, when the passengers are few, less than one-third of those travelling in summer; and therefore the number of days of bad weather is not a correct index of the number of persons who suffer from it.
2. Numbers of passengers avoid crossing in storms, and wait until they have blown over.
3. Any kind of vessel which could be employed would have motion in storms, and, if very large, there would be corresponding difficulty in handling them in the harbours, whilst the fares, from the small number of passengers crossing in the winter, would not meet the expense of running vessels of extraordinary dimensions, and, even if they possessed superior steadiness, it would not be required in summer.

Having now come to the vessels which it is proposed to employ, the chief requirements would appear to be—

1. That they should be steady, or have as little movement as possible in rough weather.
2. That they should be so large as to provide sufficient shelter, roomy airy cabins, ample promenade space on deck, and every convenience for a large number of passengers.
3. That they should have high speed.
4. That they should have exceptional steering powers, and their machinery be extraordinarily handy, so that in the worst weather they might enter and leave the harbours with safety, be easily swung in narrow and confined spaces, and be able to avoid collision with other vessels in thick weather.
5. That, in addition to ordinary holds, the vessels should be constructed to carry on deck the vans loaded with passengers' luggage, and a number of goods-waggons, sufficient, so far as the more valuable kinds of goods are concerned, to accommodate the trade, and so transfer both luggage and merchandise (excluding very light and bulky articles) from one side to the other without breaking bulk.

Having explained his views as to what gives to a ship stability and steadiness at sea, which he does not consider as being synonymous terms, the author says:—

In the case under consideration, what we have to do is to give up sail, and diminish the amount of stability required, and then further to augment the steadiness by every reasonable means.

Much light has in recent years been thrown upon this question, and it is held that, *ceteris paribus*, we have a measure of the relative steadiness of vessels, in the position of the centre of gravity in relation to the metacentre, for it has been found that as these centres approach each other the stiffness decreases, but the steadiness increases, and *vice versa*. From this it follows that the nearer these centres can be brought the better, if we want a remarkably steady ship; and this may be effected—first, by diminishing the breadth of the vessel; second, by increasing the displacement or draught of water; or third, by raising the weights of or in the vessel.

The effect of the opposite conditions is seen in ordinary steam vessels of light draught and high speed, which involves great weights of engines and boilers low down; hence such boats are unsteady and roll violently.

Lastly, on this point, as affecting rolling, it has been found advantageous to have the means of winging the weights.

In vessels for the channel service it obviously would not do to restrict their breadth, because this would be to diminish the space required for the comfortable accommodation of the passengers. Nor is it apparent at first sight how vessels with increased displacement and draught of water could make use of the existing harbours, or how their weights could be raised; but a brief outline description of the proposed steamers will show how steadiness may be secured in the manner indicated without involving what appears to be the corresponding disadvantages.

The author proposes that the vessels should be about 300 feet in length between perpendiculars, and very little more over all, and about 36 feet in breadth. The ordinary draught of water to be 8 feet 6 in. with all weights on board, including passengers and their luggage and a considerable quantity of goods; and the vessels to be so constructed that, by the admission of water ballast when at sea in bad weather, they would be steadied by having their draught increased to 11 feet.

The vessels to be propelled by two pair of paddle-engines driving one pair of wheels amidships, and the speed to be 17 knots. Having two independent sets of propelling machinery, the vessels would require no masts, sails, or rigging.

It is further proposed that there should be three cabins for first-class passengers, viz., a main saloon, a ladies' saloon, and a cabin where refreshments could be obtained, and that there should be an after-cabin for second-class, and a fore-cabin for third-class passengers.

The first-class ladies' cabin would consist of a lofty saloon, before the machinery; further aft would be the main saloon, of large dimensions; and in connection with all the cabins there would be lavatories and other conveniences.

In addition to the unoccupied main deck fore and aft, and over the machinery, and to the wing passages along each side of the saloon cabins, there would be an extended promenade on the upper deck.

It is intended that the vessels should be constructed with double bottoms and double sides, in fact, except at the ends, the construction would be, to a great extent, like a hull within a hull; and, excepting where the steam machinery intervened, there would be a lower deck, all fore and aft, and watertight athwartship bulkheads. The result would be great strength combined with lightness, and, what is very important, security in the event of collision.

There are other reasons for adopting the construction described, which need not at present be adverted to; suffice it to say that the vessels would be almost unsinkable, a matter of some moment, considering that their course lies directly across the track of ships passing up and down the Channel. Spaces would be provided into which water ballast could be introduced, and thus the draught increased and the vessel steadied at sea in bad weather; and when nearing port the water could be expelled, and the vessel raised to her light draught again. By simple arrangements, these operations, namely, the admission and expulsion of the water, could each be effected in less than five minutes. Such is a general outline of the dimensions and peculiarities of the proposed vessels.

Reverting now to the qualities which the vessels were to possess, it will be found that the first was steadiness in a sea-way. There being no masts or top hamper, and no sail to be carried, it is obvious that, as compared with rigged ships, the stiffness might be diminished with perfect safety.

The author does not ignore the fact that, the wind being favourable, sail steadies a vessel, but he wished to obtain a better result than sail would give; and it should be remembered that the full value of sail (for this purpose) could only be realised with the wind abeam or nearly so. Next, the form of hull might be such as, to a limited extent, to diminish the breadth at the water-line without the displacement below; and by admitting water into the compartments prepared for it, the draught would be increased, and the displacement still further augmented.

The same operation (the admission of water) could be so arranged as in some degree to regulate the position of the centre of gravity of the vessel in relation to the meta-centre, and cause these to approach each other sufficiently near to produce steadiness combined with perfect safety. Moreover, the proposed arrangement would give the commander unexampled facilities for regulating the trim of his vessel, to suit varying conditions of loading and weather, and so to produce the best results.

Without going further into the subject it will be apparent to all, that a large, well-proportioned ship would have less motion in our Channel seas than a small, light vessel, dancing on the surface; and, therefore, that the steamers proposed, being (in displacement) about four times as large as those at present employed, greatly increased steadiness and immunity from sickness on the part of passengers might safely be reckoned upon.

The next requirement was, that sufficient shelter and comfortable accommodation should be provided for a large number of passengers. A comparison with the steamers at present employed in the service between Folkestone and Boulogne will illustrate the superiority of the proposed vessels in this respect, for it would be found that the area of the deck and the area of cabin would be double that of the largest of the existing steamers.

The next requirement was that the vessels should have high speed. It will be enough to say that power sufficient has been reckoned upon to give a speed of 16 knots per hour, even in rough weather, so that, even in adverse circumstances, the passage could be made in about 95 minutes. The time at present allowed, including crossing the Channel, from starting at Charing-cross till the train leaves Boulogne, is about 5 hours 25 minutes, of which 3 hours and 10 minutes is allowed from the time of leaving Folkestone harbour till the time of leaving Boulogne for Paris. On the return journey, the time from leaving Boulogne till the train leaves Folkestone for London is about 2 hours and 40 minutes. Then, as the proposed vessels would make the passage in 95 minutes, and with the improved arrangements contemplated at Folkestone, and the steamers being berthed close to the train on the west side of the harbour at Boulogne, 30 minutes would be sufficient for embarkation and disembarkation, there would be a saving of from 50 minutes to 1 hour and 20 minutes, thus reducing the journey to and from Paris to about 8½ hours.

The fourth requirement was that, as compared with the existing steamers, the new vessels should have superior steering and manœuvring powers. The recent opening of the new basin at Boulogne will no doubt do much to diminish the crowding of the tidal harbour, and the works being carried out are designed to improve the channel and entrance. Similarly the improvements which it is proposed should be effected at Folkestone would remove the existing difficulty to the entrance of vessels and their being swung in the harbour; but, nevertheless, chiefly with reference to Boulogne, it is suggested that the machinery of the proposed new vessels should be so arranged that, even in bad weather, they might be readily as well as safely handled.

When the International Communication Bill was before the Committee of the House of Commons, evidence was given, by eminent and experienced men, to prove that the increased size of vessel promoted steadiness in entering a harbour; and having had opportunities of discusing this matter with some gentlemen of experience, the conclusion the author arrived at was that such vessels as those proposed could be safely navigated to and from the port of Boulogne as it exists.

Although about 100 feet between perpendiculars, they would only be about 70 feet over all longer than the resent steamers, and the increased length would render them less subject to be influenced by a heavy sea, whilst with disconnected paddles, and the starting gear now introduced, by which the engines are handled with such facility and rapidity, the course of the vessels would be more perfectly under control than if dependent upon the rudder alone; but as they could enter and leave the port at high speed, and consequently with good steerage way, the influence of the rudder would also be augmented.

Inasmuch as the proposed vsssels could make the passage in less time than the steamers at present employed, a foot or more of tide might be saved when arriving on the ebb, and as the existing vessels draw 7 ft. 6 in. to 8 ft., the new steamers might have sufficient water although they drew 8 ft. 6 in.

But, to take the worst view of the matter, let it be assumed that there would arise occasions when the proposed vessels could not safely be taken into Boulogne harbour—what would this amount to? It has already been shown that out of the 365 days in the year, the average number of "days of gales and storms, with heavy seas," is only 29. Let it further be assumed that two-thirds of these gales are from the westward, then the remaining third would not preclude large vessels from entering or leaving, because Boulogne "is sheltered by Cape Grisnez from easterly gales." This would reduce the number to 20, and we arrive at the conclusion that, generally speaking, at a period of the year when the number of passengers is small, there would be a few occasions on which one of the existing packets would be substituted for the large vessel, and, it may be, one or two violent storms when no steamer could cross the Channel.

With disconnected wheels the vessels could be swung in harbour in little more than their own length, but, still further to facilitate their being handled, it is suggested that they should be fitted with steam capstans. Under this head it may also be desirable to mention that it is proposed that the saloon cabins should occupy the middle portion of the vessel. This is not unimportant, because a deck-house, for example, placed aft, would, from the action of the wind upon it in bad weather, render a vessel less manageable in entering a harbour.

The last requirement was that the vessels should be so constructed that the vans containing the passengers' luggage, and a certain number of waggons with merchandise, should be ferried across the Channel without being unloaded. The vans and waggons could be placed by a crane on the main deck, and secured there in a few minutes, but it is suggested with regard to the former that the bodies only should be shipped, and not the frames, wheels, and axles. They could be so constructed that there would be no difficulty in this.

Inasmuch as the weight of luggage and goods carried would vary, it seems to the author that the employment of water ballast would be advantageous, for otherwise the trim of the vessel would seldom be that which was desirable.

The Channel service is said not to be remunerative at present, and the question naturally arises, how will matters be improved in this respect by employing larger vessels?

There are now (between Folkestone and Boulogne) four services per day, viz., a morning or mid-day express boat from each side, and an evening or night boat from each side. This arrangement is no doubt necessary at present, on account of the smallness of the boats employed; but it does not appear that it would be necessary with larger vessels; and the author thinks it could be shown that one boat per day from each side would be quite sufficient for the traffic.

It is proposed that the vessels should be arranged to carry five goods waggons on deck, and, in addition, that they should have hold space for carrying a considerable quantity of merchandise below.

Then as to passengers. At certain seasons they are very numerous, but even during the busiest month, August, it would not be necessary to put on an extra steamer until the traffic had greatly increased; for it will be remembered that it has been shown that the proposed vessels would afford double the accommodation to be found in the largest of the existing steamers, and therefore there should be no doubt of their capacity and fitness to carry, at one trip, as many passengers as the present boats carry at two.

Nor does it appear that the existing double service is more convenient for passengers; for what are the facts? By the night service—the time occupied from London to Paris, and *vice versa*, varies from about 16 to 22 or 23 hours, the majority of the services averaging about 17 hours; and it is not conceivable that any one would subject themselves to the inconveniences of such a tedious journey unless for a weighty reason. This reason is doubtless to be found in the reduced charge; but if the fares be less, the profit to the carriers must be diminished, and therefore it is not unreasonable to hold that the passenger traffic by the night boats does not pay. But is it not advantageous to the poorer class? No doubt it is, and if these were very numerous at any period it might be desirable to run one of the existing small boats for their accommodation. At other times, a considerable number of third-class passengers might be carried by the express steamers at a slightly increased fare, compensation for which would be found in the saving of time and diminished cost of refreshment for the journey.

Assuming that there would always be sufficient accomodation in the mail steamers for the higher classes who prefer, or are compelled to adopt, night travelling, the author concludes that if the proposed vessels had only to make one passage for two of the existing steamers, it would follow that a great economy in working expenses would ensue, more than sufficient, one would think, to convert the alleged present loss into a considerable profit.

It is necessary to have special regard to the protection of the passengers from inclement weather when embarking or landing. This can be readily effected at Boulogne. In the case of Folkstone, the steamers are at times unable to enter the harbour; on such occasions the passengers are compelled to walk to or from the station to near the end of the western pier, exposed to rain and wind, but it is proposed that the embarkation and landing should always take place inside the improved harbour, and directly from the carriages, which would run alongside the steamers, so that the passengers would not at any time be exposed to the weather.

The new steamships would, of course, involve additional outlay; but considering that one or two of the present vessels being retained, only two would be required, and that after they were built, the majority of the vessels composing the existing fleet might be disposed of, and that, being fast handy boats, they should realise good prices, it does not appear that a very serious addition would require to be made to the capital invested in shipping.

It will be seen that, according to the author's view, it would be better to postpone the establishment of a service at fixed hours until the traffic increased sufficiently to pay for it.

There is nothing startling in the present proposal. It may be said to consist chiefly in a somewhat novel combination of well-tried means to effect a specific result; for, to refer to one prominent feature of the plan, viz., the occasional use of water ballast, numerous vessels are daily at work which have their draught thus increased at pleasure, so as to bring them into good sailing trim. The peculiarity of the case under consideration is, the application of this system to secure the comfort of passengers at sea, and at the same time to overcome the difficulty arising from the deficiency of depth of water in the harbours.

Before concluding, one or two points remain to be noticed. It is obvious that such a system would not be applicable for long voyages; that when in rough weather the vessel was put down in the water to steady her, in order to maintain the same speed additional power would have to be developed by the engines, and thus the consumption of fuel would be augmented. On examination, however, it will be found that the increased working charge for so short a distance is not worth consideration. During fine weather of course the vessel would be steady at her light draught, and therefore it would only be occasionally that she would be immersed to her deep line.

There would be a substantial increase in the first cost of the machinery, but, on the other hand, the engines could be worked more expansively, and therefore economically, when the vessel was at light draught.

It may occur to some that the varying immersion of the paddle wheels would be a difficulty, but it should be borne in mind that the diminished immersion of the floats at light draught would not be inconsistent with the decrease in power required to drive the vessel in that condition.

One word more. The quantity of water to be admitted and expelled for the purpose of bringing down the vessel from light to deep draught would necessarily be considerable; but it has been ascertained that four centrifugal pumps, and those not of extravagant dimensions, would suffice to effect the expulsion of the whole in less than five minutes.

Tables were appended to the paper which will be found useful in considering the amount of accommodation required in vessels adapted for the service. They will be published in the "Transactions."

Evening Meeting, Rev. Joseph Woolley, LL.D., *in the chair.*

ON THE RELATIVE INFLUENCE OF BREADTH OF BEAM AND HEIGHT OF FREE-BOARD IN LENGTHENING OUT THE CURVES OF STABILITY.

By N. Barnaby, Esq.

(President of the Board of Construction to the Admiralty).

It is just three years since curves of stability were first introduced to public notice in a paper read here by the late Chief Constructor of the Navy. Few of us supposed then that they would receive such a melancholy notoriety as has since befallen them, and no one attached enough importance to them to calculate them for an actual ship until last August, when, unhappily, the curve only served to show clearly why the ship for which it was constructed was lost, instead of preventing the calamity.

I do not propose to enter into the reasons for this. They have been widely discussed with but little profit. My object is to meet the arguments of those ardent lovers of low free-board, who throw all the blame on want of beam, and refuse to see in the lowness of free-board the danger which always besets it; and what I may say will perhaps show also to those who have a superstitious horror of low free-board, that, with very considerable beam, low free-board ships may be made quite safe against upsetting. There are those who contend that the *Captain's* insecurity arose from want of sufficient beam, and others that it arose from want of sufficient free-board. Both parties are right. But I propose to show that peril is far more readily incurred and averted by alteration in free-board than it is by alteration in beam. This effect of free-board is no new discovery. It is, as I am informed, an old maxim of the sea, that in bad weather sail should be shortened in a high-sided ship to save the spars, and in a low-sided ship to save the ship. This wise maxim has been the result of experience. For the future, every naval architect who designs, and every sailor who commands a ship must know why this is so, and must know also the limit of the resistance which his own ship is capable of offering to the pressure of her canvas.

A curve of stability, although extremely difficult to construct, is easily understood. It consists of a base or line of abscissæ, graduated in degrees, from one degree up to the greatest inclination at which the ship continues to possess righting power. This varies in different ships from somewhat over 30° to 120°, which we have calculated.

At each of these several inclinations the exact amount of the righting force is calculated, or rather the length of the arm of the righting lever is calculated, and this length is set up as an ordinate at the angle to which it corresponds, and a curve is drawn through the outer extremities of these ordinates. This curve crosses the base line at zero, because there is no righting force when the ship is upright, and crosses it again at the position of the angle of vanishing stability. The highest point of the curve indicates the position of the angle of maximum stability. It will be seen that the amount of the righting force may be ascertained from this curve at once for any inclination, by measuring the length of the ordinate and multiplying by the weight of the ship.

I have referred to the considerable differences in the range of stability in ships of different proportions, and I have now to ask your attention to a few illustrations of this. Taking the *Captain* first, it will be seen that the highest part of the curve corresponds with an angle of 21°, and that both in the upright position, *i.e.*, when the angle is zero, and at 54½°, the curve crosses the axis, and there is no righting force in operation. It may be inferred from this curve, that if the ship had been rolling among waves in a calm she might have rolled to near 40° from the upright each way with safety, the difference between 40° and 54½° being allowed for the slope of the waves. But with a pressure of the wind upon the sails, a considerable portion of this curve becomes of no value. Suppose, for example, that the ship were sailing, and were held down permanently by her canvas to 20°, it would follow that, as the upsetting power of the wind is already nearly equal to the greatest resisting power of the ship, a small increase in the power of the wind, raising it, say, from 7,010 foot-tons, which it would be at 20°, to 7,110 foot-tons, would be greater than the greatest resisting power of the ship, and that therefore the smaller resisting powers which the ship is capable of exerting at the larger angles would fail to prevent the ship from being carried completely over. If the ship were permanently inclined at 10° by the pressure of sail, and were carried by the heave of the sea to as much as 38°, she would recover herself, because at 38° the righting power of the ship is precisely the same as at 10°, and the upsetting power of the wind would have decreased in proportion to the square of the cosine of the inclination of the ship to the upright. Taking this into account, the ship may have been rolled over under this sail to 46°, and would have returned to the upright. Or take the case of a squall. If the ship had been, as already supposed, permanently heeled under canvas to 10°, and a squall capable of holding her inclined to 16° had struck her, she would still have been safe; she would have been carried over to about 25° in order to absorb the force of the blow, and finding there more righting force than the steady force of the wind could overcome, she would have rolled back to 16°, and inclined permanently at that angle. It will be seen at once that the imminence of any peril to which she may have been exposed, so far as this curve would indicate, it would depend upon the assumption made as to the angle at which the ship would be permanently inclined under her canvas. The man who has reason to suppose that the ship would never be inclined permanently among waves or in squally weather to more than 10° would argue, as we have already shown that he might, that both as to the heave of the sea and the sudden force of a squall, there was a considerable margin of security. But if he supposed the ship to be permanently heeled to near 20° among waves or in squally weather, the curve would show him at once that the ship was in the most imminent peril. It would be seen, therefore, that the question of the ship's danger, as indicated by this curve, does not turn on the amount of stability, but on the proportion which the angle of permanent heel of the ship under canvas bears to the angle at which the stability is greatest. And, with reference to the range of stability, I shall be able to show that, while with a low free-board it is possible to increase the amount of the righting force at small angles indefinitely, the position of the angle of greatest stability alters very slowly, and it is impossible, with any breadth of beam and practicable position of centre of gravity, to give them righting power when on their beam ends, a matter which is easy enough in ships with high freeboard.

I am happy to say that, in the opinion of the Committee on Designs, the range and amount of stability provided in the original design of the *Thunderer* would have been sufficient for an unmasted ship for ocean service. But supposing it had been decided otherwise, we had provided a remedy. That remedy is not to increase the beam of the ship or (to use popular language) to reduce her heavy load of armour, piled up centrally to a height of 20 feet above the water, but to pile up 130 tons more upon the top of her, and to take care to keep these new weights well away from the middle of the ship. The effect of this addition is to nearly double the stability of the ship, the maximum righting force being increased from 7,430 to 14,140 foot-tons, to carry the maximum angle to 30½° instead of 20°, and to increase the range to 55¾°.

This is due simply and entirely to the raising of free-board through the middle of the ship. The effect on the centre of gravity of the ship has been, of course, accounted for, and the necessary drawback on that account has been taken into the calculation.

The effect of the additional weight at the sides of the ship, on the moment of inertia, will be to increase the steadiness of the ship.

The use made of the superstructure referred to is to give healthier and more commodious quarters to the officers than can be given under the bomb-proof deck, and to furnish space for sick-berth, cooking arrangements, seamen's head, &c. I only refer to it here as a further illustration of the influence of free-board on the curve of stability.

In order to show, by comparison among similar vessels, how the curves of stability varied with increase in beam and increase in free-board, I have had the curves of stability calculated for a number of prismatic bodies, with rectangular cross sections.

You will see on the walls some of the curves of stability which we have constructed during the last few months. I have selected such as I thought would best illustrate the remarkable effect of high free-board in ships with but little initial stability. The *Inconstant* is one of these cases. Every one knows that we have put 180 tons of ballast into her—not a large amount for a ship of 5,500 tons displacement. It is not known to every one that she possesses among her admirable sea-going qualities a range of stability extending no less than 105½°. That, in other words, she would bear to be thrown over not only on her beam-ends, but to 15° beyond it, and would still possess righting power.

But a more remarkable case is that of the *Juno* and *Thalia*, which, with very small initial stability, possess righting power up to 115°, *i.e.*, to 25° beyond their beam-ends. The Indian troop-ships *Crocodile*, *Serapis*, *Euphrates*, *Malabar*, and *Jumna* are well known for their lofty, towering sides. It may be some satisfaction to persons who have regarded this as top-heaviness merely, dangerous to their stability, to know that these ships have the most stability of any of the ships hitherto calculated; that the stability increases perpetually up to an inclination of 50°, and that they possess righting power to beyond their beam-ends. I have given also the curve of stability of the *Vanguard*, *Iron Duke*, *Audacious*, and *Invincible*, in order to show how well-grounded our confidence in these ships has been when they were properly treated. These ships are now floating at near the lines to which they were constructed, having been brought to them by ballast. In order to show what their qualities really are in this respect, I will compare them with a ship which has been universally and justly praised for her behaviour, viz., the *Achilles*.

They stand thus:—Up to an inclination of 54°, the *Achilles* has a greater length of righting lever than the *Vanguard* class; the maximum length of this lever being 2·48 feet in the former ship, and 2·32 feet in the latter, this maximum occurring at $42\frac{1}{3}$° in the former, and $44\frac{3}{4}$° in the latter. At 54° the righting levers are the same, and while the stability vanishes in the *Achilles* at $80\frac{1}{4}$°, it goes up to $83\frac{1}{2}$° in the *Vanguard*. So that while the ships of this class are not quite so stiff under the same proportionate spread of canvas as the *Achilles* is, their range of stability is greater, and their safety more assured.

ON THE CALCULATION OF THE STABILITY OF SHIPS, AND SOME MATTERS OF INTEREST CONNECTED THEREWITH.

By W. H. White and W. John,

Associates, Fellows, and late Students of the Royal School of Naval Architecture and Marine Engineering.

The calculation of the stability of ships has occupied a very prominent position from the time when the mathematical theory of naval architecture began to assume a definite form; and the present state of knowledge on the subject has been reached by gradual advances.

Canon Mosely's investigation of dynamical stability brought our theoretical knowledge almost to its present position; and its formula, taken together with Atwood's for statical stability, still constitute the foundations of our calculations. But the determination of the formula still left the naval architect without the power of making with ease the calculation of stability for an actual ship; and although several attempts were made to solve this difficulty, none can be regarded as having been practically successful until Mr. Barnes put forward his method, a description of which appears in the second volume of the "Transactions" of this institution. From that time onward, naval architects simply had to decide whether or not it were worth while to make detailed calculations of the stability of ships designed by them.

A specimen calculation for an actual ship is given, with a few explanatory remarks, which will probably be of some value to those engaged in actual calculations, as it illustrates the method best adapted for ships of ordinary form and high freeboard.

The calculation leads to results which enable the authors to construct curves of flotation, centres of buoyancy, and metacentres for this particular ship, and these are, they believe, the first specimens of such curves ever constructed for a ship. In the paper, diagrams illustrative of the principal points in connection with these curves are given, but in abstract only a few of the leading conclusions can be indicated, and particularly those which derive a special interest from the fact that they had not been anticipated by previous writers.

The curve of centres of buoyancy in this case, as in all others, is shown to be closed, and to have no regular points, being in fact always concave towards some interior point. The metacentric curve for the exemplar ship has eight cusps, these corresponding to points of maximum and minimum curvature on the curve of centres of buoyancy, which is the involute of the metacentric curve. These cusps occur as follows:—One when the ship is upright; another when her upper deck is just immersed as the ship heels over; a third when the keel is just coming out of water, the ship being nearly on her beam ends; a fourth when the other edge of the upper deck is just immersed; and a fifth when the vessel is bottom up. The remaining cusps are symmetrical with the second, third, and fourth, and need not be described, since they correspond to positions similar to the preceding, through which the vessel would pass if she were heeled over in the opposite direction.

Being constructed on purely geometrical principles, these curves are determined by the form and immersion of the ship, and are not influenced by her structural arrangements or stowage. Hence the metacentric curve may be taken as a good index of what Mr. Scott Russell has termed "stability of form." It is interesting to note too, that the metacentric curve can never be wholly without the curve of centres of buoyancy, although it may be wholly within, or partly without and partly within, that curve.

Positions of equilibrium, either stable or unstable, are determined by the condition of tangents to the metacentric curve passing through the centre of gravity. In the diagram previously referred to the centre of gravity is supposed to occupy various positions, and the number of tangents that can be drawn from each position is determined. In every case it is found that the number is even, and that position of stable and unstable equilibrium occur alternately. In the case illustrated by the special ship taken as an example, there were four positions of equilibrium, two stable and two unstable; under other conditions, stated in the paper, only two positions of equilibrium are possible, and under others no less than six positions can be found. The last-named case, it is shown, affords an explanation of the singular fact that some ships—for instance, the *Sidon*—although unstable in the upright when floating light, become stable at a slight angle of heel. The well-known fact of merchant ships "lolling" over, to find a position of rest when light, also comes under this head. When the centre of gravity is below the metacentric curve, we have the case of a self-righting lifeboat; and the converse occurs when the centre of gravity lies above the metacentric curve, as the vessel will then be stable only when bottom-up.

When stability of form is small, slight variations in the position of the centre of gravity may have a very considerable effect. For example, in a vessel with circular sections, like the "cigar-boats," the metacentric curve degenerates into a point, coinciding with the centre of the sections. If the centre of gravity lies ever so little below this centre, the vessel resembles a self-righting lifeboat; if it lies ever so little above this centre, she is stable only when bottom-up.

The curve of flotation of the ship taken as an example has no less than six cusps. The existence of cusps on this curve for a ship has never, so far as the authors are aware, been anticipated, although it is shown now to be the rule rather than the exception. Dupin, in his elegant investigations of the properties of these curves, quite overlooked the possibility of their occurrence, and was led by this oversight to demonstrate the impossibility of this curve and the curve of buoyancy intersecting each other. His demonstration, however, fails when there are cusps on the curve of flotation, and in the paper there are given diagrams of bodies in which the curves actually do cut each other in as many as twelve points.

The diagrams illustrating the paper will be given in the "Transactions."

Friday, March 31st.

The Right Hon. Sir John Pakington, Bart., M.P., G.C.B., *in the chair.*

ON A NEW METHOD OF MOUNTING, RAISING, LOWERING, AND TURNING GUN TURRETS IN SHIPS.

By Rear-Admiral E. A. Inglefield, C.B., F.R.S.

In 1864, I invented and patented a plan for raising and lowering a gun platform on turntable, protected on the side engaging the enemy by means of a semi-shield. The arrangements for loading and pointing the gun were adapted to be used when the gun was lowered on to the main deck. The gun was then raised by means of a hydraulic engine, which derived its power by the admission of the external column of sea-water. A gunner accompanied the gun to the firing position, and when it was finally laid and fired it was then lowered to the main deck for re-loading. The object of this plan was to prevent the necessity for carrying ponderous turrets and guns above the upper deck when the ship was at sea, and, whilst fighting, to give the gunners a greater protection.

Since that time turrets have become an institution in naval architecture; and though the talented invention of my lamented friend and brother officer Captain Coles has been brought almost to perfection by his unwearying zeal, still practice has shown that the great height of the enormous mass of metal above the water-line of the ship has materially affected the stability of vessels so fitted, and in one lamentable case has, I fear, been the material cause of our losing an iron-clad frigate and nearly every man and officer of her crew.

The turrets fitted in that splendid specimen of naval architecture the *Monarch* are found to work with considerable difficulty when the ship is inclined—steam being unequal to the task.

I am of opinion that even with more powerful engines, the compressibility, elasticity, and condensability of steam renders that agent not the best adapted for this purpose. In this paper I propose to describe a new method of mounting, raising, lowering, and turning turrets, the agent employed being the external column of water adapted in several ways for the purposes named.

Some drawings of a section of the *Monarch* were then explained, representing a water-tight circular compartment in the centre of the ship, extending from the upper deck to the inner skin of the double bottom. The diameter of this circular compartment (it will presently be seen) must depend entirely on the weight and displacement of the turret and its tubular mounting.

The armour-plated portion of the turret is so constructed that it protrudes beyond the turret-barrel; and there is a recess in the water-tight compartment, so as to admit of the turret-barrel with the turret being lowered down, so as to conceal the ports when loading, or at sea, to carry its weight lower in the vessel—a point not unimportant when it is remembered that it has been found necessary to place a large amount of compensating ballast on the bottom of some of the new turret vessels.

In conclusion, the advantages proposed by the system adopted of mounting, raising, lowering, and turning turrets are as follows:—

1. The ability to carry the turret at sea lower in the vessel.

2. The economy of space, and safety and convenience for the stowage of powder, shells, and shot.

3. The advantage of carrying the turning gear below the level of the water.

4. The comparative ease, certainty, and steadiness with which the turret is turned, it being nearly balanced and entirely suspended in a fluid.

5 The addition of other large water-tight compartments in the centre of the ship, and which, if the bottom were penetrated in several places, would (when of sufficient dimensions and clear of stores) be alone sufficient to keep the ship from foundering.

In the building of the vessel this water-tight compartment would form a material addition to the strength of the whole structure.

ON THE MEASUREMENT OF YACHTS AND TIME ALLOWANCE FOR RACING.

By Henry Liggins, Esq.,

Associate, Member of the Royal Thames Yacht Club.

No subject has occasioned so much difficulty and discussion among yacht-builders, owners, and sailors, as the subject of yacht measurement and time allowance for racing purposes, the object being to ascertain, when two or more yachts of different sizes are sailing together, which vessel, in proportion to her size, is really the fastest.

During the last twenty years, many plans have been tried and found wanting, while others have not been attempted, from the apparent difficulty which besets the subject, and because some of them, however apparently practicable in theory, were found in practice impossible.

The Royal Thames Yacht Club rule for tonnage is as follows:—"Every yacht entered to sail in a match shall, previous to starting, be measured, agreeably to the mode specified in the following rule, by or under the inspection of two members appointed by the Sailing Committee. These members shall sign a certificate of her measurement so taken, which shall be considered her true measurement, for all purposes of the club, until an alteration be made in the said yacht.

"The tonnage of yachts eligible to sail in matches, for prizes given by the club, shall be as follows:—1st class, exceeding 35 tons; 2nd class, exceeding 20 tons and not exceeding 35; 3rd class, exceeding 12 tons and not exceeding 20; 4th class, 7 tons and not exceeding 12. The measurement for the purpose of ascertaining such tonnage shall be taken in the manner following:—The length shall be taken in a straight line at the deck, from the fore-part of the stem to the after-part of the stern-post, from which, deducting the breadth, the remainder shall be esteemed the just length to find the tonnage. The breadth shall be taken from the outside of the outside plank, in the broadest part of the yacht; then multiplying the length by the breadth so taken, and the product by half the breadth, and dividing the whole by 94, the quotient shall be deemed the true tonnage; provided always that if any part of the stem or stern-post project beyond the length taken as above mentioned, such projection or projections shall, for the purposes of finding the tonnage, be added to the length taken as before-mentioned, and that all fractional parts of a ton shall be considered as a ton. The measurement to be taken either above or below the main wale."

This rule was devised partly with a view to disturb as little as possible the tonnage under the old law, which, until the modern clipper was introduced, since 1851, it did pretty satisfactorily; but its principal object was the laudable one of checking the construction of any exaggerated form of vessel—in fact racing machines, useless as vessels for any other purpose; and I believe in this respect it has given universal satisfaction, except to the Americans, who complain, through the New York Yacht Club, that it is not fair for us to measure the depth of our deep and narrow vessels by half our breadth, as against their shallow vessels, with much greater breadth than our own.

I wish I could add that this club or any other club had been equally successful in making a time allowance for the supposed difference of speed between cutters, yawls, and schooners, and also between yachts of different tonnages as measured by the same rule.

The oldest yacht builder at Cowes, and a member of our Council, I believe is of opinion that the fairest mode of measurement for racing purposes would be by displacement, which no doubt possesses many elements of fairness, but I fear is quite impracticable, on account of the disinclination felt by builders and owners of yachts to give that publicity to their drawings which this system of measurement would require; and also because, if adopted, it would not work fairly as between our yachts, of extreme displacement and large cabin accommodation, and the American models, of small displacement and inferior cabin accommodation. The builder of the *Cambria*, Mr. Michael Ratsey, of Cowes, has suggested a simple rule, which, however, has to be tried, viz. :—Take the length of the yacht on the load water-line, subtract from it the extreme breadth, multiply this by the breadth, then by the draught of water in the deepest place, and divide by 94. By this plan the *Cambria* works out five tons larger than by the Royal Thames Yacht Club rule.

Whatever plan is used, simplicity is for obvious reasons necessary; and for years past some experienced yachtsmen have advocated one measurement only, viz., length. I fear in practice this would be fatal, for it would permit unlimited breadth and depth, and encourage the carrying of unduly large sails, and foster mere racing machines.

There are some high authorities who assert that for racing purposes the only correct measure for a yacht is the measurement of her sails, which I believe has not been tried; and here again is the objection, and a very natural one, that owners are not inclined to furnish to their competitors in races any information which, on a future occasion, might be used against them.

At first sight, it would appear that this plan would leave the designers of the hull free to shape them in every particular in the most perfect form to insure speed, usefulness, safety, and ease at sea; but I confess that I have such a high opinion of the skill of our builders in evading every rule to insure speed, that I think this plan would offer a high premium to racing machines, and our yachts would become less useful vessels at sea than they are at present, and that naval architecture would rather retrograde than advance.

The mode of measurement by displacement, which may be called the outside measure, is objected to; and the measure of capacity, which may be called internal measure, is clearly open to many objections on the ground of easy evasion; but if it were practicable without too much cost of money, inconvenience, and difficulty, to arrive at the weight of sea-water displaced by a yacht, perhaps that mode would be open to less evasion, and be more fair for all sorts of designs of vessels than any other plan that has been proposed.

The plan now in use, and for some years past adopted by the New York Yacht Club, appears to answer for their form of vessel, and gives them general satisfaction; but as far as comparison with our usual plan, it is open to the objection that it only observes two dimensions, and takes no notice whatever of depth. It is as follows :—

"Time should be allowed for difference of measurement according to certain tables.*

"The measurement of area for the purpose of this rule shall be the product of the multiplication of the extreme length, on or under the water-line, from fore side of stem to aft side of stern-post, by the extreme breadth whenever found, both measures to be feet and decimals."

Mr. Liggins gave at length an extract from the "Royal Yacht Squadron Time Table," with the admirable remarks of the Sailing Committee appended thereto, and said as it is rarely used by other clubs, even at the Isle of Wight, it cannot be said in practice to give universal satisfaction. This extract will appear in the "Transactions."

ON THE MEASUREMENT OF YACHTS, AND ALLOWANCE OF TIME IN COMPETITIVE SAILING.

By **Charles H. Haswell**, Esq.,
(Civil and Marine Engineer, New York, Associate.)

There is a very general dissatisfaction prevailing with members of yacht clubs as to the justice of the various rules under which the competing capacities of yachts are computed.

The cause that renders any rule necessary, arises from the operation of the physical law that, *cæteris paribus*, large vessels have greater proportionate stability, easier water lines, and less proportionate surface of friction, and by their greater inertia are less disturbed by rough water than small vessels; and hence all yacht clubs have adopted a system of measurement whereupon is based an allowance of time or distance by the larger vessel to the less one. Stability in a vessel is the determining element of capacity to sustain sails, that is, her capacity to carry and maintain her power of progression.

A vessel which has a sufficient degree of stability from her dimensions will sail faster than one which, in order to bear a like area of sail, requires to be ballasted with greater weight, as she will roll easier; added to which, one that has greater proportionate beam and little depth has more stability than one that is narrow and deep (unless a like degree of stability is obtained by ballasting), which incurs an increase of displacement involving an increase of resistance, and consequently, loss of power to meet it. In order to illustrate wherein this function of stability as applicable to vessels exists, I will give its elements: Stability of a body in flotation depends upon its relative solids of immersion and emersion; that is, when applied to a vessel, to the conformation and weight of the mass of the hull, spars, rigging, &c., above this line; or, in physical terms, the distance of the centre of gravity of the vessel from the vertical, passing through the centre of displacement when the vessel is inclined; or, in other terms, it is for ordinary angles of heeling the height of metacentre above the centre of gravity of the mass.

In similar bodies, that is, for larger or smaller vessels, increased or reduced from the same lines, this variation of the position of the centre of displacement does not vary at small angles, and the vertical intersects the middle line of the vessel at the same point, that is, at the metacentre. Hence, the stability of a vessel is in proportion to the height of this metacentre and the centre of gravity, and the distance moved horizontally is as the sine of the angle of inclination, or, in general terms, this height is represented by $\frac{L B^3}{V}$, where B represents the beam, L the length of load line, and V the volume of displacement of the hull. That is, with the same displacement, the measure of stability is as the cube of the beam into the length, hence double length gives double stability, and double beam gives eight times the stability.

By the observations of experts, it appears in general terms, that in ordinary vessels the centre of gravity of displacement (of the hull) is about ·9 of the centre of gravity of the amidship section below the load line. In the *America*, the centre of gravity of her amidship section is 2·58 feet below her load line; hence her centre of gravity of displacement is about 2·32 feet below her load line, assuming the same ratio for a yacht as for an ordinary vessel, which would be erroneous, and, therefore, ·7 or 1·71 feet would probably be found to be more correct. The centre of gravity of the mass, or of the entire vessel, is generally at or near the load water-line.

As it occurs that the immersed volumes of vessels differ very essentially from a rectangular solid, it becomes necessary to introduce the proportionate volume of the immersion, compared with a solid of like external dimensions, which is here noted as r, and represents the ratio of the actual displacement of the vessel compared to her circumscribing solid; hence the expression becomes $\frac{L B^3}{(L B D)\, r} = \frac{B^2}{D r}$; D representing the depth of the immersed section of the vessel at χ (dead flat or amidship section), measured from the underside of the garboard strake to the water-line, and r the ratio of displacement of the hull compared with the circumscribing parallelopipedon, which, therefore, in general terms represents the height of the metacentre; that is, as the beam squared, divided by the product of the depth of the immersed section, and the ratio of displacement of the immersed hull, to the circumscribed solid as determined by its dimensions.

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* These tables will be given in full in the "Transactions."

The application of the elements of stability, with reference to the sails of a vessel, is as follows:—Their surface is in proportion to the dimensions of the load line, the yards or booms to terms of the length of the vessel, and the height of the masts in proportion to the breadth; that is, the surface of the sails, being in proportion to the dimensions of the load line, will be in constant ratio to $L\,B\,\frac{B^2}{D\,r} = \frac{L\,B^3}{D\,r}$: In order then to determine the surface of sails of a similar vessel, it is computed by the formula—

$$S : S^1 :: \frac{L\,B^3}{D\,r} : \frac{L'\,B'^3}{D'\,r'} \text{ and } S^1 = S\,\frac{L'\,B'^3.\,D\,r}{L\,B^3.\,D'\,r'}:$$

S and S^1 representing the surface of the sails of the different vessels. Hence, if two vessels in comparison have the same beam, depth, and ratio of displacement, the surface of their sails, as well as of their stability, will be directly as their lengths; or if they are alike to each other in every respect except their breadth, the surface of their sails, as well as their stability will be in proportion to the cubes of their breadths; or, if two vessels of unequal volume, but absolutely equal in form, that is, built from the same drawing, the scale only having been changed, the ratio of $\frac{L\,B^3}{D\,r}$ will be a constant quantity, and the surfaces of their sails, as well as their stability, will be as the cubes of the length, or as their respective displacements. These are the general rules as to stability. The actual stability, in the case of individual vessels, depends upon the exact position of the centres of gravity and displacement in each case.

It is held by many that the proper basis of measurement is that of displacement, and by others that it is amidship section; both of these systems fail to meet the requirements of the case, and for the following reasons:—Vessels of different dimensions, with varying stability, may have equal displacement or weight, or like amidship sections; thus, a short vessel with a long floor may have equal weight with a long one with great rise to her floors, and a vessel with greater depth may have a like section with one of greater beam and less depth; and hence, in neither of these conditions could they compete upon equal terms, as the one with the greater stability would be able to bear sails in excess of the other.

If an allowance of time was given by one yacht to another for the purpose of putting them, when of different constructions, capacities, lines, sails, and trim, upon an equal footing, and it was estimated with exactness, the competition between yachts in these points would be eliminated or negatived, and it would then be restricted to the proficiency of the sailing-master, pilot, and crew; difference in models, lines, &c., as elements of competition, would be ignored, and yachts built like to a bowl, or of the form and proportionate dimensions of a cigar, would be placed upon the same footing as a yacht having the most efficient models, &c., yet known to naval architecture. It occurs, however, that such an absurd condition is not the case, but that character of model and lines, immersion, ballasting, sparring, and rig are essayed to be the elements of competition.

It has been shown that the physical element of speed is stability wherewith to support sails or power, and that it is due to length, beam, and weight, and those of instability are depth and an undue difference of location of the centres of displacement, gravity, and effort of the sails. When, therefore, yachts are in competition, it is but proper that they should be charged with any of the physical elements they make use of over and above competitors. If the two weights of a balance are to equipoise each other, and one arm of the beam is longer than the other, the weights must be proportionate thereto, the one with the longest arm must give weight to the other or shortest arm.

The point essayed is for two or more parties, with like elements, to produce the best results, alike to two parties constructing steamers of like external dimensions of hull, dimensions of engines, and capacity of boiler, and competing to ascertain which could produce the highest speed, bear the greatest load, and consume the least fuel, by the difference in the lines of the hull, and the conformation of the boiler and engines.

The arbitrary elements—the physical being equal or duly estimated—are depth, character of lines, outline of cross section, sparring, rig, sails, trim, &c., and upon these points alone should competition be based.

The matters of sailing, piloting, and crew are accidental, and are not to be considered, for a yacht sailed and manned in the best manner at one time may be sailed and manned in the worst at another. It is upon the physical elements alone, then, that an allowance of time should be computed, and to their operation must the elements of relative capacities of yachts be confined.

In the absence of the exact value of r, I have assumed it to range from ·315 to ·45; its exact value in the *Cambria* being ·315, in the *Palmer* ·367, and in the *America*, ·375.

In estimating the value of the quotients deduced by the above elements and formula, I have based them upon the *Una* and *Julia*, built by the same parties, essentially alike, and of which their relative capacities are well known, and I have assumed that the *Julia* had an excess of speed over the *Una* of about six minutes in a course of 40 miles, and time of sailing six hours. As a very pointed illustration of the correctness of the estimates given, I submit the cases of the *Julia* and *Zouave*. The general model of the latter would have enabled her not only to compete with the former upon like terms, but to allow her time in consequence of her greater beam, but the value of that beam was impaired by the fuller lines due to her less length, and to her greater beam and depth of hold. Hence, if one should estimate the correctness of the allowances given by the results of the performance of this or any other yacht, he will commit the grave error of expecting of yachts speed in a ratio directly with their physical elements, without reference to lines, sails, form, and location of amidship section, &c., &c.

A consideration of the elements of the subject presents the following:—

The existing rule of measurement of the New York Yacht Club is at variance with the physical law controlling the capacity of a vessel to bear sails, and insufficient, as it does not embrace the elements of displacement or weight and depth of immersion. The other methods that have been adopted by yacht clubs, and are yet in operation, are measurement by tonnage and by area of sails. The first method, by tonnage, is fallacious, as the result of the computation to arrive at tonnage (as operated) embraces beam and depth in direct ratios, when the former has a value as its cube, and the latter an inverse ratio; and it uses a standard co-efficient as a divisor, without any reference to the model of the yacht to which it is applied. The latter method, by area of sails, so far as it is applied, is correct in its application, as it requires of one yacht to give time to another, in proportion to the power of her sails; and, as power and stability are convertible terms, the former becomes an exponent of the latter. The application of the rule, however, without being combined with the elements of either displacement or weight, is incomplete, although it is one well calculated to develop good models or efficient hulls, as each owner of a yacht, in essaying to attain the greatest effect from a minimum of sails, would be compelled to seek a model of least resistance; but taken in combination with the elements given in the table, and the rule becomes complete in all its bearings, as power would be proportioned to capacity to bear it, and then the physical elements would be eliminated from the arbitrary, and perfect competition would be the result.

A system of measurement based either upon area of load line or tonnage, admits of the very objectionable and increasing abuse of an unlimited area of sails or power. The question, then, of the best model, rig, &c., is made secondary to the stoutest spars, the heaviest stays, a disregard of consequences, and the degree of pecuniary resources of the owner of a yacht to supply spars, sails, and incur repairs; added to which, this practice is calculated to deter many persons from entering the field of competition, from an unwillingness or inability to incur the expenditure rendered necessary to compete upon equal terms.

It is generally, if not universally, held by yacht owners that the limit of sails is the inability to bear them; with me, I entertain the conviction that flying staysails, jib-topsails, and gaff-topsails that buckle the masts, when considered in combination with the resistances offered by the spars and rigging that support them, by their area of resistance to the wind, their weight, and the weight of the canvas aloft, all of which tend to throw a vessel off her proper sailing lines, and therefore, as a whole, or "by and large," they are productive of more losses than advantages, for it is not a consequence that because a flying sail is distended by the wind that it is "drawing."

As an illustration of the fallacy of carrying upper sails, which tend so much to heel a yacht when sailing with a fresh wind "abeam," I find, by actual measurement, that when the *America* is heeled 17 deg., the secant of the arc described by the head of her fore and main topmasts as a radius, are so much shortened from the radius or vertical that the actual resisting surfaces of her foresail, mainsail, and gaff-topsails are reduced more than the full area of the gaff-topsails; which, therefore, when taken in connection with their masts, rigging, &c., not only are without driving power, but are a positive drawback, added to proportionably raising the centre of gravity of the mass, and thus reducing its stability.

In assigning the unit of division to range from 15,000 to 22,000, and in my estimate of the value of r, in some cases I may have erred, but that does not affect the system. The basis of the rule is positive, it is deduced from the physical operation of the elements embraced, and is not to be questioned. If the units and scale (see rule at close of paper) are not proper, they do not differ essentially from it, and r can be readily attained with exactness. If upon an examination of the results it should appear that there is a disproportion between the allowances of time deduced and the known results of some competing yachts, that as a consequence does not affect the rule; if a yacht cannot give the time due to her dimensions and sails, it is not the rule that must be made or altered to suit her capacity, but the model or rig, or both, must be looked to.

The carrying of sails, under any or all systems of allowances of time, should be restricted in sloops to mainsail, jib, and flying jib, and jib and gaff-topsails, and in schooners to the same, with the addition of foresail and fore gaff-topsail, and in both cases the topsails should have a fixed proportionate area to that of the lower sails over which they are set. To meet the error of this condition of unlimited sails, I submit that the area be computed in conjunction with the stability, and that they shall be restricted in a race to such as are set to the mast or masts and standing stays. That any allowance of time based upon tonnage, sails, area of flotation, or stability alone, is insufficient and imperfect, as they singly do not embody the elements necessary to arrive at a just estimate of the competing qualities of yachts. That the only just method of computing the relative capacities of yachts is by embodying with their statical capacity the area of sails they may carry, and thus combining capacity and power.

Reviewing, then, the elements submitted, I am of the opinion that the formulæ submitted presents a sufficiency of the elements wherewith to grade the capacities of different yachts; and that whilst the elements of centre of gravity and centre of displacement, if admitted, would render the expression perfect, yet, in consequence of the very slight difference they would effect in models of like construction, added to the very great difficulty of attaining them, the omission is not to be regretted. The element of r, or ratio of immersed volume to the solid, circumscribed by the length, breadth, and depth of immersion of the vessel, can be readily obtained by depressing the model to its load line in a fluid, and then measuring the volume of the fluid displaced.

The stability of the *Cambria*, as determined by the formula given, is not as great as it would be were the elements of centre of gravity of the mass and of displacement to be included in it, for the reason that with her model the position of these centres is proportionally much below that of the yachts with which she is compared, they being fully 2 feet below those of the *Dauntless;* hence her great capacity to carry sails compared with her length and breadth, it being proportionally double to that of the *Dauntless* and *Sappho.* With models of like character, the elements, as before stated, are unnecessary of admission into the formula; but when varying models, as with those of English and American, are compared one with the other, the introduction of these elements becomes imperative.

In conclusion, I submit the following rule of measurement whereby to determine allowances of time between competing yachts, viz.:—Multiply the length by the beam cubed, and divide the product by the product of the depth of immersion from load-line to under side of garboard strake, and the ratio of displacement of the hull (compared with the volume as determined by its length and breadth at the load-line and the depth as above); all dimensions to be in feet and decimals. Divide this quotient by 15,000, and the result will give the time in minutes and decimals for an amount under 100,000, and by 16,000, 17,000, 18,000, 19,000, 20,000, 21,000 and 22,000 for amounts respectively under 150,000, 275,000, 350,000, 550,000, 850,000, 1,350,000, and 2,200,000.

To ascertain the difference of time, divide the quotient first obtained by the area of sails, and multiply the quotient thus obtained by the difference of time; divide the product by the quotient producing the least proportionate area of sails, and the result will give the difference of time in minutes and decimals.[*]

Illustration.—The difference of times between the *America* and *Maria* is 35′ 09″.

The quotient first obtained for the *America* is 323,404, which, divided by 5,470, her area of sails, equals 59; and that for the *Maria* is 1,115,428, which, divided by 6,593, her area equals 162 (which is the least proportionate area).

The $35' \, 09'' = 3\frac{09}{60}$ of $35^{1,00} = 35{\cdot}15$, which multiplied by $59 = 2{,}073{\cdot}85$, and $2{,}073{\cdot}85$ divided by $162 = 12{\cdot}8$ or 12 minutes 48 seconds.

ON COMPLETING THE LAUNCHING OF SHIPS WHICH HAVE STOPPED ON THEIR LAUNCHING SLIPS.

By William Braham Robinson, Esq.,

(Master-Shipwright and Engineer, H.M. Dockyard, Portsmouth, Member of Council.

The *Cæsar*, a 90-gun two-decked wooden ship, having been prepared for launching, was attempted to be launched on the 21st July, 1853, at the Royal dockyard, at Pembroke-dock; but after she had slid down the launching ways some 80 feet, and thus immersed her after-part into the water at high-tide, she stopped entirely,* and all the subsequent efforts made that day to move her were of no avail. The declivity given to the launching-slip was the usual amount, and the plank and material used in the ways were also of the usual description. The plank on the launching-slip was pitch pine, a material commonly applied to that purpose at Chatham-yard, though it had not been used at Pembroke for some years previous in launching heavy ships.

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[*] In assigning these units of division, I have purposed at this time merely to illustrate the operation of the rule; a perfect or elaborate one upon the basis given would increase the number of the units so as to equalise the operation of it.

Between the 21st and 26th July, some small hollow vessels, built for the purpose, and a few casks, &c., were put under the ship's bottom, below high-water mark, with the view of reducing the weight of the ship on the ways, and at the time of high tide efforts were then made, by means of purchases, to pull the ship off, but all these measures were unavailing.

A careful inspection of the work at low water the night after the ship stopped, and on subsequent occasions, convinced me that the real cause of the failure on the 21st July was the want of a sufficient and proper lubricant between the sole of the ways and the launching slip, and the sliding surfaces being made too smooth by planing them. Acting on this opinion, and observing that the ship's stern was sufficiently immersed in the water, when the tide was up, to admit of proper vessels being placed so as to lift the ship abaft, I advocated persistently before the then master-shipwright the necessity of adopting the unique plan of building camels for breaking the too close contact that appeared to be established between the sliding-ways and the launching-slip, by lifting the stern of the ship so as to take its weight off the launching-slip. On Tuesday evening, the 25th July, it was determined to build three large camels for this purpose. I thereupon caused to be laid off in the mould-loft, in a few hours, a camel to fit each buttock, 72 feet long, to be planked with 4-inch fir plank, and one for the stern, 20 feet square in section and 48 feet long, to be built of 5-inch fir plank, the collective lifting power, when properly in place, being estimated equal to 1,100 tons. The artificers were set to work from 3 a.m. to 8 p.m. cutting out plank, &c., for these camels, no suitable material being in the yard, and in the incredibly short period of nine days these large vessels were built and launched, and on the following day, the 5th August, they were got partly into place, under the very great difficulty of having to secure the after one with nothing firmer to rest upon than soft mud. On two subsequent tides, the camels being only imperfectly shored down, and therefore only partially in action, the ship was moved, when a pulling power was applied, 9 feet and 45 feet successively; and at last, on the evening tide of the 17th day after the ship had stopped on the slip, the camels having been properly kept down in their places by bearers put out at the quarter-ports on the lower deck, and shored to the main deck upper sills to keep in place the quarter camels, a similar plan having also been adopted to keep down the stern camel, without any pulling power being applied, the ship, about one and three-quarter hours before high-water, abandoned her unworthy connection with the land, and glided gracefully into the haven, amidst the rejoicings of all the people in Pembroke dock. An examination of the launching slip after the ship had left it proved that the opinion I had formed had been founded on no hypothetical reasoning, since the absence of grease was apparent enough, and the too great smoothness of the sliding surfaces was equally evident. The camels, it may be added, which have been briefly described, were provided with valves for reducing their lifting power, but it was not found necessary to use them.

During the seventeen days and nights the ship remained on her slip, it was pleasing to observe the interest every man in the yard appeared to feel in the preparations making to get her off; and they worked most willingly day and night, the water drinkers coming out of the trial fresher certainly than many others.

On the 9th August the ship was docked, the stern camel having been kept in place, and 70 tons of ballast having been put on board forward to trim the ship. The sheer of the ship, which had broken when the ship was on the launching slip about 1 6″, returned in great part to its normal form on docking the ship, and it was held there by the introduction of "double fastenings" in the wales, and by an admirable method of coaking and "keying up" the iron diagonal riders proposed by the then master-shipwright of Devonport-yard.

With the experience of the case of the *Cæsar* stamped on my memory, I surveyed the condition of the *Northumberland* when she stopped on her launching slip on the 17th March, 1866, as the *Cæsar* had done, and I at once observed that her position was just such as would require her to be dealt with in the same way as the *Cæsar* had been—with this difference, that in the case of the former ship, a very rigid iron hull, which would keep the ways straight and to their form, had to be dealt with, instead of, as in the case of the *Cæsar*, a flexible body, which would bend, if not well supported, to a large extent before breaking.

On the afternoon of the day on which the *Northumberland* stopped on her launching slip (the 17th March, 1866), after I had carefully examined into all the circumstances connected with the position the ship was in, I inquired for the office, and obtained after some trouble a quarter of a sheet of foolscap paper, upon which I briefly described the experience I had acquired in the case of the *Cæsar*, and proposed lifting the ship abaft by means of camels built for the purpose, or suitable small ships which might be found lying in the river; and this definite proposal I put into the hands of Mr. Lungley, the then manager of the company, when that gentleman was standing alongside the ship. On a subsequent day I mentioned the subject of the memorandums referred to, to the chairman of the company, but notwithstanding this, nearly the first action taken was to lay a second launching slip alongside the original one, at a less declivity than the original slip had been laid at. This was done I believe with the view of sliding the ship down far enough for her weight to come upon the slip with the lesser declivity. Together with this certainly very novel arrangement, some means for lifting the ship abaft by mooring lighters, &c., was provided; and on the 2nd of April, all being ready, an attempt was made to complete the launch of the ship, but it failed, as I had predicted it would when speaking to the gallant chairman of the company at the head of the ship, just before the event.

Immediately after this failure my proposed plan of lifting the after-part of the ship was adopted, and measures were taken to build the requisite camels in the two neighbouring Royal dockyards, Woolwich and Deptford, where the usual willing exertions were exhibited by officers and men; and the four camels—two for each quarter—were built in a very few days; and they were secured in place by the 17th April (just one month from the first attempt to launch the ship being made), and on the rising of the tide they lifted the ship abaft off the launching slip, when she glided into the river without the help of the large pulling power which had been provided.

The camels which have been referred to were admirably detailed by the officers who built and prepared them, and the valves were most successfully managed on the day of the final launch, so as to prevent the camels from lifting the ship above the ribands on the launching slip.

The day after the ship left her launching slip, I, at low water, inspected the slip, the plank of which was oak, not fir, as in the case of the *Cæsar*, and saw enough to convince me that my first impression had been a right one, namely, that the ship had stopped in the first instance mainly for the want of a proper and sufficient unguent on the ways and slip.

The forces in action when a ship's stern is lifted under similar circumstances to those which obtained when camels were used to lift the after parts of the *Cæsar* and *Northumberland* may be illustrated as follows, by which it will be seen that it could scarcely be necessary to provide a large pulling power in addition to the lifting power of camels :—

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* I was not the responsible officer engaged on the launch.

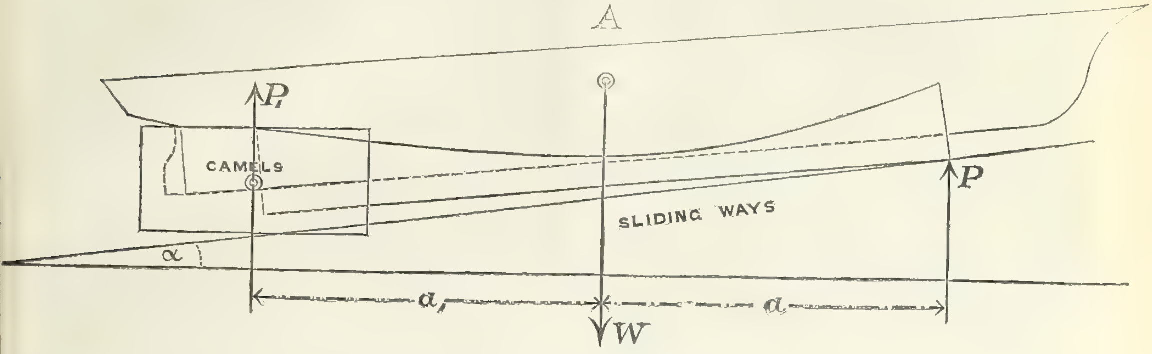

Fig. A, represents a ship in the position I have been describing, and it will be seen that the forces acting upon her are as follows :—

1st. Weight, W, acting downward through the centre of gravity of the ship.

2nd. The upward thrust, P_1, of the camels, which is equal to their buoyancy, and acts through the common centre of gravity of their displaced volume.

3rd. The re-action, P, at the fore end of the slipway.

The force which acts to push the vessel down the slipway we will call F, and this will be equal in amount to—

$$\text{P sine L} - \mu \text{ P}_1 \text{ cos. L}$$
$$= \text{P (sine L} - \mu \text{ cos. L)}$$

When μ is the co-efficient of friction and depends upon the kind of unguent used, and L is the angle of inclination of the sliding plank.

By reference to the Fig. it will be seen that—

$$\text{P} = \text{W} \frac{a}{a + a_1}$$

and as a will under most circumstances be nearly equal to a_1, we may take—

$$\text{P} = \frac{\text{W}}{2}$$

and we shall then have—

$$\text{F} = \frac{\text{W}}{2} \text{ sine L} - \mu \text{ cos. L)}$$

If the stern of the ship were not lifted, but her whole weight rested on the slipway, the force acting to push her down the slip would be—

$$\text{W (sine L} - \mu \text{ cos. L)}$$

or double what it is in the present case.

The advantages obtained by the use of camels are due to the fact that they take all the weight of the ship off the bilge-ways, except at the extreme fore-end, so that the after-part is lifted clear of any obstruction that may exist ; or, where the grease used is bad or insufficient in quantity, the adhesion of the surfaces in contact is overcome, and they are left free to slide upon each other.

To the foregoing it may be added that due consideration should at all times be given in preparing the "launch" of a ship to the relative weight of the ship and area of the soles of the ways, declivity of launching slip, and to the time it is intended the ship shall rest in her cradle before the launch takes place, and then finally on the kind and quantity of grease to be used between the sliding surfaces. All these points affect the *stiction* to be overcome in launching the ship.

ON THE POSITIONS OF THE MASTS IN MERCHANT SHIPS.

By William Symington, Esq., Associate.

This short paper is an endeavour to prove that the present positions of the masts in our merchant ships are much too far aft to obtain the best results in sailing, steering, and general working, which these vessels are capable of evolving.

During twenty-five years' active service at sea, in a variety of ships built at the principal ports from London to Aberdeen, both inclusive, and the greater number by members of this institution, I have never yet been in one that would sail close-hauled on even keel with the helm amidships ; moreover I have no hesitation in saying, there are not ten English sailing ships in existence that will do so.

This is a startling fact, and I respectfully urge it as one not unworthy the attention of this institution.

If our ships sail, as my experience has proved (and I may venture to say it will be the experience of nearly all merchant captains), then I submit their progress is seriously impeded ; first, by the action of the helm carried several degrees from the fore and aft line ; and, secondly, being trimmed by the stern. The first cause will readily be admitted, and requires no further comment ; but the second may not, because trimming by the stern is so universal a custom that I am led to believe it is tacitly considered by our naval architects to be the necessary and normal condition of our sailing ships.

A ship sailing "by the stern" is impeded because she presents the entire length of the face of her keel at an angle to the passing water ; and because all the "water lines" before "dead flat" meet the current at a more oblique angle than the designer contemplated.

I think it will be conceded that I have shown two obstructions to exist, however much our opinions may vary as to their amount ; and also, that I do not advance causes new or singular ; but I claim to place before the institution the generally unsatisfactory performance of our merchant sailing ships "upon a wind"—a result, I believe, unknown to the majority of its members and associates, or assuredly a remedy would have been devised, and applied to remove such impediments.

I know of only two existing causes why a ship will not sail close-hauled on even keel with the helm amidships. The first is, that as the ship heels over, the form of the lee bow presents a greater angle to the water than the weather one, thereby tending to rush the ship up to windward. As this cause is not the subject of the present paper I do not propose to deal with it, merely remarking that it is being gradually eliminated by the adoption of the U form of bow. The second cause is that the masts are too far aft, and this may be proved by a "stiff ship" going "upon a wind" 5 or 6 knots an hour without perceptible heelings, when it will be found there is still "weather helm" carried, and I am unable to account for this except by the erroneous positions of the masts.

It may be worth while to inquire how come the masts in their present positions?

I speak under correction from gentlemen present, who must probably know better than I, if our existing rules for placing the masts in the merchant service were not adopted from the royal dockyards, fifty to one hundred years ago. At those times the mizen mast of the frigate was quite a small one, as compared with the main or fore, and the centre of effort was calculated for such a size of masts, yards, and sails. This was all very well, and would have answered to the present day, if our private builders had strictly adhered to the relative sizes of the masts for which such positions were calculated; but no, they have gone on increasing the size of the mizen until it is now nearly as big as the main or fore; and in three well-known London ships it is actually of the same size, if I may judge by inspection. Surely no further proof is required to show that some of our naval architects have no conception of the performance of our sailing ships "upon a wind," when it culminated in such an absurdity as a mizen mast as large as the fore one and the positions remaining as usual.

Again, with this increased size of mizen mast came also larger yards and sails, and one—a cross-jack sail—not included in the original calculated centre of effort, but notwithstanding all this the early positions of the masts are still retained. Surely we cannot expect the same satisfactory performance from our ships with all this additional canvas stuck on their sterns, unless the masts are moved more forward.

Mr. John White, in his "Theory and Practice of Shipbuilding," says, "sailing on anything but even keel is an absurdity that can plead nothing but custom." With all deference to such high authority, I maintain it is an absurdity which we are compelled to continue, and we must also trim our ships "by the stern" in order to get the best results we can out of them, until the masts are shifted more forward. In other words, the sailor is forced to balance one error by two others, that is, to counteract the erroneous positions of the masts, he must trim his ship "by the stern" and carry "weather helm," the combined result being to retard the vessel's progress from half a knot to one knot per hour.

I offer a suggestion which is arbitrary, but developed from much attention and reasoning on the subject before us. Place the mainmast always in the middle length of the keel, the fore mast at one-eighth the length of keel from the fore-end of it, and the mizen mast at one-quarter of the same length from its after-end. For example: in a ship of 200 feet keel, the main mast will be in the middle, the fore one 25 feet from the fore-end, and the mizen 50 feet from the after-end of the keel. By adopting this arrangement I have no hesitation in saying we shall get the best results which the present form of ship is capable of producing. However, under any circumstances, the main mast ought not to be abaft the middle of the ship's length; there it becomes neutral as a turning agent; but at present it is not so, for the instant the main sails are aback "in stays" the lever is exerted against the turning direction of the ship, because it is now considerably abaft the axis of turning circle; were it placed before that axis, then it would materially help the ship round as soon as the sails came aback. Again, the foremast, by being farther forward, would increase the ship's power to turn, when the foresail comes aback, in an arithmetical ratio; likewise the sails on the mizen mast would become less of an opposing force than they are at present when aback.

You will observe, I only show the advantages when the sails are aback, and I do this purposely, because there is never—except in extreme cases—any doubt about getting our sails aback when we desire to tack; but the "miss stays" takes place when the wind is blowing between the "backed" foresail and the jibs. I contend, that by placing the masts as I suggest, we shall get rid of "weather helm" entirely, do away with the necessity of trimming "by the stern," materially assist the ship in tacking and ordinary working, and generally evolve the best results which our merchant ships are capable of producing; and all this without any additional expense or trouble, except by the simple process of placing the masts a little more forward.

As a practical test of what is here advanced, I respectfully urge the members of this institution to place the masts as I suggest in the next sailing ships which they may build, and watch or obtain reports from the captains as to the result. I do not think our naval architects and shipbuilders are aware to what extent the evil of "weather helm" and trimming "by the stern" exists, and I attribute this to the limited intercourse which takes place between them and merchant captains; and although the latter make no pretensions to technical scientific information, nevertheless they may claim to have the best practical knowledge and experience of the performance of the ships they command; and if more of this experience were communicated to our builders it might be productive of the best results.

REMARKS ON THE PRESENT AND PAST CONSTRUCTION OF THE NAVY.

By Sir William Fairbairn, Bart., Hon. Member.

As one of the pioneers of iron shipbuilding, I have ventured to approach the above subject, but not without hesitation as to my fitness for such a task. It properly belongs to the Admiralty and professional officers of Her Majesty's navy more than to a civilian. Considering, however, that I have been largely engaged with investigations connected with these important constructions, I may perhaps be excused if, in these days of transition, I offer a few remarks on the general character of the ships of the British navy, and the adaptation of the various forms of vessels to meet the requirements of a general and special service.

On the quality of the material, and its adaptation to the different parts of naval construction, I am more at home than I could possibly be in my attempts to advise on the magnitude, form, and other conditions of a class of vessels of reduced dimensions, intended to meet not only special cases, but at all times to be available for general service either in or out of the fleet. Vessels of this class, with light draught of water, appear to be essential to the efficiency of the navy; and I venture to question whether these conditions have been carefully considered during the numerous experimental researches which have taken place during the last ten years.

The craving appetite for progress in this age of change, has overrun every other consideration but that of large guns and large ships. Large sums have been expended for increasing the power of our guns, and enlarging the size of our ships, which have been overlaid with a thickness of iron armour plating causing them to roll and plunge when they should be active and buoyant.*

To render vessels of this class invulnerable, armour plates of enormous thickness have been used to cover the sides, from six to seven feet below the water-line to the height of the bulwarks of the upper deck; and these again have rendered the ship unwieldy in her movements, and deprived her of that celerity of motion which is necessary for either attack or defence.

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* There are, however, exceptions to this, as I am informed that the *Bellerophon*, *Hercules*, and *Monarch*, which carry the heaviest guns and thickest armour plates of any ships afloat, are much smaller, steadier, and handier ships than the *Warrior*, *Achilles*, and *Minotaur*.

No doubt vessels of this ponderous class, armed with large guns, are formidable in action, either on the turret or broadside system; but the question arises whether a lighter or smaller class of vessels might not be introduced, equally safe and much more handy than such as the *Minotaur*, *Achilles*, and *Warrior* to which I allude.

I am not adverse to a limited number of ships of 6,000 tons burden; but I apprehend that vessels such as the *Bellerophon*, with the same size of guns and properly armour-plated, would be nearly as effective as the larger description of vessels. There is, however, another class of vessels to which I would venture to refer, and these are what I would call an intermediate class between the gun-boat and the *Bellerophon*, or from 2,000 to 3,000 tons burthen. These, if well armed with large guns and powerful engines, would, in my opinion, be fit for any service, either in the open sea or the estuary of rivers or harbours which it would be dangerous for larger ships to navigate.

I have been led to these considerations from the circumstance that the recent Franco-German war may at some future time call into existence a class of vessels which, to all appearance, may be shortly wanted. The almost total inaction of the French fleet during the Prussian invasion was evident to every observer, and it would not have escaped the notice of the government that nothing was done. And why this inaction? It must have arisen either from want of foresight on the part of the French Admiralty, or the want of a class of ships of light draught of water, calculated to navigate the waters of the Baltic and the shallows of the North Sea.

During the Crimean war, when Admiral Napier took the command of the Baltic fleet, it was found that our three-decker and large frigates were of little or no use; and in place of having a class of vessels capable of reaching the enemy's works, we had to look helplessly on, without the power of firing a shot. It is true we commenced building gun-boats, which never came into action, and have never been heard of since.

Nothing can be more proper than the present re-organisation of the army; but what appears of even greater importance is the re-construction of the navy, on which the defence and safety of this country chiefly depends. It cannot have escaped the attention of the government that the unity and greatly extended power of the new German empire is not without danger. Its present grasping ambition is not confined to an army of 1,000,000 soldiers and a few small frigates. It appears quite the reverse, as the authorities of Berlin are doubtless alive to every contingency, and are not likely to stop for want of ships when such a wide field of action is open before them. The construction of a large and powerful fleet is sure to be the result, and that united with Russia, and probably America combined, may at no distant period dispute with this country the sovereignty of the seas. We may not have any immediate apprehension of such an occurrence; but who are to set limits to German conquests, now that they feel their power and the desire to exercise it when it suits their interests to do so. Doubtless, we have a powerful fleet of iron-clads; but there appears to be a want of ships calculated to meet Prussia and Russia combined, in the critical navigation of the shallows of the Baltic, the harbours of the North, and other fortified places of the Black Sea. We could do little or no damage to either empire with our present class of large vessels; and in order to be prepared for any exigency, a suitable class of vessels, adapted for that and similar services, should not, in my opinion, be lost sight of.

In my work on iron shipbuilding, I endeavoured to point out the advantages of a class of vessels of limited capacity, varying from 2,000 to 2,500 tons burden, which, armed with 400 or 500-pounder guns, and a limited draught of water, would, according to my views, be equal to any service, either in the shallows of the Baltic or the open sea. There may be objections to this description of vessels; but, as far as I can judge, it appears to meet the requirements of the service in the navigation of inland seas, and, what is of equal importance, would be equally efficient for general service with the fleet.

Referring to these statements, I find in a letter I addressed to the Lords of the Admiralty, dated December, 1864, it is recommended;—

"1. That strong, well-built iron vessels, varying from 3,500 to 4,000 tons burthen, carrying from four to six 350 or 400-pounder guns, having fine lines and great speed, appear to be the class of vessels which would form an important addition to our naval force.

"2. That such vessels be protected, in the line of the neutral axis, by a belt of iron armour plating, varying from 3 to 5 feet above and below the water-line, according to size, all round the ship.

"3. That in cases where the battery is broadside and at midships, the armour plating to be carried up to a sufficient height on both sides to protect the guns, as shown in the case of the *Penelope*."

This plan of construction was suggested to the Admiralty for the purpose of increasing the thickness of the armour plates, for the protection of the ship below the water-line, and in front of the guns on each side where danger was imminent.

In these recommendations the cellular system, longitudinal kelsons, &c., were strongly recommended, and the Controllers of the Navy (Sir Spencer Robinson and Mr. Reed) were not slow to avail themselves of them; and hence followed the *Penelope* and the *Bellerophon*, two of the strongest built vessels in her Majesty's Navy.

I have ventured on these observations to show what may yet be required to render the navy more efficient, particularly by the introduction of a class of vessels of medium dimensions, light draught of water, and such as are suitable to navigate the Baltic Seas, and reach the innermost recesses of the defensive works of hostile nations.*

Evening Meeting, E. J. Reed, Esq., C.B., *in the chair.*

ON THE WORKING EXPENSES OF STEAMERS OF SMALL SIZE.

By A. F. Yarrow, Esq.

Steam launches have for several years been extensively adopted in Norway and Sweden, carrying on there successfully the traffic across the many estuaries and fiords formed by a very irregular coast line. It is, however, only within a comparatively recent period that these little craft have become generally known in this country. To identify more particularly the type of boat I am now referring to, I may mention that they vary from 30 feet to 60 feet in length, and from 6 feet to 12 feet in beam, generally have no deck, and are propelled mostly by one, but occasionally by two screws, driven by high-pressure direct-acting engines.

One of the first successful attempts made in this country to develop passenger traffic by boats of this type was started at Plymouth, in 1869.

A small company was formed, called the Oreston Steam-boat Company, with a view to run between Plymouth and Oreston, calling at Hooe, Turnchapel, and Mount Batten, the only communication at the time being by watermen's boats, or a three-mile walk and a toll of one penny.

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* Since the above was written, I have noticed in the Parliamentary Debates on the Navy Estimates that Mr. Greaves, M.P. for Liverpool, has suggested the construction of a number of gun-boats for harbour defence,—a class of vessels highly valuable for such a service. These do not, however, interfere with an intermediate class, adapted, as I propose they should be, for general service.

The first steamer purchased was called the *Little Pet*. It was 40 feet in length by 7 feet 6 inches beam. The success of this boat induced the company to order another (which was called the *Favourite*), 50 feet in length by 10 feet beam, driven by a pair of 5½ inch cylinders, and licensed by the Board of Trade to carry 84 persons. The average time occupied by this boat in the run of 1¾ miles, was fifteen minutes, including stoppages, and the fare charged 1d.

There was no deck whatever, but a cabin, the full width of the boat, and 10 feet in length, was provided aft. The draught of water, when at work, was 3 feet, with a speed, over a straight course, of 8 to 9 miles an hour.

To show more clearly the exact nature of the traffic carried on, I beg your reference to the rough map of Plymouth. At the Barbican-pier the boats run alongside the quay, and at Oreston there is a small jetty; but at Hooe, Turnchapel, and Mount Batten, the boats are generally run on to the beach, and a plank thrown out forward for the outgoing and incoming passengers. This simple means appears to answer the requirements of the case, and the boats, which are strongly built of wood, and suitably shaped to take the ground, do not materially suffer.

A considerable business is done in taking off and putting on board passengers from the vessels lying at the anchorage in the Catwater; and, if hailed from the shore, the boats are frequently beached to take people up.

Gained from the experience of this company, the cost of working such a launch as the *Favorite*, running 24 journeys per day of 12 hours, each journey being 1¾ miles, it has been found that the consumption of fuel has been 8 cwt. per day, and the consumption of fresh water 350 gallons per day. I may here mention that water tanks are fitted to this boat sufficient for four hours' constant steaming, these tanks being replenished from time to time by the hose at the quay.

The crew consists of a captain, receiving 24s. per week, engine driver 21s. per week, and a collector 18s. per week.

These and other expenses I have tabulated, the total working expenses per week being £8 12s. 11d.

This company has attained considerable success; the credit for which is mainly due to Mr. Edmund Jones, a resident of Plymouth, who writes as follows:—

"During the past summer, each of the three boats has earned occasionally as much as £20 per week, and the opposition company, who have also three boats, nearly as much. The cost of repairs, however, is very heavy; the watermen, who show a most determined hatred to the boats, do much injury; and for a long time we had always to keep a watchman on board to guard against malicious damage; and what with racing with the opposition, and consequent coal-wasting, law-suits, summonses from the watermen whenever we by chance carried over our legal number, we have had a tough lot of battling, gaining, by paying dearly, valuable experience. During the last dry summer the fresh water supply ran short, which caused much injury to the boilers from want of sufficient care in constantly blowing off, to prevent incrustation when feeding from the sea. The boats, however, after paying for all this, as well as putting by towards renewal fund, have given a very good profit."

We will now just glance at quite a different style of steamer, one which I have specially selected as doubtless familiar to us all—I refer to those running on the Thames between London and Westminster-bridges and intermediate piers.

They average 110 feet in length by 14 feet beam, being certified to carry 370 passengers, and are propelled by condensing padddle engines of 24 horse-power nominal.

To give some idea of the cost of working such a steamer, I have tabulated the expenses at £29 4s. 9d. per week.

These boats are of a type doubtless well designed and ably managed, but I contend that they are unsuited for the work to be performed. Boats of smaller size, such for example as the one I have briefly described, would, in my opinion, fulfil the requirements of the case much better. They could be more numerous, leaving the piers more frequently; they would be much more easily handled and brought up alongside the landing stages; a very much smaller original outlay would be requisite, as well as greatly reduced working expenses. I will admit that during certain hours of the day in fine weather in the summer months, the present steamers will have their full complement of passengers; but it is clearly an error to entail excessive working expenses during the whole year, for the sake of rendering available the maximum traffic during a very limited period.

When running in fresh water, on lakes or rivers, the extreme simplicity of the ordinary type of steam launch enables it to be worked with perfect safety and success, by any one of moderate intelligence and care; but when used at sea, where salt water only can be obtained for the supply of the boiler, the difficulties are greatly augmented, owing to the risk entailed from incrustation and eventual destruction of the boiler. Whatever care may be requisite on board ocean steamers worked by competent men, even still greater care is required with high-pressure engines, the boilers adopted as a rule having much greater evaporative power in proportion to their contents.

With the aid of the salinometer, the amount of brine requisite to be blown off to prevent salting up can be carefully regulated, and the boiler preserved for many years in perfectly good condition. This, however, requires an amount of care and attention which experience has proved to be most difficult to obtain even in this country, and abroad, in places where skilled labour is scarce, it is sometimes simply impossible. In all cases where a supply of fresh water can be procured on shore, it is unquestionably desirable to have tanks fitted on board from which to feed the boiler, and if these tanks hold sufficient to last until they can be replenished, the boat can be worked without any special care. The use of the ordinary surface-condenser is one mode of obtaining a supply of fresh water; but the great complication of such means is a serious barrier to its adoption, sacrificing at once the marked feature of the steam launch, which is its simplicity, in addition to increasing the cost, and depriving the boiler of the benefit of the blast up the chimney.

It has frequently been proposed, and even tried, to condense the steam by passing the exhaust pipe along the outside of the boat, the external surface coming in contact with the water, and thereby condensing the steam within. I am not aware of any trials of this kind which have proved successful until the middle of last year, when Mr. Alexander Crichton, of Cork, fitted two government steam launches with such apparatus. These launches were of the well-known twin-screw type, having two cylinders to each screw secured to the sides of locomotive boilers. The exhaust pipes were passed through the boat's bottom, and carried alongside the keel for 14 feet, and then returning 16 feet re-entered the boat, and were at once connected to two small air pumps worked by eccentrics. These air-pumps delivered into a hot well, to which the suction of the feed pumps was attached. Under these circumstances, the whole of the exhaust steam was condensed, and returned to the boiler as fresh water, the only loss worthy of notice being that due to the steam jet, which had to be kept going in the funnel to maintain the requisite draft. In both these launches there appeared to be a considerable gain both in power indicated as well as in speed. The capacity of the air-pumps, which were single acting, was one-twentieth the capacity of the cylinders. There can be no possible doubt that if these results can be confirmed over a lengthened period, that they are indeed most valuable, and great credit is due to Mr. Crichton.

We ourselves last month tried some experiments in the same direction, with a small wooden tug boat we have just completed for the Brazils, in which it was a most essential point to carry water and fuel for as many hours as possible.

The boat was 37 feet in length, 9 feet in beam, and 5 feet in depth. The engine consisted of a single cylinder, 9½-inch diameter by 12-inch stroke, and the boiler of the usual return tube type. As the boat was small for the weight of machinery, there was not buoyancy left sufficient to carry the desired quantity of fresh water. We, therefore, considered this a specially favourable instance for testing the merits of this system. All we were anxious to do was to secure the return of the bulk of the water to the boiler, at the same time retaining amply sufficient blast.

The exhaust pipe was passed to the forward end of the boat, terminating in a breeches piece, which went through the skin on each side of the keel. To this were secured two 3-inch copper pipes, each 21 feet long, running along the boat's bottom towards the stern. At the after-end of these pipes was attached another breeches piece, which re-entered the boat, and was connected to the suction of a small plunger pump 1¾-inch diameter by 6-inch stroke, worked by an eccentric from the screw shaft, as shown. This pump delivered into tanks placed on each side the boat. The inclination of the condensing tubes, when the boat was running, was about ⅝ of an inch to the foot.

We provided means for conducting the exhaust either wholly up the chimney or partially into the chimney and partially into the condensing tubes, always retaining ample collective area for the steam to pass through, which was never less than equal to an orifice of 2¼ inches diameter.

Over a lengthened trial the following were the results obtained, which I have tabulated on sheet 6 :—Consumption of midland coal per hour, 120 lbs. ; evaporation of water, 780 lbs. ; pressure of steam per square inch, 54 lbs. ; estimated indicated horse-power, 20½ ; revolutions per minute, 120.

Under these circumstances, we found three-fourths of the steam could be condensed without apparently injuring the draft, the remaining one-fourth passing up the funnel :—The exact quantity of water delivered back into the tanks was, per hour, 580 lbs. ; the temperature of the water in the river being 44 degrees ; the temperature of water pumped from condensing tubes, 59 degrees.

The following will be the practical bearings of these results, which are tabulated on sheet 7 :—Presuming the tanks and boiler to be filled with fresh water, and worked in the ordinary way, the tanks, which contain 320 gallons, will be emptied after 4 hours' steaming. If the condensing apparatus be at work they will be emptied after 16 hours' steaming.

We will now assume that, after the expiration of these times, we are forced from necessity to pump from the sea, and we will also assume that the water in the boiler must never have in solution more than $\frac{3}{33}$ its weight of salt, and that up to that time there is no fear of incrustation.

The boiler contains about 1 ton of water, and as the sea holds in solution $\frac{1}{33}$ its weight of salt, it is clear that 3 tons of water must be evaporated and replaced by 3 tons of sea-water before $\frac{3}{33}$ of salt will be present in the boiler. This would occupy in the ordinary way 8½ hours additional. If with condensing apparatus at work 34 hours additional. We, therefore, finally arrive at the fact that the total length of time the boiler can be worked with perfect safety from first starting, without risk of incrustation, will be :—With fresh water tanks only, 12½ hours; if with condensing apparatus, 50 hours.

For the sake of comparison I have added the time that it would require, if salt water only were used for the boiler, for it to arrive at the same degree of saturation; this could be attained after the evaporation of 2 tons of water, which would occupy 5¾ hours.

I will make no remark on these figures; the practical results are clear without further comment.

The boat upon which these experiments were tried was of wood, but had it been of iron the condensation of the exhaust steam would have been even more readily effected, the condensing pipes would have been quite unnecessary, the skin of the boat itself serving equally well as the conducting medium. To illustrate one practical method of carrying this out, I beg your reference to sheet 8. That portion of the exhaust to be condensed would be passed into a receiver, of which the skin of the boat would form its external side ; assuming the frames of the boats to be 18 inches apart, ample area would be obtained if the space between three frames be taken, and from the water level on the one side, to the water level on the other, this would not only form a suitable reservoir for receiving and condensing the steam, but would give additional stiffness to the hull at the very place required, as well as serve as a substantial platform for the engine. The feed-pump could take its suction, as shown, and force direct into the boiler, no additional pump being required.

As to whether this plan is capable of extensive adoption (which I firmly believe), it is not for me now to enter ; but it is certain the required end is obtained at a nominal cost, and without additional complication.

ON THE COMMERCIAL ECONOMY OF SEVERAL TYPES OF MERCHANT STEAMERS ON SOME OF THE PRINCIPAL LINES OF STEAM-SHIP TRAFFIC.

By Walter C. Bergius, Esq., (Glasgow).

There has been such extraordinary progress made within the last few years in the powers of locomotion, and the commercial economy of steam-ships, that the economical conditions of the carrying trade at sea have been most materially changed, and are still changing in favour of improved and well-managed steam carriers *versus* sailing vessels.

For the purposes of comparison I give below a table showing the annual performance and the annual cost of five different merchant steamers, each representing, as to size, speed, and the local and economical conditions of its traffic, a distinct type of ship.

To compare these five types of ships upon fair and equal terms, I have omitted in their cost per annum the expenditure in port dues and pilotage, as well as the risks of interruption of traffic by accident, which would not be covered by insurance. The management account, which is so extremely different in different undertakings, and has really little to do with the engineering question of commercial economy, has also been omitted—so that the three items constituting the annual cost of the vessels are only crew and provisions account, coal and engine store account, interest, depreciation, wear and tear, and assurance account ; the latter figure being charged at an equal rate or per centage of value against all the ships except the "foreign coaster," which has to carry one-half more under this head, as she trades in a locality where accidents to her machinery involve at once a voyage, perhaps under sail, to a repairing port not situated on her line.

The figures given for the annual performance of the five ships are likewise computed in such a manner as to bring them upon fair and equal footing for comparison. As we wish to consider only the engineering question of commercial economy, we must assume the ships to be fully employed all through the year, omitting to take into account any loss of time resulting in one or other of them through ice in her ports of sailing, or through delays arising from extraordinary repairs which are not made good by the underwriters. We must further assume the five ships always to have full cargo, deducting, in computing the deadweight carriage, the amount of coal carried for the particular trade the vessels are engaged in, and fixing the draught and dryside in accordance with the scale of the Liverpool Association of Underwriters for the Protection of Shipping.

The performance of the five ships is given in carriage units, called "ton-miles," computed in an analogous sense to "train-mile" in railway terminology. A ton-mile is the performance accomplished in carrying one ton of deadweight for the distance of one nautical mile; therefore, if a ship carries 200 tons deadweight, besides her coal, upon load draught, and runs a distance of 35,000 nautical miles per annum, her total annual performance as a freight carrier is 35,000 × 200, equal to 7,000,000 ton-miles.

Annual Cost and Annual Commercial Performance of Five Merchant Steamers recently constructed

Type of Ship.	Annual Cost of Ships.				Annual Commercial Performance of Ships.			
	Interest, tear and wear, maintenance, and insurance accounts.	Coal and Engine Store Accounts.	Crew and Provision Accounts.	Total Annual Cost of Ships.	Dead-weight besides Coal.	Mileage per Year.	Commercial Performance per Year.	First Cost of Commercial Performance.
	£	£	£	£	Tons.	Nautical Miles.	Ton-miles.	Pence per ton-mile of Carriage.
1.—German Ocean Water Ballast Collier	3,100	540	1,350	4,990	1,000	38,000	38 millions	0·031*d.*
2.—Baltic Goods Carrier	4,500	2,450	1,850	8,800	1,000	37,000	38 ,,	0·057*d.*
3.—Home Trade Grain Carrier	1,500	520	1,250	3,270	350	38,000	13⅓ ,,	0·058*d.*
4.—Foreign Coasting Steamer	3,500	4,750	1,550	9,800	500	38,000	19 ,,	0·124*d.*
5.—North Atlantic Mail Steamer	18,000	8,400	1,300	34,700	1,200	42,000	50⅓ ,,	0·165*d.*

A few general data about the economical conditions of the service of the five ships above mentioned should be added to the table.

1. The German Ocean water-ballast collier trades under the advantage of the cheap coal of a coal exporting port, and carries, like the Baltic goods carrier and the home trade grain carrier, its own coal for the home voyage on leaving the United Kingdom. The 38 millions ton-miles of commercial performance, which she can do at a cost of £4,990, are not realised in her service, as she makes her own trips in water ballast only, so that, in the present practice, one ton-mile of coal carriage costs 0·062d.

2. The Baltic goods carrier is proportionately very expensive in her coal account, as she has common engines and a common condenser also, although of recent construction. She goes at a speed of 10 knots in service.

3. The home trade grain carrier, on account of her small tonnage, is expensive in crew and provisions account, and has dearer fuel, as she trades from channel ports.

4. The foreign coasting steamer pays £3 per ton for her coal, and, as she has some 35 per cent. of her value charged against her annually, by way of interest, depreciation, tear and wear, and maintenance and insurance account, on account of the excessive cost of repairs in her service, her performance as a freight carrier is necessarily very expensive for so slow a vessel—her speed in service being only nine knots.

5. The North Atlantic mail steamer is a very expensive freight-carrier, both for the cost of her large crew and for her great first cost. Both these conditions, of course, are consequent upon the nature of her service, her extreme speed of some 13 knots in service necessitating such an immense consumption of fuel, which, with the length of the voyage, increases immensely the size and cost of the ship of comparatively small dead-weight capacity. She uses Welsh coal on her voyage out, and American coal coming home, both of which qualities of fuel, of course, are much more expensive than the fuel used in home-trade ships.

The figures given above as the cost of one ton-mile of freight carriage in different lines of steam-ship traffic, differ very much in amount, and will repay the trouble of some further consideration. The 13 knots North Atlantic mail-steamer, having to carry all its coal for a voyage of some 3,000 nautical miles, and being, therefore, comparatively to her size and cost, small in deadweight capacity, costs over five times the amount per ton-mile freight of carriage compared with the German Ocean collier doing the same unit of performance.

The principal items of commercial economy of merchant steamers, viz., cost of coal per ton, speed per ton in service, length of voyage, appear graphically in the diagrams, each of which is intended to illustrate the influence of one of these items upon one of the steamers of our table.

The diagrams are computed in the ordinary manner, and will scarcely need any explanation for being read by the gentlemen present, many of whom have so largely assisted the introduction of the graphical system of investigation.

The object of the writer in compiling the above figures and diagrams was not so much to convey information concerning any novel or extraordinary facts, as an attempt to arrange and reduce to practice, from a commercial point of view, some general items of the present economical conditions under which goods are carried on some principal lines of steamship traffic.

ON THE EXAMINATION OF ADJUSTERS OF COMPASSES.

By Thomas Brassey, Esq., M.P., Associate.

Speaking on this subject as an amateur sailor, my object is to befriend, as far as I can, our seafaring population, a class for whom I have ever felt a most hearty sympathy.

No skilful navigator, as I am well aware, will neglect the duty of perpetually testing, when at sea, the accuracy of his compasses by azimuths and other astronomical observations; but the difficulty with which we have to deal arises from the impossibility of testing compass errors in the cloudy and thick weather which so frequently prevails in our own latitudes.

To provide the navigator, as far as possible, with the best means of safely navigating an iron ship, until he has had an opportunity of making an independent verification of the errors of his compass, the Board of Trade require that the compasses of all iron ships should be properly adjusted before they proceed to sea. With strange inconsistency, they have hitherto accepted, as evidence that that adjustment has been properly made, the certificates of persons for whose competency to undertake a very difficult and important task they had no guarantee.

In the year 1865 the Royal Society entered into an interesting and valuable correspondence on this subject with the Board of Trade. The Royal Society stated that an organised department of skilful men, under able supervision, would probably be of much advantage, not merely in laying down rules, but in giving advice and suggestions to naval constructors, compass makers, and adjusters, and in producing a uniform system of adjustment.

In support of their recommendation, they pointed to the fact that all the advances which have hitherto been made in the science, and which have placed England at the head of the science, are due to their having been for the last twenty-five years one officer, appointed by the Admiralty, to attend to this duty almost exclusively.

In September, 1865, the Admiralty, at the instance of the Royal Society, addressed a communication to the Board of Trade on this subject.

They pointed out that in the Mercantile Marine there is no guarantee for the competency of the adjuster, and that regulations for the adjustment of their compasses are thereby rendered in many cases inoperative, or nearly so. They admit that by constant practice, but without any very clear knowledge of the principles of magnetism, several skilful adjusters of compasses are to be found at some of the great mercantile ports; but they declare that no system can be expected to be satisfactory which does not gradually develop itself under proper supervision. Notwithstanding this concurrence, on the part of the authorities at the Admiralty, in the views originally put forth by the Royal Society, the Board of Trade declined to accept the recommendation which had been made.

I have made inquiry on the subject, and have reason to believe that no change has taken place in the views represented to the Board of Trade in 1865, both by the Royal Society and by the authorities at the Admiralty.

A similar opinion is entertained by the Astronomer-Royal, who informs me that he assents most strongly to the requirements that, as a condition of seaworthiness, the adjustment of compasses should be carried out by a certified adjuster.

"A condition equivalent to this," he says, "was urged by me on the Admiralty in 1839. All people who have at later times entered carefully into the matter have expressed the same opinion. I may cite particularly, Capt. Evans, Mr. Rundell, and Mr. Towson, the examiner of the Local Marine Board of Liverpool."

I have also consulted the committee of Lloyd's, and the committee of the Liverpool Shipowners' Association. Both of these associations are in favour of requiring that all adjusters of compasses should possess a certificate of competency.

Such being the views entertained by men of science, by shipowners, and by insurance associations, I will now turn to one of the most interesting communications which I have received on this matter; interesting, because it comes from a highly distinguished officer of the mercantile marine, Sir James Anderson, whose practical experience of the difficulties of navigating iron ships gives the greatest possible weight to the opinion which he expresses:—

"The compass is, of all other essentials, the most important part in the equipment of an iron vessel. It is of all others the least understood, either by those who build ships, sail ships, or make the compasses that are used in the mercantile marine.

"My opinion is that there are not fifty officers now afloat, either in the Royal Navy or mercantile marine, who are conversant with the laws of magnetism, as affecting ships and compasses as they should be understood.

"The greater number of casualties to iron ships may be traced, in my judgment, to errors of the compass and lee-way.

"When you reflect that a quarter of a point will cause about 2½ miles of error upon a hundred miles of distance run, and that after the usual observations about noon, or even during the afternoon, the steamers of the present day may easily run a distance of 200 miles before there is an opportunity of obtaining another observation, this would give an error of five miles in a ship's position.

"There can be no reason for objecting to a law which shall require that all compass adjusters at the seaports shall be men who have passed a strict examination, and that they must be properly certified by the Compass Department of the Admiralty."

I now proceed to consider the best mode of conducting the proposed system of examinations.

If it should be thought impracticable to entrust the proposed duty to a department of the Admiralty, I would suggest that the Astronomer-Royal, Captain Evans, the President of the Royal Society, an eminent representative of the shipowners, a representative of the insurance interests, and a practical nautical instrument maker of repute, would constitute a council, which, under the authority of the Board of Trade, could readily consider the subjects in which candidates should be examined. Examiners could be appointed to act under the direction of the local marine boards, and conduct the examinations in the same manner in which the examination of masters and mates is now conducted in the principal ports.

Mr. Rundell, from whom I have so often quoted, expresses the belief that when adjusters shall have passed an examination, and have been certified by the Board as competent, it would be reasonable to require that they should be called upon to make a formal declaration that their work had been done in the best manner. "This," he says, "would tend to make an adjuster of compasses more particular, from the fear of the effect which any accident to a ship, which could be traceable to the compasses, might have upon his personal reputation as the holder of a certificate from the Board. It would also give him a more independent standing with shipowners."

One merit which belongs to the proposals now made is, that while it would afford to all interested parties reasonable security that all iron ships holding a character from Lloyd's and the Liverpool registries, would be sufficiently and satisfactorily equipped as regards compasses, it would probably be termed by the mercantile community "Government interference."

To some, indeed, it may appear unnecessary that the Board of Trade should interfere in this matter; but, as Sir Frederick Arrow observes, though to the intelligent and scientifically-disposed officer the state of the law may be comparatively unimportant, in this, as in all other matters, we should legislate for the stupid.

I can only say, in conclusion, that in my humble judgment, it is quite as necessary to secure a guarantee of the competency of the adjuster of a ship's compasses, as it is to require the possession of a certificate of the knowledge of seamanship and navigation in the officers responsible for the duties of navigation.

THE DEPOLARIZATION OF IRON SHIPS.

Mr. Chas. F. Henwood, member, read a paper on the invention of the late Evan Hopkins, C.E., F.G.S., by which the sub-permanent magnetism of an iron ship, the principal cause of the deviation and consequent depreciation of the compass, is stated to be completely and permanently removed. The paper contained a number of extracts, and a table showing the deviations of the compass of H.M.S. *Northumberland* before and after depolarization, which will be given in the "Transactions" of the Institute.

Saturday, April 1st.

Vice-Admiral Sir E. Belcher *in the chair.*

"RICHARD COBDEN" IRON SAILING SHIP.

By John Grantham, Esq., C.E., Member of Council.

This paper is presented to the institution more as an historical record of a remarkable vessel, one of the earliest class of iron sailing ships, than from any idea that it will add much to our knowledge of ship building, or be an example to follow. In considering her peculiar construction, however, some remarkable features are developed, which form a singular contrast to modern practice.

The *Richard Cobden* was built in Bristol, in 1844, in the same yard and by the same parties who built the *Great Britain* screw steamer. Her dimensions, as shown in the register, were 136·7 feet long, 27·6 feet broad, and 19·2 deep. Tonnage, O.M. 522, N.M. 461, the great difference between these being due to her remarkable form, the old measurement requiring the length and breadth only to be taken into account; the new professing to give the cubical contents of the ship, which in this case, as will be seen in the section, is very small. The half-breadth model now before you shows her exact form.

She was broken up in the summer of last year, but up to that time, for a period of 26 years, she had been frequently employed in the China and other trades. Her plates, which were about 2′ 4″ wide, were lapped on the principle then in use, and were of the following scantling. The red figures show what is the thickness required by the London Lloyds' Regulations for a vessel of her size, having the highest class.

The *Richard Cobden*, when ready for sea, but without cargo, drew about 10 feet. This, as will be seen, showed her to be a small carrier. She was re-classed in the Liverpool Book in 1860, having had all plates that were much worn cut out of her.

The dimensions of her frames are not given, but they were about 2′ 6″ apart, were of single angle iron; each was set down to the form of the plates, and no liners were used—a system of great labour, but when well done it made sound work. She had a few horizontal ties and lower deck beams with a stringer. There were no frames from the mizen mast to the stern, and no floorings except as shown in the drawing.

She was barque rigged, and on her first voyage the masts were all carried away owing to the great stability of the ship, causing her to roll excessively. As an instance, however, of the absence of correct views, and even ordinary observation of many seamen, the captain recommended that her masts should be reduced from their former dimensions, supposing this would reduce her rolling.

Experience, however, no doubt showed the owners this mistake, and she was ultimately so rigged as to give her a fair character as a fast sailor and good sea-boat.

She had not been long at work before she grounded in the port of Shanghai, and, falling over on one side, was flattened inwards considerably on one side, and so remained to the end. She, however, met with some other accident last year, to repair which would have cost a large sum, and being a small carrier, and thus an unprofitable ship, it was not deemed desirable to repair her.

The *Richard Cobden* was a favourite vessel, was always tight, and seldom, if ever, damaged any cargo.

In reflecting on all these results, one is struck with the fact that a vessel so severely tried as she was, and yet so very far from coming up to the standard of strength now required, should have done her work so well. One reason for this undoubtedly was, that the iron and workmanship were excellent, and it may also be assumed that the weight of iron frequently put into our ships is excessive, and, if too much, then a great evil. To carry out the first and avoid the second must be our aim. There is no excuse for bad iron or bad workmanship. How best to dispose of the iron so as to give the greatest strength with a given weight is the test of skill and judgment in the naval architect.

ON A VESSEL IN MOTION, AND WHAT BECOMES OF THE WATER SHE DISTURBS.

By Henry Ransford, Esq., Associate.

In considering the subject, an important difference between solids and fluids must not be overlooked: it is this, in forcing a solid into another solid the particles are frequently compressed together, without altering the external form of the bodies, as driving a post into hard ground, or a nail into a block of wood; but, water being incompressible, a body forced through it, floating partly above and below the surface, or a solid let down into it, alters the form, and in either case that can only be done by raising the surface; and, unimportant as this proposition may seem at first sight, it is a principle that cannot be set aside; and, although witnesssed by many every day, yet in regard to its real effect on the movement of ships has not yet been duly considered. Another great difference between solids and fluids to be considered in the movement of vessels is, that the particles of the latter so readily communicate motion one to another without materially altering their position; thus it is a common saying with seamen, when speaking of a fast steamer, to say, "her bow is so sharp, that she does not raise even a ripple before her," not considering that a great displacement and consequent movement of water to the surface somewhere has taken place, but which, being some distance ahead, or obscured by the motion of the waves, they have not perceived.

To observe the effects on water by a vessel in motion requires peculiar opportunities, that rarely occur to a sailor or persons interested in this difficult problem; it can only be seen perfectly by the side of a river, when a steamer is passing, and the surface of a glassy smoothness, and in the greatest perfection, morning or evening, when the sun is not very high above the horizon, and the tide does not cover all the shingle. If a person will then take his stand and watch a steamer approaching, he will see a wave advancing a little ahead of her, and spreading out in a curve that reaches the shore. Selecting a large pebble close to the water's edge, or driving in a small stick as a mark, he will see, as the wave approaches, the water rises and covers his mark. The wave having passed on the water subsides, and then recedes quite as much below as it had risen above the previous level (like a stream running towards the steamer); then in a few seconds comes another wave, rising fully as high as the first one, followed by several smaller ones, which diminish in size, until the surface of the water again subsides to the same condition as before the passing of the steamer.

I was first struck by the receding of the water behind the first wave below its previous level, and was soon convinced that not merely a carrier wave had passed along the surface, but that the steamer had set in motion a stratum of water the whole distance between her bow and the advancing wave—that is, the particles of water communicated motion one to another from the bow, until they rose as a wave above the surface, which, on losing the thrust of the stratum as the boat advanced, commenced to spread or subside, but I could not at all account for the receding of the water after the passing of the wave. I at once commenced to observe closely the various kinds of craft passing up and down the river, and the effects produced when they were moving with the tide, against it, or in still water, and soon found the results were the same, but differing according to the state of the tide and the build and speed of the vessels. All bluff bows similar to barges (when being towed) raised a wave very close immediately in front of them with very little spread, the effect of which on a vessel would be similar to the wheel of a cart sinking in soft ground. Ordinary bows sent the waves further ahead with an expanding curve, and the sharper the bow the wider the arc, thus increasing the distance from the wave to the bow, consequently lessening the resistance of the displaced water sent to the surface; and I observed the wave of displacement (as I term it) invariably travelled at the same rate as the vessel, irrespective of the depth of the water, quickly subsiding when a steamer stopped at a landing-stage, and commencing as soon as the boat started again.

After referring to some experiments on the Erie Canal, he said:—These observations took a long time to note before feeling satisfied as to their correctness, and the invariable effect on the water. The inference that I at length drew from this accumulation of facts was, that all bows strike the water at a right angle from the plane of their curve; consequently what is considered an ordinary good bow, strikes the water with a downward as well as a side force, thus giving the particles or stratum of water, when first set in motion, a partially downward direction; then moving upwards in a curved line (the curve depending on the resistance received) until a wave is forced up on the surface, equal in bulk to the displacement, between the stem and the extreme beam of the vessel. A sharp bow striking the water more laterally than downwards, the wave of displacement does not rise to the surface so near the vessel as in the former case. The resistance not being so great from having less curve before it rises, it has a longer inclined plane (if I may so term it) to move on in its upward progress. It was evident that the following waves flowed on to fill up in some way the space left by the forward movement of the vessel; but it was a long time before I could account for the receding of the water on the shore, behind the wave of displacement. Close observation, on very calm mornings, at length showed me there was an evident depression of the surface of the water, commencing alongside the steamers, and extending towards the shore. Reasoning on this fact, I perceived it was caused by the water close to the vessel's side sinking down to occupy the space she was leaving. A screw steamer shows this far plainer than one with paddle-wheels. One fact, clearly proving the displaced water is first forced downwards by an ordinary bow before it rises is this, a steamer, say between Hammersmith and Kew, goes slower directly she gets into shallow water. The men on board say "she drags;" the real truth is, the stratum set in motion by the bow strikes the bottom, and, instead of curving gradually upwards as in deep water, has considerable reaction against the bow, causing the vessel's head to rise and her stern to drop. Judging from these observations, it appears that what causes one ship to sail faster than another—other things being equal—is the shape of bow, which forces the water she displaces laterally, rather than downwards, for, action and reaction being alike, water forced downwards against water of greater resistance reacts against the bows, and consequently the more lateral the thrust, so much less will be the reaction; because the water is only forced against water of the same pressure, and the wave of displacement rises more easily to the surface. Now the displacement by the bow, and the sinking down of the water which fills up the space the vessel is leaving, must be simultaneous movements, and the particles of water in each case must communicate motion to those next to them, at the same velocity; it follows, that so far as the wave of displacement would extend on either side, and so fast as it would travel, just so far and so fast would also the particles of water be affected that are set in motion, to fill up the space the vessel is leaving; consequently, the receding on the shore is the action of the natural law of fluids filling up the space the vessel is leaving. It seems impossible that the space a vessel is leaving can be filled up in any other way than by the water in contact with the sides sinking down to occupy that space; the idea that the water comes up somehow from below, is surely opposed to the law of fluids. I ask what power raises or lifts it up? what water takes its place? I leave it to wiser heads to determine, but I believe it may be accepted as an axiom, that the limit to the speed of a steamboat, however powerful the engines, is the rate at which water will flow in to fill up the space she leaves; and further, that the following must be recognised as laws in hydrostatics, viz., any ship or vessel floating in water can only move through the same by forcing to the surface a body of water of equal breadth and depth to its immersed midship section; and the bows of all ships in motion impel the water they displace at a right angle to the plane of their curve.

ON SHEATHING IRON SHIPS.

By Howard Ninnis, Esq., Associate.

Copper is still strongly advocated as a sheathing for iron ships. I am perfectly aware that there exists a great difference of opinion as to the merits of that metal when so applied; also that zinc, the great, and perhaps we may say, only true rival of copper as a sheathing for iron, is daily gaining advocates; still, as long as copper is in use, it is our duty to try and lessen the well-known dangers of its application as an anti-fouling substance.

Having summarised the various compositions and plans devised for anti-fouling purposes thus:—Wood, lead, copper, zinc, porcelain, Roman cement, leather, tin, yellow metal, india-rubber, tinned iron, woven metal, and vegetable fabrics, brass, glass, and plaster, and briefly referred to the various and most important plans suggested for the preservation of our iron-clads, Mr. Ninnis came to the conclusion that the real problem to be solved is simply this—it is necessary to adopt some substance that shall fulfil the double essential of preserving the iron from corrosion, at the same time securing a perfectly clean and smooth surface, so that the least possible resistance shall be experienced by a ship on her passage through the water. The "poisoning" theory, he said, has been proved to be an absurdity. All compositions have likewise proved but indifferent protectors either of the iron, or against fouling. Thus there remains but two substances with which we may hope to attain the desired results—zinc and copper. We all know how valuable the latter has proved as applied to our wooden ships; and when we come to analyse the reason of its effectiveness, we at once perceive what must be the *sine qua non* in all sheathings, viz., the property of exfoliation. Now copper, in oxidising, exfoliates equally in parallel layers, a peculiarity at present monopolised by this metal. True, zinc oxidises, and, to a certain extent, exfoliates, but, as far as we are yet acquainted with its action in this particular, it is not so equable. Besides, as this latter metal is still, I believe, being experimented with, we must await the results of those experiments ere we decide either for or against its use. We are therefore reduced to the one substance, copper, with its uniform exfoliation securing a mechanical detachment of all substances adhering thereto, for, as we have seen, this property of exfoliation is the only principle at present known that can be depended upon for ensuring a clean surface.

In advocating copper as a sheathing, I am fully sensible I am supporting, as it were, the employment of a dangerous servant, and one that may possibly prove even our master, but my chief reason, as I before said, for so doing, is that I find this metal still in use, and the very fact of its application being dangerous, has led me to suggest a method that may possibly lessen that danger—to obviate it entirely I fear is impossible of accomplishment, so long as ships are liable to run aground, or come in contact with sunken dangers; and yet this contingency is not quite so formidable as it at first appears, at least, if we are to credit the opinion of those fully capable of judging of the matter; for Mr. Mallet has placed on record that there certainly would be no such amount of corrosion as to endanger the safety of the ship at sea before she could get home or into some port where the accident could be repaired. The fact is, that the surfaces of both metals, when left to themselves in sea-water, get coated more or less with various insoluble sulphates and other salts and oxides derived both from iron and from the sea-water, which alter altogether the rate of corrosion that would otherwise take place were chemical action quite unimpeded." These remarks seem fully borne out by actual experience, for we find that it took eight months ere the iron plates of the *Royal Oak* were eaten into to the depth of $\frac{3}{8}$ of an inch, although, in some of the French iron-clads, the destruction was somewhat more rapid.

I will now simply, and in as few words as possible, lay before you the suggestions which I have ventured to introduce to your notice, viz., a method by which we may apply copper in such a way as to insure the least chance of creating any of those dangers incidental to the close proximity of the two mortal foes, iron and copper. Firstly, I propose attaching a stout wooden sheathing of say two inches in thickness, fixed directly to the hull, which may be done either on the admirable principles laid down by Mr. John Grantham, or else in the way shown in the diagram before you, and still more plainly in the little model I have roughly prepared, which is lying on the table. Those capable of judging shall decide which is likely to prove the best. The advantage claimed for the plan exhibited in the diagram, is that of lightness combined with strength. On this inner wood sheathing it is proposed to place a layer of gutta percha, of $\frac{1}{4}$ inch in thickness. This is intended to form a perfect insulator between the copper and iron, and likewise insulate the fastenings securing the inner wooden sheathing to the hull. Outside this gutta percha it is intended to fix another layer of timber, of one inch thickness, which shall be secured by brass screws to the inner planking, or by the ordinary wooden bolts. The copper is then to be attached in the usual way, except that screws $\frac{1}{2}$ inch long shall be used instead of the ordinary nails.

I am aware that timber sheathing has been already used to form a basis for the attachment of the copper, but then I find that the fastenings attaching the sheathing to the iron hull have to a certain extent suffered from the close proximity of the copper, for the wood sheathing has been applied in one thickness only; whereas in the method now brought under your notice there is the inner and stouter 2-inch wood sheathing firmly fastened to the hull, forming a safe basis for the attachment of the lighter and outer 1-inch sheathing, on which is fastened the copper, which is completely insulated by the gutta percha from the fastenings in contact with the hull.

I have suggested the use of gutta percha, for the simple reason that I find it one of the most perfect insulators, being so largely used in the construction of telegraphic cables, where perfect insulation is of such vital importance. At the same time there may be other materials that might prove of sufficient insulating power for our purpose and at the same time be less expensive. I have proposed the use of brass screws in fastening the outer 1-inch to the inner 2-inch sheathing; at the same time I have suggested the use of the ordinary wooden bolt. My reason for making the latter proposition is that if we can secure a sufficiently strong fastening of wood we lessen in a great degree the liability of metallic contact between the copper and iron.

My reason for using screws instead of nails in attaching the copper is that a $\frac{1}{2}$-inch screw may prove more effective than an inch nail, with this advantage over the latter, that the screw penetrates the wood but half the distance that would be required in a nail of equal holding power.

ON FURTHER EXPERIENCES OF THE APPLICABILITY OF ZINC FOR SHEATHING IRON SHIPS.

By **Chas. F. T. Young, C.E.**, Associate.

It is unnecessary in the present paper to go into any arguments to prove the peculiar fitness of zinc as the only proper material at present known or available for sheathing iron vessels, and this the more especially when it is remembered that such high scientific authorities as Faraday, Davy, Percy, Noad, Medlock, Crace Calvert, Normandy, Kane, Bakewell, Gruelin, Rankine, Wollaston, Abel, Graham, Brande, and others, have pointed out the dangers of using copper or yellow metal in connection with iron vessels, and shown the fitness of zinc for the purpose.

It may be remarked, however, that though the above-named high scientific authorities have shown and explained why zinc will keep clean on an iron hull, as well as copper does on a wooden one, the "practical" men of the present day do not appear to understand it, nor to appreciate the necessity of allowing the iron hull of the ship to be in contact with the zinc sheathing, so as to produce the necessary amount of exfoliation required to cause the zinc to keep clean, without which no satisfactory result can be arrived at by its employment.

The Admiralty, it seems, have at last arrived at the conclusion that sheet-zinc may be tried as a sheathing for iron ships, and have applied it to the *Audacious*, but have caused a wood casing or sheathing to be built over the iron hull, on which casing or sheathing the zinc sheets have been applied, whence it appears that the action of the zinc is not yet fully understood, or they would never have interposed a material between the iron and the zinc which cannot fail to render the action of the former on the latter much less than it should be, and introduce a powerful means of causing its failure.

The adoption of zinc sheets for sheathing iron hulls in the Navy appears to have resulted from some experiments which have been under trial by the Admiralty for some years, but the particulars of which have not been officially notified; and it may be interesting here to give a brief account of the mode in which these experiments were carried out, together with such information as to the results as have been obtainable from other than official sources.

In 1863-4, the value of zinc as a sheathing for iron in sea-water having been proved in conjunction with the government Special Committee on Iron, in the beginning of 1865 the then Admiralty caused two iron plates, 7 ft. long, 3 ft. wide, and $\frac{3}{4}$ of an inch thick, representing part of the hull of a ship 3,000 to 4,000 tons, to be prepared for experimenting on the action of zinc and iron in sea-water, with the view of proving the fitness of zinc for sheathing the submerged portions of the hulls of our iron-clad fleet, the plates being put together, and the zinc fastened on, in accordance with the manner patented by Mr. Daft, by means of which the sheets of zinc can be fastened by nails driven into strips of dried compressed teak, which are firmly jammed into grooves left round the plates forming the hull of the vessel, and by means of which the building of a wooden hull over the iron one, only to carry the sheathing, is rendered unnecessary.

The original intention in carrying out this experiment was to place the zinc in direct contact with the bare iron, so that the action of the iron on the zinc would be unimpeded, and thus allow of sufficient galvanic action taking place to cause the zinc to exfoliate at the rate required to keep clean and bright, but it appears by some accident—which it is unnecessary here to describe—the iron was coated all over with a composition formerly much used in Her Majesty's dockyards, known as "Hay's glue," and a sheet of tarred felt was interposed, by which means the action of the iron on the zinc was almost completely prevented; and in order to establish some connection between the two metals, some iron nails—common clouts—long enough to pass through zinc, glue, felt, and wood, and turn upon the iron, were driven in, and on the 31st March, 1865, these plates were put into the water at Portsmouth-dockyard, one at one end of the great landing stage, and the other at the other end.

The unfortunate application of the glue and felt to the two plates, and the certainty of their limiting, if not preventing, the desired action of the iron on the zinc, caused great anxiety lest they should act prejudicially to the invention, and in order to prevent this a third plate, of about three feet by two feet, without any glue or felt, the metals being in direct contact, was prepared at Portsmouth, and put down at the end of 1865.

It was intended that all these three plates should remain under water one whole summer, and be lifted at the expiry of one year from the period of their submersion, but on the 12th October, 1865, they were lifted for a preliminary examination, and again submerged, remaining untouched until August, 1866, when they were drawn up for the examination of the Lords of the Admiralty, on the occasion of their official visit of inspection to the dockyard.

Having been unable up to the present time to get a copy of the report or results of this experiment, or any official information on which I can rely, I can only refer to a report of the correspondent of the *Standard* at Portsmouth, which was given on August 15th, 1866, as to the results of the trial of the three plates.

Objections have been raised to the use of zinc for a sheathing for the hulls of iron ships, because the zinc and iron do not expand at an equal rate; but the following will show how little this difference can affect the matter in practice:—Zinc from 32° to 212° expands ·0029 of its length, and wrought-iron under the same circumstances expands ·0012, giving a difference of ·0017; this multiplied by 36, the number of inches in a yard = ·0612 in that length. Thus it will be seen that zinc expands 3 parts in 1,000, over a range from 32° to 212° = $\frac{3}{10}$ in 100, or $\frac{3}{8}''$ in 10 feet nearly. If we deduct the expansion of the iron, and take 45° as a maximum difference of temperature, we have $\frac{1}{64}''$ in 3 feet as the greatest that can happen, an amount which will be entirely lost in practice in the slack of the nail-holes. This was satisfactorily proved in the case of the plates tried at Portsmouth, which, when they were taken up, were proved to have the zinc perfectly flat and safe, without the slightest appearance of bulging, or having bulged.

In regard to the rate at which the zinc should exfoliate in order to keep clean, the waste should not be less than two ounces per square foot per annum, in order to secure a clean, bright surface. In the Portsmouth experiments with the glued plates, the zinc had only wasted at the rate of one ounce per square foot per annum, which was not enough, and was less than that of the copper on ordinary wooden ships; and there is no doubt that if the zinc be allowed to exfoliate at the same rate as copper on wooden ships, it will be found to fulfil all the requirements of the case. Within certain limits, the rate of exfoliation of the zinc can be regulated, and increased or diminished, by leaving a greater or less portion of the submerged part of the hull exposed, which may be done without injury to the iron, as the zinc in its immediate neighbourhood will protect it so as to prevent corrosion.

It may be asked, if these facts are correct, how it is that all our iron-clads are not sheathed with zinc, or why it is that they are not constructed, or constructing, on the plan patented by Mr. Daft, seeing that some seven years have elapsed since it was brought before the public? To this I am unable to give any explanation. But one thing is, I think, very certain and unquestionably proved, and that is, that it is not on account of greater cost, for we find that the *Active* and *Volage*, two unarmoured iron corvettes of 2,322 tons each, have been built with brass stern-posts and a wood sheathing, to enable them to be covered with copper or yellow metal, at an increase in the cost of their construction of £6 to £7 per ton of the ship B.M., as was related at the meeting of this institution in 1869, by the late Mr. Bell, who had been engaged in looking after their construction; and in the case of the *Audacious*, which required iron of a particular section to be rolled for arranging the wood sheathing on which the zinc was nailed, and which had to be attached to the hull after the ship was built. I do not know the particulars, but the plan patented by Mr. Daft can be carried out whilst the ship is being built, with a very slight increase in the weight of iron used, at an increase in first cost which will not exceed 35s. per ton B.M. of the ship, making a thoroughly good and sound job, giving a stronger ship and providing a ready and certain means of increasing the durability of the hull to an unknown extent, besides affording a great saving on the working expenses from having always a clean bottom, thus avoiding the great and expensive outlay caused by the plans now adopted, and avoiding the serious danger of injury to the ship which exists, and must infallibly show itself where copper or yellow metal sheathing are applied on an iron hull and exposed to the contingencies of sea service.

ON THE STEERING OF SHIPS.

By **Evan Leigh**, Esq., Engineer, Associate.

The desirability of having a perfectly balanced rudder for steering ships must be admitted by all nautical men; hence so many attempts have been made of late years to effect this important object. It is, however, evident that no plan of balanced rudder acting either at the stem or stern can operate without seriously retarding the ship's motion, if perfectly balanced, and, if only half balanced, to a less though considerable degree.

The plan now submitted to your notice is very simple, and, whilst effecting a perfect equilibrium, doubles the steering power instanter, which, in case of emergency, is an enormous advantage.

When the cry is raised of breakers ahead, or, dimly outlined through the fog, a vessel is discovered bearing dead upon the mariner, what would not be given in that supreme moment for the ability to turn his vessel aside?

Reflecting upon this subject, some time ago, showed me that, as the common helm is perfectly useless to control a vessel in emergencies at sea, some greater force must be requisite to arrest its course. Now, when a large mass of matter is in rapid motion, the momentum becomes so great that nothing can stem it unless an approximate force be brought to bear upon it. By seizing hold, therefore, of the ship's momentum, the very power required to be restrained is made to restrain itself. To bring this law of self-control into action, I simply place a helm fore and aft, and connect them together in such a manner that the force derived from the enormous pressure on the fore-helm, when it is turned aside, is made available for bringing up the aft-helm in the opposite direction, and the ship swings round instantly. The helms being in equilibrium, any boy may easily work them, and the largest vessel afloat may be made to stagger on the water, first to one side and then the other, by simply pointing the fore-helm alternately to starboard and larboard so long as the ship is in motion.

I am of opinion, after giving the subject much thought, that no balanced or any other rudder which can be devised, can give such perfect and instantaneous control over a ship as this plan of steering. Theoretically, also, with such a steering apparatus, a ship ought to turn round in half the time, beause she has two rudders acting instead of one; but in this case, practice, which usually runs panting after theory, may be made to go ahead of the latter, as the helms, being perfectly balanced, may be increased in size, seing that it requires so little power to work them. If ever there was a case in mechanics in which practice can be made to laugh at and mock theory, this is one—for the power required to turn a ship may be instantly commanded to a far greater extent than is necessary to simply turn it in half-time, as the double rudder alone would indicate.

ON A PNEUMATIC SOUNDING MACHINE.

By **Walter C. Bergius, Esq.**, Glasgow.

To obtain from a vessel, going rapidly through the water, a sounding worth having, it is necessary that some means should be used which will not depend for its accuracy upon the vertical position of a sounding line by which the distance from the ground to the sea level is measured.

Now, I think there is scarcely a simpler and more constant agent available for this purpose than the pressure which the head of water above any of the bottom of the sea will exert upon an apparatus of such a construction that it will retain, and show for indication, the amount of the hydrostatic pressure to which it was exposed in the moment of striking the bottom. The instrument which I have to submit to your notice will take in a certain quantity of water in going down into the sea, and when hauled up on deck it will indicate, by the level of water on the scale outside, the vertical depth below the sea level which it had obtained in striking the bottom. It will indicate, for instance, an actual vertical depth of 30 fathoms, although there may be 60 fathoms of stray line overboard, consequent upon the progress of the ship made during the operation of the sounding. It obviates the awkward possibility of a mistake being made in feeling for the knots of the sounding line in the dark on deck, as it is carried, with the indicating water in it, up to the bridge or into the chart-room for the inspection of the officer on duty.

The instrument acts upon a principle analogous to that of the barometer, by which the height of a mountain is measured through the weight of a head of air above it upon a vacuum.

It works in the following manner:—When fixed with its eye at the top on to a sounding line, which does not need to be measured or provided with knots, it will go down by its own weight into the sea. As long as the instrument was at the surface the expansion of the air inside was equal to that outside. As soon as it is immersed there is added to the pressure from the outside the pressure consequent upon the head of water above. When the instrument arrives, for instance, at a depth of about five fathoms, the pressure from the outside is one atmosphere in addition to the atmosphere at the sea level. The consequence is that, at a depth of five fathoms, such a quantity of water has entered the inside space of the instrument that the air contained in it, and which has no means of escape, is compressed until it attained the same pressure, viz., two atmospheres. This takes place when the air is confined to one-half its original space, the other half being replaced by the sea water which enters. To prevent the latter from coming out again when the pressure from the outside decreases—consequent upon the instrument being hauled up to the surface—the water first ascends the tube shown in the section (which is always open at the top), and then falls down and collects through its weight at the bottom of the inside space of the instrument. No possible depth of water would fill the instrument entirely, as atmospheric air is a permanent gas. The inside is designed of such a shape as to correspond to a certain scale which is desired to be attained. For the Merchant Navy two sizes are made, of 100 fathoms and 45 respectively,—the latter being mostly used for home trade steamers in the North Sea. Any desirable scale may be attained by a different shape of the inside, for the purposes of geographical survey and for use in laying telegraph cables, where so much difficulty—resulting from the operation of taking correct soundings—has been experienced.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

A special meeting of Her Majesty's Commissioners for the Exhibition of 1851, was held on Tuesday, at Marlborough-house, under the presidency of the **Prince of Wales**, for the purpose of consulting as to the best steps to be taken in order that the participation of France in the forthcoming International Exhibition might be adequately provided for in the face of the present emergency. A number of gentlemen interested in the subject were invited to meet Her Majesty's Commissioners, and letters were read from several who were unable to be present. The business of the meeting commenced by his Royal Highness requesting Colonel Scott to read the letter with enclosures, which was addressed by M. du Sommerard to Her Majesty's Commissioners on the 25th ultimo.

The Prince of Wales explained that the object of the present meeting was to induce possessors of French works of art to come forward and assist the French commission in completing their section of the exhibition, by the temporary loan of works of painting and sculpture, as well as as of important pieces of art furniture, and other specimens of applied art. His royal Highness stated that the recent sad and disastrous war rendered such an application necessary. The objects lent would probably only be required for a short time, until the French commission had had an opportunity of obtaining others from France; but in case of the continuance of existing difficulties they might posssibly be required till the close of the exhibition. He added that the greatest possible care would be taken of the objects lent.

M. du Sommerard, Commissioner-General for France in connection with the International Exhibition of 1871, then read the following telegraphic despatches:—1. "The Minister highly approves of M. du Sommerard remaining in London, notwithstanding the events in Paris, and requests him not to leave before he has taken steps for the success of the French part of the Exhibition. If any delay takes place in respect to the transit from Paris, in consequence of present events, the lost time would be made up by the rapidity of delivery at a later date. The country exhibitors will forward without delay. We write to the Chambers of Commerce, and the manufacturing centres for pottery and woollens, to reiterate the firm intention of France to take part in the London Exhibition." 2. "In order to hasten the transmission of goods from Paris, a committee has been formed by the principal manufacturers to remove any difficulties which may arise at present in reference to the exit from Paris of objects intended for the International Exhibition." M. du Sommerard explained that although the principal artists and manufacturers in Paris were ready and anxious to contribute to the Exhibition, yet it was hardly probable, under the existing impediments to the transmission of goods from Paris, a sufficient number would arrive in time for the opening of the Exhibition. He added that a meeting had been held at Versailles, which had resolved to send works as soon as they could be obtained from Paris, and that he had received like promises from many of his countrymen at present residing in London. It seemed, therefore, that what was at present required was the promise of works which the French Commission could count on in case of necessity.

Mr. Gladstone said he feared that he possessed few objects which were worthy of the notice of the French Commission, but that such as he had he would be happy to lend. He had the utmost confidence that other possessors of more important works of French art than his own would place them at the disposal of the Commission as gladly as he did those belonging to him.

All the gentlemen present at the meeting expressed their readiness not only to lend any French works of art in their own possession, but also to invite their friends to contribute; and generally to do all in their power to promote the object for which the meeting had been convened.

The proceedings terminated with a resolution:—"That letters should be addressed, in the name of Her Majesty's Commissioners, soliciting the loan of modern works of French art, and requesting possessors of such works to communicate as quickly as possible with the secretary of the commissioners."

France.—About sixty specimens of the highest class of French fine art has been placed at the disposal of the Commissioners for exhibition. They are part of a stock, of the value of over £30,000, that has been received by a private firm.

India.—A large number of cases have just arrived from India, containing many valuable exhibits, including shawls, jewellery, and ivory carvings.

CORRESPONDENCE.

FALSE EXALTATION OF ORNAMENTAL ART.

Sir,—Although Dr. Dresser's paper has already given rise to much discussion, two of his important errors have passed unchallenged. Doubtless, many who would otherwise have taken part in this discussion have refrained, from an idea that too many of the valuable pages of the *Journal* have already been occupied with it. But it is important that any errors which have been uttered from the rostrum of the Society of Arts, and recorded in the pages of the *Journal*, should be exposed and corrected in those pages.

Before passing to my subject, let me refer to Dr. Dresser's last remark, that "not one word has been written or said to controvert my statement, that ornamentation is a high art, and that it is even the highest of the arts." I thought Mr. Sala had replied, "there is a high and a low status in art, but the lowest and meanest article, a pot or pan, a brass-kettle, may by industry, skill, ingenuity, and the employment of those gifts which the Almighty has given us, be ennobled to the highest and most exalted degree." "Ornamentation may become a high art, but not necessarily so." This appears to me a complete answer to Dr. Dresser. Ornamentation is not necessarily the highest art, nor high art, nor fine art, but it becomes high art when practised by a Cellini or a Ghiberti.

One of the remaining unrefuted errors of Dr. Dresser's paper is this. Speaking of the lofty mission of the ornamentist, he says:—"The artist, then, holds in his hands a power greater than that of any other who addresses himself to the world." Then, this little sister of the arts, the "Cinderella" of Dr. Dresser's paper, turns out to be the very chief of all the Muses. Who, besides Dr. Dresser, would claim for a great ornamentist an influence over mankind equal to that of a great writer? Has the ornamentation of the ancient Egyptians and Assyrians been as powerful in its influence on the world as the literature of the contemporaneous Hebrews? Have the designs of the Greek ornamentists addressed their teachings to the world in successful competition with the works of the grand old philosophers, historians, and poets of that people? Then, as to the durability of these influences, perhaps the most God-like in art creativeness, and the most industrious among artists was Phidias; and do the shattered survivors of his works show as vigorous an immortality as the poems of Homer? And let it be observed that I am now comparing the most enduring expression of art-sculpture, rather than the comparatively ephemeral ornamentation of which Dr. Dresser is a master.

The other error I would point to is contained in these passages:—"Ornamentation in its higher forms has always been the handmaid of religion." "While it is a high art, and while a high art only, will religion continue to associate itself with it in the work of moral teaching." Worse than Egyptian darkness enshrouds the mind of that man who confounds the emotions produced by ornamentation, or art of any kind, however pure or true, whether in a cathedral or elsewhere, with the emotions of true religion. Religion is a purely spiritual intercourse with God, and that intercourse is most complete when the physical eye is closed to all disturbing effects of external works of art. Even when ornamentation is combined with holy passages, that ornamentation is an impeder of the realisation of the sense and beauty of those passages, by distracting the attention from the contemplation of the meaning, and only when the art emotion ceases can the mind begin to realise the ethic or spiritual meaning of the text. I am now speaking of that strictly ornamental art which is the subject of Dr. Dresser's remarks, and find it impossible to ascribe it to any other mission than to produce a mere pleasant sensation. A beautiful picture, illustrating a sacred subject, speaks another language. Contemplating the "Transfiguration," we read, "Christ was divinely beautiful, and radiant with divine brightness, and the glory of heaven shone down upon him upon the mount.' This is merely a painter's translation of an interesting passage in the life of Christ. It is as legitimate to contemplate it in a temple of worship as to listen to the reading of an historical passage of Scripture. But the picture may be seen, and the passage heard, without any experience of religion, while the emotions of the religious heart and its communion with its Maker are quite independent of the picture. If good ornamental art taught religion and morality, there should be most religion and morality where there was most good ornamental art. But we believe that the existence of true religion is as vigorous in an "Uncle Tom's Cabin" as in the most gorgeous palace or cathedral.

Dr. Dresser claims to have settled the question that ornamentation is the highest of the arts, the utterer of the most powerful language which can be addressed to mankind. He has given the little sister of the arts a hoist up to Parnassus. But she is a light little thing, and the doctor's lift is so vigorous, that I fear, instead of landing her safely on the summit, he has thrown her right over the top, to the other side, where she will roll down to the same level from which he sought to exalt her. Sam Weller committed the same mistake in giving Mr. Pickwick a leg up to the garden wall at Bury St. Edmunds. While speaking of Pickwick, the thought occurs to me that the mystic symbolism attributed by Dr. Dresser and others to the ornamentation of the ancients is very much like the ingenious and learned theories of the meaning of the signature and mark of Bill Stumps. Bill Stumps had no idea when, in an idle hour, he was cutting his mark and the letters of his name on the stone in front of his door, that he was engraving letters everyone of which would become a subject for ingenious interpretation by learned antiquarians. Nor, perhaps, had the Egyptian ornamentist any idea that the forms of the lotus, papyrus, &c., which he accidentally conventionalised, were "not only so many forms of idealised reality symbolising imagination or emotion, but were also forms calculated to teach some moral lesson or inculcate some important truth." Let Dr. Dresser be content with making "a carpet, a lamp, a bowl, a wall-paper, and a window-hanging" pretty, and leave the "moral lesson" and "important truths" to be taught by the philosopher and minister of religion rather than the pencil of the ornamentist.

I will now beg to allude very briefly to Dr. Dresser's notice of my remarks on "Truth in Ornamental Art." He says that throughout "there is a strange confusion of the principles of pictorial art with those of ornamental art." There must have been a "strange confusion" in the brain of the doctor when he wrote these words, for my letter especially draws attention to the distinction between the language of pictorial and the mere voice or tune of ornamental art. Then, because I say that "truth in ornamental art is the accomplishment of its purpose or promise," he says that by the same reasoning "the rogue uses true words if he thereby induces the widow to place her little money in a bubble company." On whose side is the illogic? Can any definition of truth in ornamental art contain inference that a rogue may swindle? Is there no difference between truth in decoration and truth in business? In my previous letter I endeavoured to show that there was, and others have endeavoured to show the same thing, but Dr. Dresser persists in shutting his eyes to it. Yet he seems to imply that there are more sorts of truth than one in ornamental art, for, after confessing that he agrees with my definition of that truth, he says that "the truth of which he speaks has nothing to do with the truth of which I speak." Will Dr. Dresser tell us of *what* truth he speaks? He says something about not meaning an opera-box, nor a coach-box, nor the plant box, but a Christmas-box. What *does* he mean?

I have now only to say that, in quoting a portion of my remarks preceding the reference to the gates of Ghiberti, there is an evident unfairness; the idea conveyed is so incomplete, and the advantage taken of it so eager, that it is as much the commission of a falsity as may be in stating "the truth, but *not* the whole truth."—I am, &c., William H. Goss.

Stoke on-Trent, March 11th, 1871.

BALANCE OF TRADE.

Sir,—Mr. Welton, with customary discrimination, has called attention to the fallibility of returns of imports and exports in relation to the balance of trade.

It is quite possible that returns of imports at a Custom-house may be much smaller than those of exports, without any loss being incurred. The exporter's transactions are not settled at the Custom-house, but in his own counting-house or warehouse, and the profit between the Custom-house estimate and the actual sale may meet the operations. The export rate of entry does not represent a real value, because the goods may be sold at a higher rate in the foreign market, at a lower rate, or, if sold at a higher rate, may sustain a loss in the returns. Such entries, consequently, include in many cases a fallacious profit.

These are only some among the many causes which suggest caution in accepting the notion that India has been impoverished in the last few years, or that there is any ground for the representations that in the last hundred years or ten thousand years this country has increased a debt towards her of five hundred millions without interest, or of thousands of millions with compound interest.—I am, &c.,

Hyde Clarke.

32, St. George's-square, S.W.,
31st March, 1871.

GENERAL NOTES.

Indian Colonisation.—Peshawur is called the Valley of Death. In fourteen months (since its arrival in this pestilential place) the 38th Regiment has sent into hospital 2,117 admissions of ague and fever alone. Peshawur fever clings to the constitution for years. Until some sanitary remedy may be found out, it is recommended a hill-station may be found for the men. English soldiers in a hill settlement become feeders of colonisation; they consume local produce, and encourage local industry, the growth of tea and cinchona, and some afterwards find employment in the hills.

Colonial Reporter and Museum.—The ordinary meeting of the Royal Colonial Institute was held on Monday, when the paper read was on the appointment of a reporter on trade products for the colonies, which was followed by a long and interesting discussion. Lord Bury, M.P., the president, said, on behalf of the Council, that the proposition was so beneficial, and of such importance in all its bearings, that the Council considered no time should be lost in bringing it into operation. He therefore moved a resolution, which was carried unanimously, that a committee be appointed for this purpose, consisting of the members of the Council, Mr. Hyde Clarke, and Mr. P. L. Simmons, to address the government and take the necessary measures. Mr. H. W. Freeland threw out a suggestion, which was well received, that an application should be made for co-operation to the Council of the Society of Arts, which during its long career has done so much for the colonies and India. The subject of a Colonial Museum in connection with the proposed department, on the plan of that conducted by Dr. Forbes Watson, was considered, and particularly the adaptation of the East London Museum.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

April 12.—On "Boiled Oil and Varnishes." By Charles W. Vincent, Esq.

April 19.—On "The Economical Construction of Workmen's Dwellings, and especially in reference to Improving the Health and Habits of the Class." By J. H. Stallard, M.D.

April 26.—"Photography in the Printing Press, being a description of the working of the Heliotype Process." By Ernest Edwards, Esq., B.A.

May 3.—"On the Production of Artificial Cold." By Professor John Gamgee.

MEETINGS FOR THE ENSUING WEEK.

Mon. .. Geologists' Association. Excursion to Cambridge.

Tues. ...Medical and Chirurgical, 8½.
Photographic, 8.

Wed. ...**SOCIETY OF ARTS, 8.** Mr. C. W. Vincent, "On Boiled Oils and Varnishes."
SOCIETY OF ARTS, 8. First of a Series of Six **CONCERTS** at the **ROYAL ALBERT HALL** in aid of a National Training School for Music.
Graphic, 8.
Royal Literary Fund, 3.
Archæological Association, 8.

Thurs...Mathematical, 8.

Fri.......Astronomical, 8.
Archæological, 4.
Quekett Club, 8.

Sat ......Associated Arts Institute, 8¼. Mr. F. S. Potter, "That Art is properly in itself an End, and not merely a Means to an End."
Royal School of Mines, 8. Dr. Cobbold, F.R.S., "Geology." (Swiney Course.)

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FRIDAY, APRIL 14, 1871.

PROCEEDINGS OF THE SOCIETY.

EIGHTEENTH ORDINARY MEETING.

Wednesday, April 12th, 1871; P. Le Neve Foster, Esq., M.A., Secretary of the Society, in the chair.

The following candidates were proposed for election as members of the Society:—

Beazley, Captain, Army and Navy Club, S.W.
Day, Charles, 16, Mount-street, Berkeley-square, W.
Dykes, Robert C., 4, Devonshire-villas, King's-road, Peckham, S.E.
Francke, Abel P., 84, Portsdown-road, Maida-hill, W.
Francke, D. O., Gottenberg.
Phipps, Captain, R.N., *Warspite* Training School, off Charlton.
Routh, William Dehague, 14, St. James's-square, S.W.
Sevastopulo, Michael Alexander, 18, Leinster-gardens, W.
Thompson, Robert F., Hooghly, Bengal.
Verity, Richard, Ph.D., 35, Warwick-street, Regent-street, W.

The following candidates were balloted for and duly elected members of the Society:—

Boyle, R. Vicars, C.S.I., 9, Stanhope-place, Hyde-park, W.
Brigg, Benjamin Septimus, Burlington-house, Keighley.
Cama, Dorabjee Pestonjee, 16, Holland-villas-road, Kensington, W.
Lardner, George Darley, care of Messrs. Price and Bowstead, 34, Craven-street, W.C.
May, John William, F.R.M.S., 9, Fairfax-road, St. John's-wood, N.W.

The Paper read was—

ON BOILED OILS AND VARNISHES.

By Charles W. Vincent, Esq.

My chief desire on the present occasion is to render as complete an account of the process of oil-boiling by steam as I can, without committing any breach of confidence towards those for whom I have been professionally engaged. A certain amount of reticence is necessitated by this latter consideration, but, at the outset, I may state that it applies only to the particular substances used to give the necessary drying or solidifying qualities to boiled linseed oil, and hence technically termed driers. The process itself may be used with any of the substances commonly employed in boiling oil by fire for the same purpose. The apparatus employed and *modus operandi* being well known throughout the trade, I am rather benefiting than injuring the cause of the manufacturers by publishing an account of the present state of a mode of manufacture which must eventually become the principal source of boiled oil.

The first consideration which presents itself to a practical man, on approaching a subject which he wishes thoroughly to master and understand, is, What do I want to do? the second being, How can I do it? Viewed in this way, it became evident to those engaged in this research that oil-boiling might be reduced to a much more simple and perfect operation than that ordinarily pursued.

The principal worker who has published the result of his researches is M. E. Chevreul, who, in 1856, in an admirable paper in the "Annales de Chimie," definitely pointed out that the act of drying of linseed oil is one of absorption of oxygen, and consequently might more properly be termed solidification than drying (we will, however, retain the accustomed term); next, that many driers act catalytically; and lastly, that too long boiling retarded the drying of the oil. For instance, oil boiled three hours without driers, and afterwards three hours with litharge, dried more slowly than the same oil boiled for three hours with litharge, without any previous heating.

To whom the next discovery is due, viz., that the high temperature attained in oil-boiling by fire is unnecessary, I do not know. I discovered the fact for myself in 1859-60, when engaged in a research for Messrs. Leighton Brothers, of the *Illustrated London News*, on varnishes for printing inks; and at that time I introduced a mode of steam oil-boiling and varnish making which is still carried out by some of the largest makers of printing inks and those kinds of varnishes. The fact is now very generally accepted, though some manufacturers still hold aloof.

There are reasons which interfere with, and which stop the progress of, many arts and inventions, though against reason, and the oil trade is not free from these drawbacks. A principal one is, that the manufacturers are in a great measure tied down by the wishes and desires of their customers, so that in many cases they have to produce rather what the consumers think they require than what they really need. It is this multiplicity of objects which causes the great variety of modes of manufacture of linseed oil for painting purposes. It is a common case to find that what one person, a large consumer, calls a thoroughly good boiled-oil, his neighbour, an equally large consumer, will pronounce entirely unfit for use. Now, it is my earnest wish that, as far as possible, you should hold yourselves free from preconceived notions of what constitutes a good boiled oil or varnish conventionally, and, considering merely the uses to which they are required to be put, reflect how far these requirements are met. My own personal experience has placed certain points before me as of paramount importance, and to these I shall direct your attention. Those characteristics which may be essential to the good quality of one mode of boiling oil, but do not forward results produced when these articles are applied to their various uses, I shall neglect.

Before entering upon my subject, I must remark that no paper read before the Society of Arts on oil-boiling and varnish-making can be complete and appropriate without at least some allusion to that communication on the subject presented by Mr. J. Wilson Neil, for which the Isis Gold Medal was awarded to him in the session 1832-3 of the Society, which was published in the "Transactions," vol. xlix, part 2. It is not within the scope of the present paper to treat of the modes of manipulation, recipes, and precautions which he there so fully, carefully, and, indeed, conscientiously describes; but the fact remains that that paper was the foundation, and remains so to this day, of all the published accounts of modes of manufacturing varnishes. The alterations and modifications which have been from time to time worked out, are more in the shape of mechanical appliances for facilitating rapidity, easing labour, and providing greater safeguards against fire, than improvements of process. The principle of manufacture remains the same, and the varnishes now made cannot be said to be better in quality, though they may be made at a less cost, and in shorter time, than those produced under the processes detailed by Mr. Neil. Many firms still retain modes of operation almost (in some cases quite) identical with those he describes. The paper is still of such value that the Society would, even now, confer a benefit on the trade were they to republish it.

For a process of oil-boiling by fire, Mr. Neil's is nearly perfect; the new process depends on principles entirely different from those he dealt with, and therefore it is necessary to begin the subject, as it were, *de novo*. Linseed-oil is boiled for two reasons, as you all know—firstly, in order to facilitate its drying when spread on thin surfaces, either alone or mixed with paint; secondly, that it may serve as a vehicle for the mechanical suspension of the finely-divided particles constituting a paint; that it may give a certain cohesive power to the mixed paint so constituted, enabling it to adhere to the surfaces on which it is spread, neither running into drops, nor leaving the colouring matters behind, but carrying the whole of the colour evenly diffused through it over the whole surface upon which the paint is laid, and when dry, forming together a surface which is, as far as may be, impermeable to gases and liquids. Technically, these are the two qualities which consumers rightly agree in desiring in boiled oil—that it should be a quick-drying oil, and have a good body. But it is frequently the case—and, in my opinion, they err in so doing—that consumers require in boiled oil, besides these two essential qualities, others in reality quite adventitious, to which, either from experience of some particular sample, from the custom of their trade, or from the mode in which they have been led to believe good boiled oil alone can be made, they attach a fictitious importance. It is of every-day occurrence that, unless the oil complies with these artificial demands, it is unhesitatingly condemned, independently of the two essentials upon which all are agreed. For instance, some persons attach the idea of a particular smell to be a good sample of boiled oil. If all were agreed as to what that smell should be, the desire would be easier to satisfy; but taking it for granted that the smell is a guarantee that the oil has been heated for a certain time at a certain temperature, it is obvious that two samples of oil may have that odour, whilst from the different ages of the oils previous to boiling, the quality of the seed from which they were expressed, or the driers employed, their qualities of drying and body may be widely different. Other persons, again, confine in their opinion good quality to a particular shade of colour and degree of brightness; a third party requires a particular shade of colour, body, and smell combined; others quarrel with the manufacturer if he vary his standard shade of colour, smell, &c. The truth is, that these are circumstances independent of the proper treatment of the oil. The varying qualities of oil require a varied treatment to bring them to one standard of body and drying power. If these be the standards to be maintained, the others, which after all are only indications that the oil has been manufactured, are of no importance. This applies to the ordinary process of boiling oil by fire, and I do not insist but that, if a uniform quality of oil be employed, and the same process always pursued, the colour and smell would be indications of the success of that particular process upon that particular oil; but, at the present day, the field from which you obtain linseed oil is much wider than it was of old; you cannot always buy the oil you prefer, and, of necessity, the mode of manufacture you adopt has to some extent to vary. If once the idea be thrown over that a high temperature is essential to the preparation of a good boiled oil, you at once obtain modifications of these peculiarities of colour and odour, though the other qualities, body, and drying power, may be the same, or even increased.

With these preconceived notions it is that the new process of oil-boiling had and still has to contend, people imagining that unless the boiled-oil attains a conventional standard of appearance, it of necessity must be bad. One of the advantages of the new process is hereby much diminished, since oil-boilers have to adopt expedients to give a colour to the oil which otherwise it would not have to nearly the same extent. And to the practical man an aim has to be added which frets and annoys common-sense and honesty of purpose, viz., that in addition to that of good and improved methods of manufacture, there must be sufficient similarity in appearance to accustomed samples to avoid awakening those prejudices against anything new, merely because it is new, still largely existing amongst the mechanical part of our population. It is the more to be deplored, since the colour of white zinc, delicate blues, &c., are much deteriorated by the dark oil used for mixing with them.

I discovered, in the beginning of 1860, that with suitable driers, I could obtain an oil which, although it had never been raised above the temperature of 228° Fahr., nevertheless, had the body and the drying power of a good boiled-oil. This led me to investigate the subject further, although, the trade being limited, and the persons engaged in it having acquired a certain reputation for a good merchantable article, made by processes which they have not unfrequently worked out for themselves, they have not the same incentive to seek for improvements, or even to adopt them when brought before them, as exists in many other manufacturing processes. I do not claim any merit as an originator of steam oil-boiling, for I have reason to believe that it has been practised in Germany for many years past; but as far as I am personally concerned, I may state that all I know concerning the process I have discovered for myself, not even being aware that it was practised by others for some years subsequently to my own discovery and use of it.

Chevreul's experiments, to which I have previously alluded, form a good substratum for a disquisition on this subject. The principle being clearly laid down that it is the absorption of oxygen by linseed oil which causes its solidification, it follows that all the substances which can be used as driers must be such as are capable of parting with oxygen or dissolving in it, and being themselves oxidisable in combination, they, in that way, increase its absorptive power. There is a class of driers which act whilst mechanically suspended in the oil, as white copperas, &c., for example, increasing its absorptive power by their presence, but leaving no increase of drying power when withdrawn.

The substances which act catalytically belong, in my opinion, to the first class. They part with some of their oxygen to this oil, become to a certain extent deoxidised, and again coming in contact with air they reassume their primal condition, and are ready to do the same work over again. It is this necessity of re-oxidation which caused the introduction of blowing machines for oil-boiling, when their own proper advantages in rapidly giving body to linseed oil at comparatively low temperatures were at once, and to me unexpectedly, made manifest. These catalytic driers are now generally adopted, the effect of their use being simply this (and you will see that the result is a great advance upon previous methods), that by treating the oil with these driers under the influence of heat and air, its own absorptive powers for oxygen are greatly increased, and remain so when the primary incentives to absorption are removed. This likewise has to be borne in mind, that what we want to do is not to render the oil solid or partially so now, but to enable it to become so when exposed to the air.

Many years ago, the late Professor Faraday was consulted as to the possibility of hastening the drying of printing inks, so that work might be milled (that is, compressed between zinc plates passed through closely-set rollers) with less delay after printing. A fortnight was the usual time taken, and, if ordinary driers were used, the whole of the ink would skin on the rollers, with many other inconveniences. Faraday's far-sighted sagacity at once decided that one solution of the difficulty would be by the mechanical introduction of a substance to act as a drier which should be inert till it was exposed to the air. As Professor Faraday's advice and assistance, in a research on the same subject for the same firm was of material service to me, and, indeed, enabled me to supersede the drier in question, I break no confidence by stating that it was binoxide of manganese which almost without experiment he at once pitched upon. By what process of thought he chose this substance I do not know, but the fact remains that he did so introduce it, and for, I think, between 30 and 40 years it was used by the same firm. At the Queen's Bible-office they mill their work three days after printing, if it prove necessary. In order to get the binoxide in a state of division sufficiently fine to mix with printing-ink, he devised a series of washing receptacles, like successive stairs, the finer particles passing on to the lower vessels, being longer suspended than the coarser—a simple yet ingenious arrangement, which enabled the ink to be worked without any risk to the plates or formes from grit.

By properly pursuing this investigation, many other substances have been discovered which exercise this property in a high degree. Without becoming in any way altered, they induce an alteration in the linseed oil subjected to their operation. We may imagine the action as similar to that by which spongy platinum explodes a mixture of oxygen and hydrogen, or a platinum wire is kept red hot by the vapour of ether.

Litharge and the other salts of lead perform the same office whilst in solution in the oil, and to their presence for the most part is the dark colour of boiled oil due. Where the steam process is used, the oil never reaches a sufficiently high temperature to produce carbonisation. By judiciously mixing one of the substances acting catalytically and a lead salt, a drier is obtained, by altering the relative proportions of which the boiler is enabled to produce any required shade of colour. The larger the quantity of litharge, the darker the colour of the boiled oil. A lesser proportion of litharge, accompanied by a greater quantity of the catalytic drier, gives as the product an oil which will dry in the same time, and has less colour. These are the principles of oil-boiling by steam.

The risk of boiling over, and being the cause of a conflagration, was one reason for the distance at which oil-boiling businesses were formerly kept from towns; the abominable smell produced by the evaporation and partial decomposition of the oil was another. Nevertheless, it is not convenient, in the extension of businesses of a disagreeable character, to be constantly driven from the centres of industry, where their articles of manufacture have ultimately to be used, and this has been particularly the case with the oil trade. In a place like London, a very large part of the consumption of boiled oil must be local; or if the oil be exported it is the same thing as far as the manufacturer is concerned, each mile he is driven away from his customer decreasing his profits without any corresponding advantage. It became, therefore, a matter of absolute necessity that means should be taken to stop the intensely disagreeable smells arising from oil-boiling tainting and poisoning the air of the surrounding neighbourhood. This has been arrived at in a perfect manner, as an adjunct of the steam process.

The best form of pan for oil-boiling is made of copper, on account of its conducting heat better—an iron one will give equally good results, a little more time being, however, required—circular in shape, with a depth about equal to its diameter, and a rounded bottom. This pan is surrounded for half its depth with an iron jacket, between which and its body steam is admitted as the source of heat.

The jacket and pan should be capable of standing a working pressure of 40lb. per inch. The top of the pan is closed by a dome rivetted to it and forming part of it. This dome is provided with a man-hole, and in the centre is furnished with a stuffing-box, through which passes two shafts, one encircling the other, and each bearing a fan, which fans, by gearing outside the pan, are made to rotate in opposite directions, intersecting each other in so doing, and, as may be conceived, producing a most thorough admixture of any solid and fluid substances submitted to their dashing and cutting action. At one side of the top of the dome is a kind of cupola, from the top of which issues a three-inch pipe, which is carried down to the ash-pit below the boiler furnace. When at work, care is taken that every joint is tight, hence any vapours arising in the interior of the pan have no chance of escaping into the air till they have passed the burning coals. One of the greatest dangers and also disagreeable nuisances being thus obviated, oil-boiling can be and is carried on without objection on the part of either the insurance companies or the public at large, even in the heart of densely-populated districts. I myself boiled oil and made varnish in Milford-lane, Strand, for three years, without increasing the insurance of the *Illustrated London News*, though I used steam from their boilers for the purpose.

At the lower part of the pan, the inch-pipe from a powerful air force-pump penetrates through the jacket to the interior of the pan.

The workman's first care is to see that all his taps and valves are in good, efficient order, and turned the right way, after which the mode of manipulation is the following:—

The linseed oil is first shot into a large tank, holding one batch for boiling (about two tons is the usual quantity), and allowed to settle for four or five hours, according to the time taken for boiling the previous batch, matters being so arranged that as soon as one batch is pumped up into the pan another is shot into the tank, so that the oil may have as long a time for freeing itself from mechanical impurities as can be spared for that purpose. The waste steam from the pan passes through a coil of inch and a-half iron pipe placed in this tank, so that the oil is also being warmed, this much facilitating the separation of particles of dust, mucilage, &c., and also saving time when the actual boiling commences. The time having arrived when the pan is ready, the oil has acquired a temperature of about 95° Fahr. before it is pumped up (in the works I am describing the arrangement of pumps used took about seven minutes to elevate two tons of oil twenty feet), full pressure of steam is then turned on the pan, and the fan started. At first there is little or no disagreeable smell to be perceived. If the man-hole of the pan be open, an observer can watch the oil churning round with very little frothing, although the blades of the two fans, rotating in opposite directions, cause such a perfect commingling of the oil and the air that is in the upper part of the pan, that, looking in upon the whole fluid mass, it seems as if the bulk were greatly increased, as it goes on swelling and chafing, with a hollow rumbling noise, at the rough treatment it is receiving. A few minutes later, a faint, sickly odour is to be perceived, something like the smell of the raw oil, but intensified as to its woody constituents. The oil is now nearly hot enough for the air to be turned on. This may be done as soon as the steam reaches a pressure of 35 lbs. to the square inch on the pan. Directly this is done, the character and the appearance of the oil changes; the bulk appears to be still more increased, a foaming, seething, whirling vortex presents itself, the colour suddenly changes from the dark brown it previously exhibited to a mass of pale yellow bubbles, and the strong pungent odour universally accompanying the boiling of oil makes itself known and felt by the discharge from eyes and nose, if the curious observer does not take the hint that it is time the man-hole was closed, and the cauldron left to complete its witchery in darkness and solitude, if not in silence. But before it is left to itself, it may be well to observe that, before the air was turned on, a taper would burn in any part of the space above the oil where it was safe from being extinguished by splashes. After the air has been blown through the oil for a short time, if both the flue and air-pumps be stopped, so that a perfectly quiescent atmosphere remains above the oil, it is found to be perfectly incapable of supporting combustion. A few inches inside the man-hole, I have found that a brown paper torch, dipped in turpentine, has been immediately extinguished.

If a dark boiled-oil is desired, the driers should be put in as soon as the oil is thoroughly heated throughout its bulk, which is commonly about half an hour after the steam has an indicated pressure of 35 lbs. They are ground to a fine powder, mixed with oil, and are introduced through a funnel, with a stop-cock intervening between it and the pan, in a thin stream, so as to secure as perfect a distribution of them as possible throughout the oil. The quantity of driers used amounts only to about three quarters of a pound to each hundred-weight of oil, so that the necessity is obvious of great pains being taken to secure and maintain as complete a diffusion through the liquid as can be attained, and thus coincide with the theory of this method of oil-boiling, which requires that each particle of oil should be in contact or proximity to a particle of the drier used and oxygen at one and the same time.

Subsequent to the introduction of the driers, no attention is required to the process save to see that the air-pump and fan are kept constantly at work, and that the pressure of steam on the pan does not sink at all below 30 lbs., 35 lbs. being that which ought to be adhered to. The right quantity of air to be introduced for the oxidation of a given quantity of oil has not been ascertained. In practice, it is found that some oils require, and will consume, a larger amount than others; the custom is to throw in as much as the oil will take without frothing up and priming into the condenser. The cooling effect of the air thus introduced is much less than might be supposed, in point of fact, the pressure to which it is subjected in overcoming the weight of the oil, lifting the heavy valves, and the friction tubes it passes through, considerably raises its temperature before it enters the pan; it is generally found to be raised some 20 to 30 degrees above the temperature it previously had by the time it reaches the oil. Indeed, the tubes through which it passes not unfrequently become hotter than the bare hand would be able to hold in a firm grip. In four hours' time the oil is generally fit for removing from the pan to a tank, where it can remain a sufficient time for the major part of the driers to settle out from it. When bright, it is then either pumped or run off into other tanks for warehousing, or may be allowed to remain where it is for future use, if there are plenty of working tanks.

The mode of emptying the pan is by allowing the oil to rush out through a two-inch tap in the centre of the bottom of the pan into pipes which are connected by running joints, and lead it in any desired direction. Sometimes, a little difficulty occurs in dropping the oil, through the orifice of the tap leading into the pan becoming stopped up by an accumulation of driers, or by pieces of the old skins of oil which may have fallen from the sides of the pan. This may be entirely obviated by causing the air to enter the pan through this tap, and putting the second tap beyond the air inlet as an outlet for the oil. The pressure of the air-pump will then suffice to remove any ordinary obstruction; but if a stoppage, nevertheless, should occur, nothing remains but to probe the tap with a long, thin rod from the top of the pan. Until this simple expedient of letting in the air through the oil outlet was adopted, this terrible nuisance was of almost daily occurrence.

The vapour which comes off from hot oil into which air has been blown is so intensely acrid and pungent that human nature seems to be incapable of ever getting used to it. For my own part, I would much prefer entering a freshly-opened bleaching powder chamber to an oil-pan, even after the oil has been run off, and the pan cooled down. There was no task in the works more thoroughly abhorred than that ten minutes to half-an-hour, occasionally longer, during which, with the man-hole open, the workman was raking and poking between the radii of the fans to clear and find the outlet. With this now happily occasional exception, and for the few minutes during which the hot oil is being transferred from the pan to the tanks, this method of oil-boiling produces no disagreeable smell in the vicinity, the fumes being carried away with the surplus air pumped through the oil, and perfectly consumed, so far as noxious odour is concerned, in the furnace of the boiler. Members of this Society have frequently the opportunity of witnessing the efficacy of the operation of this process during some of the lectures delivered here, the air of this hall being kept free from troublesome fumes by a similar arrangement. From this paper the chemical questions involved must be, for the most part, excluded, as it would be scarcely possible for me to enter far into the subject without betraying confidence, the driers used and their *modus operandi* being essentially connected. I may state, however, that the air does not play the part which many have assigned to it, and does in reality effect nothing towards making the oil a drying one. I have boiled linseed oil with air alone, but without driers, for three days consecutively, keeping up a high temperature the whole time, and the resultant boiled-oil has taken precisely the same time to dry as the raw oil from which it was prepared. The body, however, had so much increased that the consistency was more that of a varnish than an oil.

If oil be subjected to heat alone for the same space of time, without any air except such as comes in contact with its surface, there is no such increase in consistence as in the former case; the oil simply becomes more greasy, has less difficulty in penetrating capillary tubes (as, for instance, those of paper, plaster, &c.) than it previously had, and has decidedly less drying powers. The oil which has been boiled with air is less greasy and has a greater consistence. To sum up the process in a few words, I think we show we have the means at hand of meeting all the requisites which were stated to be necessary. The close apparatus in which the work is performed secures the manufacturer alike from annoying his neighbours and injuring his own men. The air and heat secure a sufficient amount of body. The driers produce any required shade of colour. The time of drying, *i.e.*, about six hours in summer and eight hours in winter, according with the old standard of drying power. Oil can be made to dry in much less time, but this is not considered to be desirable. The mechanical appliances reduce the time of the operation to about one-fourth of that which in former years was thought essential. In the ordinary working day, starting with cold oil and a cold boiler, two batches, of two tons each, can be boiled without causing undue driving of men or machinery.

Before leaving this part of the subject, it may be as well to note, that for boiled-oil which has to be exported, long experience has shown that it is advisable in all cases to add to each barrel or drum of boiled-oil a small proportion of raw oil. After a one or two months' voyage the oil becomes brighter than it was when first shipped, and the risk of becoming what is called "fatty," and not free enough in working, is thereby avoided. For a three months' voyage, one gallon of raw linseed may be added to each four gallons of boiled-oil with most beneficial results, particularly if the boiled-oil be anything under one month old.

Varnishes.

As you all know, the main uses to which varnishes are applied are, to protect the material over which it is spread from atmospheric influences, accidental rough usage, &c.; to bring out and display more fully the varying texture of different woods; and, finally, to give a fine gloss or appearance of polish to the surfaces to which it is applied. As commonly constituted, an oil varnish (and with these alone I propose to deal) consists of some hard gum dissolved in linseed oil. This is the substance of the varnish, the two being re-dissolved in turpentine to afford the means of spreading them out in thin layers. As far as regards the ultimate value of the varnish, the turpentine is merely so much waste material. It may, if it be of inferior quality, injure the varnish with which it is mixed, but however good it may be, it can do nothing to benefit or improve a varnish which itself is in reality nothing but the mixture in various proportions of some one or more hard gums in linseed oil.

For the convenience of better understanding the *rationale* of the mode of procedure, it will be well if we commence our observations at the end instead of beginning of the process.

Turpentine, being applied for the purpose of thinning down the body of the varnish, and that body being, when cold, almost solid, has to be added whilst the mixture of gum and oil is still hot. The heat causing an increased evaporation, and consequently a loss of turpentine, the temperature is allowed to get as low as can be, consistently with a perfect and complete admixture of the spirit with the matter being secured. This is, to some extent, contrary to old-fashioned notions, but the varnishes resulting from mixing in the turpentine at a high temperature and at a low one being identical, the loss of so much evaporated material is not now taken as an essential part of the process. We have also one less risk of fire, since the whole varnish is now removed far from any fire, and out into the open air when practicable, before the turpentine is added. The quantity of turpentine required under these circumstances is much less than that stated in the various published recipes for varnish making. Enough is commonly added to bring the whole mixture to a consistence a little stiffer than linseed oil. The loss by evaporation, whilst clearing and ageing in tanks, previous to its being sent out, gives it the amount of body which you are accustomed to see it have. The next thing to consider is the body of the varnish. Time would not permit me to give a complete description of the various gums which are or may be used; I can do no better than refer you to Mr. Neil's paper for information on this part of the subject. There is one gum, however, which has come very largely into use since his time, and that is the "kauri," New Zealand gum. It is rather dull in appearance, but it is tolerably hard, and melts at so low a temperature, that the dust and chips made by cleaning the outside of large pieces can be utilised by a skilful man, without the gum being coloured by the carbonisation of the woody matter in it. The varnish made from the better qualities of kauri have a very good gloss. When dry, they are pale in colour; dry quickly, and are not so liable to crack when exposed to the sun as better varnishes. After a few months' exposure to wet, however, the whole of the gloss disappears, and, though the protecting surface remains, it becomes, through its abrasion, a harbour for the dust and dirt, and is thus rendered far from ornamental to the place of its attachment.

The temperature at which the mixture of gum and oil intended to be used melts is now recognised as forming a basis for the temperature to which the oil is to be heated previous to the introduction of the melted gum, the whole running, when the two are fairly incorporated, being also kept much under the degree of heat which was formerly considered necessary. In fact, it is in this respect that the present mode of varnish-making chiefly differs from the modes formerly employed, the greatest care being now taken to keep the temperature throughout the process as low as is consistent with perfect admixture of the several ingredients.

The next point to which I shall direct your attention is the apparatus used for the modern process of varnish-making. In the first place, iron vessels generally take the place of copper ones for all common varnishes, the bottom of the gum pots alone remaining copper, as heretofore. The lower temperature employed is found not to affect the metal, and the introduction of impurities from that source is no longer feared.

In the next place, instead of heavy copper stirrers, light thin plates at the end of the rods are used to cut the gum, &c., the greater velocity with which they can be manipulated securing more perfect mixing than of old.

In the third place, a tramway is laid down from the furnace in which the mixed gum and oil is heated, which usually runs from the shed into the open air. If, therefore, from any accident the mixture takes fire, it can be at once removed to a place of safety, where it can be put out at more leisure.

The boiling pot, which holds about 100 gallons, has a closely-fitting conical cover, which, if it can be put on, at once extinguishes the flame if it be not too far a-head. The last improvement has only recently been introduced, and is not yet generally adopted. Two galvanised iron shafts are erected side by side; one corresponds with the gum pot, the other with the boiling pot; the upper end of these shafts alike communicates with the main furnace shaft. The lower ends are fitted with caps, which are so balanced by counterpoises that they can be slid up or down their respective columns. To these caps heads are attached at right angles, which can be brought over, and which fit closely on to the gum pot and boiling pot respectively, and, when in that position, have free communication with the chimney-shaft. The front of each hood is cut away and fitted with a diaphragm, slit in such a manner that the contents of the pots can be stirred, and is removable when it is desired to see into them.

The advantages of this arrangement are obvious without further description; in place of the workmen being annoyed by the dense and pungent vapours which escape from the heated gum and oil, the whole are removed, and nothing whatever comes into the air of the shed except at the time when a pot of the gum is being tilted into the boiling pot, or when the whole has to be removed into the air. The reduction of smell, as regards the neighbourhood, is so great, that in the comparatively rare intervals when a disagreeable vapour does come off, the air of the yard mixes with it sufficiently to neutralise the effect exterior to the works. This latest improvement is due to Mr. Bewicke, of Hackney-wick, who, in consequence of a disastrous fire at his works having been caused in a great measure by the men being so suffocated with the fumes from the boiling pot that they were unable, when it took fire, to extinguish it in time, has been impelled to seek for such more perfect appliances as would bring the whole system more under control than had previously been the case. I think you will agree that the plan deserves to succeed, and from the experience it has already had, I believe it will do so. Old varnish makers, standing at the furnaces when they are in full operation, seem at first almost at a loss to know what stage of the process they are at, from the want of their accustomed choking miasma.

DISCUSSION.

The Chairman, in inviting discussion on the subject, said, if any members of the trade were present, who could furnish the meeting with any of the information which it would seem was rather kept secret, it would no doubt be of great advantage.

Mr. Tinne said he had hoped some practical man would have made some remarks on the subject, which he thought would be of great value. It was one very interesting to him, as he had seen abroad, especially in Holland, the beautiful character of what was there called porcelain painting, and he believed its great merit arose from some particular purity in the preparation of their boiled oil and varnishes. He had been specially anxious, in the painting of his own house, to apply that same beautiful white porcelain painting which he had seen in Holland, but as yet he had not seen anything of the kind in this country. Allusion had been made to this improved process having originated in Germany, and no doubt Mr. Vincent was aware that the same thing existed in Germany as he had alluded to in Holland, and which might be noticed even on the Dutch ships which came to this country. He should much like to see the same kind of thing introduced here, for, unfortunately, what was called porcelain painting generally turned very yellow in a short time. He could only ascribe this to either ignorance on the part of the workmen, or impurity in the materials employed, and he hoped, therefore, that some improvement would soon be made.

Mr. Nicholson said, with reference to what had just been remarked about oil not being produced in this country capable of keeping the colour of the paints used in its original brightness, it was well known in the trade that there was an oil almost colourless, which was used largely by decorators for the finer class of work. It was an oil which had not been heated in any way, but simply oxygenated, and it had a powerful drying tendency, almost equal to that of boiled oil; and if Mr. Tinne would confer with any decorator of note he would tell him that that oil was in constant use. He had been much struck with the low temperature referred to by the lecturer in the boiling of oil, which he thought was about 260 degrees, and that the oil then showed no fatty tendency. It was, however, well known in the trade that oil might be boiled up to 600 degrees without showing any such tendency, in fact, that was the ordinary heat to which it was subjected in the process of trial before used for varnish making. An oil would hardly show its impurities at a less temperature, certainly not under 500 degrees; at all events that was the opinion of the trade. With regard to varnish-making, the method described seemed to him somewhat of a primitive nature, for there was a process in common use whereby the whole of the vapour arising from the oil-pot and from the gum-pot was wholly absorbed and condensed into liquid, not passing into the chimney at all.

Mr. Vincent said he had great pleasure in agreeing with what had been said by Mr. Tinne with regard to the character of Dutch and German paintings, and it was really the fact that the oils which were boiled abroad had that characteristic which had been spoken of; they were, as a rule, paler than oils boiled in England, and, having no driers dissolved in them, they did not deteriorate the colours with which they were mixed, and thus the maximum of brightness was attained. He supposed the last speaker had referred to what was generally called "French oil varnish," which was a thing which had been known in the trade for the last 30 or 40 years for the purpose of mixing with pale colours, and for producing very lightly coloured, delicate paints. What he aimed at was this. There were a large number of persons in the trade who were not aware of the great advantages of using these pale oils, or otherwise there would not be so much oil boiled of such a dark colour. There was a sample on the table darker even than that which he had shown on the screen, and that was boiled especially to the order of a large consumer, who would have oil of that colour and character, and who used about a ton and a half per week at this time of the year. If there was not a demand for these dark coloured oils they would not be produced. Mr. Nicholson's other remarks were in accordance with what he had already stated, that there were a great many processes in use which were not commonly known. He himself could only describe what passed under his own observation, the varnish and oil trade being, as he had remarked, a secret one. Mr. Nicholson had not stated the particulars of the process he had mentioned for removing the vapours arising from the gum and oil-boiling apparatus, and even the one he had himself described had only become known to him within the last few weeks, and he had had a good deal of experience. It was simply because of these processes being kept secret that people who would be very ready to adopt improvements, and so avoid being troublesome to their neighbours, and at the same time be able to produce a better article, were not able to do so, and everyone had to discover for himself what other persons perhaps had long been practising. The Society of Arts had been instrumental in throwing light upon some of these dark doings many years ago, and if his paper, imperfect as it was, had the effect of drawing attention to the subject, and inducing those who had more knowledge and experience in the matter to come forward and make known the results of their experiments, all the purposes he had in view would be answered.

Mr. Nicholson said he should have much pleasure in showing Mr. Vincent over his manufactory if he had any disposition to see it.

The Chairman then proposed a vote of thanks to Mr. Vincent, which was carried unanimously, and the meeting separated.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The First of the Six Concerts organised by the Society in aid of a National Training School for Music was given at the Royal Albert Hall, on Wednesday evening, the 12th inst. Sir Michael Costa conducted, and about five thousand persons were present.

The following was the Programme:—

PART I.

1.—Overture .... (Der Freischutz) ....*Weber.*
2.—Air........."Va dit elle" (Robert le Diable) ....*Meyerbeer.*
Madame LEMMENS-SHERRINGTON.
3.—Allegretto Agitato ...... (Hymn of Praise) ......*Mendelssohn.*
4.—Barcarolle... "O ma maitresse" (Ercolanum) ...*F. David.*
Mr. CUMMINGS.
5.—Piano Forte Concerto in E flat........................*Beethoven.*
Madame ARABELLA GODDARD.

PART II.

1.—Overture............... (Siege of Corinth) ....*Rossini.*
2.—Aria .... "Della Rosa il bel vermiglio" ....*Rossini.*
(Bianca e Falliere.)
Madame LEMMENS-SHERRINGTON.
3.—Solo Violin ... (Adagio from No. 9 Concerto) ... *Spohr.*
Monsieur SAINTON.
4.—Duo "Du Repos voici l'heure" (Philemon & Baucis) *Gounod.*
Madame LEMMENS-SHERRINGTON & Mr. CUMMINGS.
5.—March .... (Tanhäuser) ....*Wagner.*

The following explanation of the work of the Society of Arts with regard to national musical education was printed with the programme:—

From the very commencement of its existence, the Society of Arts has taken an interest in promoting the teaching of music as one of the fine arts, and in the improvement of musical instruments and appliances for teaching. Of late years the Society has made special efforts to extend and improve the system of national education, and it has considered that music should form an essential part of that education. Nearly all foreign countries have a conservatoire, the function of which is to foster and develop the musical talents of the people, but England has no such institution. In 1865 the Council of the Society appointed a Committee for the purpose of considering the subject of musical education, and to obtain such information both from musical professors and others at home, and with regard to musical schools abroad, as would enable them to suggest how a really National Training School for Music could be established in England. After making every inquiry, the Committee embodied the information they had obtained in a petition presented to Parliament on the 20th July, 1869, by the Right Hon. Sir John Pakington, Bart., M.P., in which they also suggested the organisation they thought likely to obtain the object they had in view. The following extracts are from the petition:—

"That the wide cultivation and use of music in this country, from the earliest period, especially before the dissolution of the monasteries, appeared to the committee to render it superfluous for them to dwell on the importance and value of this important branch of the fine arts. They did not consider it within their province to enter upon the subject of the various systems of teaching music; but their inquiries were rather directed to ascertaining the principles and the nature of the administration by which the general musical education of the people of this country might be systematically conducted on a scale and with results at least equal to those of the academies which flourish on the continent of Europe.

"That it appeared from the evidence that the Royal Academies of Music of Paris, Brussels, and Naples, furnished instances of highly successful institutions, on an extensive scale, and presented especially useful suggestions. At Paris above six hundred out-door students, selected from all parts of France, are educated, and at Naples between two and three hundred students are trained. In both cases the education is gratuitous to the students, the expense being paid by the state; at Brussels there are above 500 students, whose expenses are defrayed partly by the state, and partly by the municipalities.

"That your petitioners submit that a national academy or musical training-school, in connection with the education of the people, for the United Kingdom, its colonies and dependencies, is a public necessity, and, when created, should provide for the instruction of a certain number of students, supported by public funds, and a certain other number paying adequate fees. That certain students should receive gratuitous training, and that they should be selected by public competition.

"That your petitioners respectfully submit to your Honourable House that a national musical training-school can never be maintained by private enterprise, but only be established by the State, and be supported by public funds, disbursed under Parliamentary and ministerial authority.

"That your petitioners are of opinion that as our colonies and India send many young persons to this country for general education, it might reasonably be expected that they would be induced to send persons having musical gifts for musical education if the facilities for training were as efficient as they might be.

"That, so far as your petitioners are enabled to judge from the evidence, they consider that at least two hundred free students should be trained, that they should receive grants for maintenance, at varying rates, in accordance with the system which is found to work so successfully in the Art Training Schools at South Kensington. That, should Parliament see fit to create a proper and responsible training school in connection with public education, your petitioners have reason to believe that private individuals will come forward and endow scholarships."

At the same time that the petition referred to was presented to the House of Commons, an appeal to the government was made by the leading operatic and other musicians, to the number of 130, and including among them Madame Tietjens, Madame Lemmens-Sherrington, Mr. Sims Reeves, Mr. Santley, Dr. Wylde, Mr. A. Mellon, Mr. G. Payne, Mr. J. F. Barnett, Mr. C. Harper, and Herr Rokitansky. This appeal "respectfully" advised the establishment of a new school of music, to be presided over by competent professors, State appointed, and under State control. They furthermore advised "the establishment of an English National Opera, believing that genuine and useful impulse might be given to the development of musical genius in this country, ultimately redeeming it from the disgrace of being the only European nation that fails to cultivate its own national music." This concluding sentence of the appeal, coming from such a body of those who, in the practice of their profession, have had the greatest opportunity of experiencing the want of musical education in this country, is worthy of careful consideration.

In continuation of its labours, the Musical Committee of the Society of Arts, in 1869, sent out, through the Foreign-office—Lord Clarendon, the then Secretary of State for Foreign Affairs, acceding to the request of the Committee to be allowed to do so—a number of queries with regard to the official musical pitch in use in continental countries. In the course of time some very valuable information was received with regard to the pitch in France, Germany, Sweden, Prussia, Belgium, Russia, Italy, and Austria. This information was published, as was the evidence of the various musical professors mentioned above, and the general results of the labours of the Committee, in the *Journal* of the Society.

In the recent parliamentary action with regard to National Education the Society took the warmest interest, and it endeavoured, as far as it possibly could, to impress upon the government the necessity of including music in the code of education. On January 20th, 1871, a deputation from its Council waited upon the Right Hon. W. E. Forster, to urge upon him the importance of the teaching of music being made compulsory in all state-aided schools. A statement made by one of the deputation was, that "there was at the present time such a demand for schoolmasters who could teach music, that a man who could do so was preferred before one who possessed much higher attainments in other branches of knowledge." When the new revised code of education came out, a few days after the deputation had waited upon Mr. Forster, it was found that music had been omitted, but Mr. Forster, in answer to a question in the House of Commons, stated that it was only a temporary measure, in order to put the whole matter on a better footing, and that schools which did not make vocal music a part of their work would suffer, in a pecuniary point of view, by the withdrawal of a portion of the capitation grant they might earn.

Desirous, therefore, of taking some practical and decisive measures with regard to the establishment of a National Training School for Music, the musical committee recommended the Council to take advantage of the opening of the Royal Albert Hall, and to give a series of six concerts, in order that a fund might be raised for starting so important a scheme. This the Council acceded to; but, as the Society had no funds at its disposal available for such an undertaking, the members and the public were asked to guarantee a sum of two thousand pounds, that being the estimated cost of the six concerts. The appeal thus made was most generously responded to, the total sum of £2,548 was soon guaranteed, in addition to which a large number of tickets were subscribed for—the members of the Society alone subscribing to the amount of £1,200.

There is a fitness in the first public performance in the hall being thus devoted towards the promotion of the art of music, not for the benefit of individuals, nor for the display of the exceptional musical talent of the few, but for the benefit of the nation at large, and in order that its humanising influence may be felt in every corner of the land.

W. G. L.

The Second Concert will be given on Wednesday evening next, **APRIL 19th.**

The following is the Programme:—

PART I.

1.—Overture .... (Ruy Blas) ....*Mendelssohn.*
2.—Duett .... "Giorno d'orrore" ....
3.—Allegretto... Symphony, No. 7 (Semiramide) ...*Beethoven.*
4.—Air... "I dreamt I was in Heaven" (Naaman) ...*Costa.*
Miss ENRIQUEZ.
5.—Overture ....(Semiramide) ....*Rossini.*

PART II.

1.—Overture ...."Ruler of the Spirits"............*Weber.*
2.—Scena ...... "Softly Sighs" (Der Freischütz) ......*Weber.*
Madame CAROLA.

3.—Solo Ophecleide ......"Oh, Ruddier than the Cherry"........... (Acis and Galatea) .... *Handel.*
Mr. HUGHES.

4.—Duett.................. "Dolce Conforto"..............*Mercandante.*
Madame CAROLA and Miss ENRIQUEZ.

5.—Overture ....(Zampa)....................*Herold.*

The Hall will be open at 7; performance will commence at 8 o'clock. Evening dress.

The prices for admission to Reserved Seats at these Concerts are as follows:—

For One Concert.

	£	s.	d.
Gallery	0	2	6
Arena	0	7	0
Balcony	0	7	0
Amphitheatre	0	10	6
A Box holding 5 persons	3	3	0
" " 8 "	4	4	0
" " 10 "	5	5	0

Promenade—One Shilling.

For the Six Concerts.

	£	s.	d.
Gallery	0	15	0
Arena	2	2	0
Balcony	2	2	0
Amphitheatre	3	3	0
A Box holding 5 persons	15	15	0
" " 8 "	25	0	0
" " 10 "	30	0	0

Tickets may be obtained at the House of the Society of Arts, John-street, Adelphi, W.C.; at the Royal Albert Hall, Kensington-gore; at the Royal Horticultural Society's Offices, Exhibition-road; at the ticket-office, Exeter-hall; of Alfred Hays, the City Box-office, 4, Royal Exchange-buildings, E.C.; Messrs. Keith, Prowse, and Co., 48, Cheapside; Mitchell's Library, Old Bond-street, W.; Messrs. Chappell, 50, New Bond-street, W.; Austin's Ticket-office, St. James's-hall; S. M. and A. Warren's Ticket-office, 1, Edwardes-terrace, Kensington, W.; and the usual agents.

CANTOR LECTURES.

The third course of Cantor Lectures for the Session will be delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will consist of Five Lectures, commencing on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed.

Lecture I.—Monday, April 17th.

General Structure and Affinities of Ruminants, and their importance as a Food-producing group.

Lecture II.—Monday, April 24th.

The Bovine Ruminants, more particularly in relation to the question of Parasitism.

Lecture III.—Monday, May 1st.

The Ovine Ruminants, especially in relation to the Mortality caused by Trematode Entozoa.

Lecture IV.—Monday, May 8th.

The Cervine, Antilopine, and Cameline Ruminants, with some account of their Parasites.

Lecture V.—Monday, May 15th.

The general question of the Parasitism of Ruminants in relation to Sewage and Public Health.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. (now Sir) W. Fothergill Cooke and Professor (now Sir) Charles Wheatstone, F.R.S., in "recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. (now Sir) Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Council invite members of the Society to forward to the Secretary, on or before the 22nd of April, the names of such men of high distinction as they may think worthy of this honour.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

IMPLEMENTS OF AGRICULTURE USED IN PORTUGAL.

Amongst the commercial reports received at the Foreign-office from her Majesty's consuls, we find there is an interesting account of the implements used at the present time by the husbandmen in Portugal. Mr. Consul Crawfurd, writing from Oporto, the central point of the three provinces embraced in his district, remarks that the latitude is nearly that of Rome and Constantinople, but the mean annual temperature, though not determined by any series of continued or trustworthy observations, is probably higher than either of these cities. The mildness of the winters and early springs, and the tempered heat of the summers, allow of the cultivation of plants and of trees which do not thrive in the climate of central Italy, nor in that of Roumelia. The mode in which the tillage of the soil is conducted, judging from the implements and tools employed, seems but slightly changed from what it must have been in the earliest and most primitive times. The ploughs differ very little from the old Roman type, and the descriptions left by the Roman writers applies very nearly to the simpler and smaller of the two kinds now used by the Portuguese. This plough consists of a beam, body, share, and sole with one stilt. There is neither coulter nor mould-board, but the share is carried far forward, as in the Kentish turn-wrist plough, being lance-shaped and turned slightly downwards. The work of the mould-board is done by two upright pegs at the heel of the plough, which pegs press out the soil on either side. The whole plough can easily be carried a-field on the shoulders of a labourer. It works only four or five inches deep, and stirs the soil in parallel open furrows, and where the land is light and crumbling, as is generally the case, they would seem to be sufficient. The other plough employed is a modification of the smaller and simpler one. It has two stilts, a low double mould-board instead of the upright pegs, and occasionally a broad coulter is inserted in a hole in the beam, which works behind the point of the share and scoves, to turn over the furrow slice, its inclination being changed at the end of each furrow; but the Portuguese ploughman has often no occasion to alter his turn-furrow, being given to the bad practice of driving a curved furrow from the boundary of a field, and continuing it, circularly, to the centre till the whole field is finished. This plough will work as deep as seven or eight inches. The harrow is also of the rudest construction, having fifteen to twenty teeth of iron or wood set, quincunx fashion, into a strong, oblong-square, wooden framework, with one cross-bar. Rollers are unknown, but, as a substitute, the harrow can be reversed and weighted with stones, and then drawn, sledge-wise, over the land.

The hoe is indispensable in Portuguese field husbandry. The larger kind is a flat piece of iron, shaped like, and two-thirds as large as, an English spade, fixed at a slightly acute angle upon a long handle. It is used in earthing up maize, in planting field cabbages, in making and altering water-courses, and in supplementing imperfect ploughing. It is handled with a skill that no labourer used to the different movements required by a spade could probably attain to. Ground can be prepared by it for seeds or for planting more quickly than it can be dug by a spade, although it is less completely stirred and turned over. The hoe is, perhaps, at a disadvantage as compared with a spade or shovel in loading earth or other material into a cart, in doing which the labourer has to use a basket, into which the earth is drawn by the hoe, and lifted when it is full into the cart. The clumsiest of all Portuguese tools is the mowing or reaping hook, which, as the cattle are mostly stall-fed, is in constant use. It is in shape a short segment of a circle, of which the arc is about a foot in length; the edge is serrated and very sharp, and the hook can be used to cut grass not more than five inches high, the tuft of grass being grasped in the left hand, and the edge of the reaping-hook being drawn against the stems. The work of cutting grass is exceedingly slow, and a man cannot cut more than a quarter of a rood in a day's work.

The cart used throughout modern Portugal is, like the plough, a modification of the old Roman type. Two low wheels of solid wood, without spikes, and with iron tires, are fixed immoveably to an axle, which revolves with them. The body of the cart is composed of four or five boards laid flat, and resting on two supports, whose lower sides are grooved where they rest in the axle. Straw or grass is retained on the flat table formed by these boards, by six or more moveable, upright poles, fitting into iron-bound sockets at the sides and corners of the table-like boards, the centre plough being prolonged forwards into a strong pole, to which the oxen are harnessed. In carrying stones, earth, or grain, a thick, wattled, and flexible hurdle, about thirty inches high, is fixed, in horse-shoe shape, upon the table of the cart inside the uprights; the opening behind is closed with a board. The whole cart is enormously strong, and the separation of the wheels and axle from the body allows it to stand the shocks and joltings of roads which are often little more than watercourses on the steep sides of hills. The yoke is fixed to the necks of the oxen—in some parts of the country, the most hilly, to their horns, and when so fixed, a leather cushion takes off the pressure from the foreheads of the animals.

Upon an average of the last five years, we learn that Indian corn is by far the largest production of the country, next, wheat and rye, and then, in much smaller proportion, barley, oats, and rice. There is a great abundance of vegetables, the broad and kidney beans, the gourd, melons, and water melons. The gourd is left on the ground for a fortnight or more after the maize is carried, and, in that short time, greatly increases in size, with full exposure to sun and air. In a richly manured soil, with irrigation, a weight of sixty or seventy tons might be raised to the acre. Three or four very well-marked species are grown, and the largest attains to the weight of 200 pounds. The crop known in commerce as the Spanish or Portugal onion is off the ground in August, and sometimes in July, and the chief place for exportation is Oporto.

For natural or artificial manures, it seems, the farmer in Portugal is almost without any choice. Guano is hardly known, though its concentrated form and its known value in growing maize might seem to recommend it in a country difficult of communications. As a substitute, from along the sea shore various kinds of sea-weed are regularly collected, allowed to ferment and decay, and applied to the maize crop with good effect. A still richer manure is furnished by a small species of crab, caught for the purpose in vast quantities. Where the coast is marshy and intersected by estuaries, inlets, and slow-flowing streams, boats are employed in dredging up the ground-weed, mixed with rich, decaying vegetable matter, and small shell-fish from the bottom of these waters, to be used as a dressing to the fields in their neighbourhood. These various manures supply valuable phosphates and alkalies, and, to some small extent, take the place of the artificial manures used in Great Britain.

EDUCATIONAL NOTES.

Teaching of Practical Science.—It was mentioned in a recent *Journal* that the University of Durham had offered to endow a school of physical science at Newcastle-on-Tyne with £1,000 a year, under certain specified conditions. In reference to this "educational experiment," the *Times* says that "it will afford a peculiarly good opportunity of ascertaining whether it be not expedient to impart scientific knowledge more in the concrete than is the habit in this country. Professor Huxley, defending the contemplated migration of the School of Mines to South Kensington, dwells on the hollowness of technical education without a basis of 'unpractical' science. We are not concerned to dispute this opinion, but we are prepared to maintain that 'unpractical' science, without a clear perception of its practical meaning, is still more hollow, while it has not the merit of being useful. By all means, let the instruction at Newcastle be scientific, as distinct from empirical, but it will be worthless if it be not utilitarian and professional in such a sense that a man who has received it will be a better engineer or viewer than his neighbours. Again, if this offshoot from Durham University should take root and flourish at Newcastle, it will give an impulse to that localisation of higher teaching which many regard as an essential supplement to our University system. The characteristic of that system is that it removes a student from home influences, and compels him to lead a college life for a certain number of years Now, however great may be the benefits of college life to young men who profit by it, it is notorious that but a very small fraction even of those whose parents could well afford it ever go to college at all. Some of the obstacles which now keep them away from Oxford and Cambridge may, perhaps, be removed, but there is no reason to suppose that we shall ever attract thither, in any great numbers, the very large class of youths destined for business. If they are to receive anything more than a boy's education, they must have the means of obtaining it at home; in other words, there must be local institutes in all our great towns not unlike that which Durham University proposes to found at Newcastle."

Payment of Fees in Denominational Schools.—The arguments in favour of paying, for parents whose poverty prevents them from doing so themselves, the fees of children in denominational schools, are clearly and exhaustively set forth in a reply of the Liverpool General Purposes Committee to a memorial addressed to that Board by 700 ratepayers protesting against this course; and, as this is a subject that has of late been much discussed by school boards, and by all interested in the education question, it may be useful to give a brief abstract of this full and somewhat lengthy document. The committee point out that it is only where there is an insufficient amount of accommodation in public elementary schools that the deficiency is to be supplied in the manner provided by the Act, and that thus, where there are already denominational schools enough, they have no power to establish "Board schools;" moreover, that whenever compulsion is brought into practical operation, it will become absolutely needful to provide for the remission or payment of the school fees where the parent satisfies the school board that he is unable from poverty to pay them. The committee believe that to draw the distinction sought by the memorialists between "remitting" fees in school board schools, and "paying" them in denominational schools, would be a direct violation of the spirit of the Elementary Education Act and of its letter, for it would practically shut the doors of all denominational schools against the children of the poor. The committee point out that the Act which gives to school boards the power to "pay the fees payable at any public elementary school by any child whose parent is, in their opinion, unable to pay the same," also declares "that no such payment shall be made or refused on condition of the child attending any public elementary school other than such as may be selected by the parent." And the Act adds—showing that the payment is not made to the school, but to the parents—"And such payment shall not be deemed parochial relief given to such parent." It remains for the memorialists to consider, say the committee, whether the conscience of parents might not be as much violated by withholding from their children the distinctive religious feeling which they desire, as by forcing upon them the religious teaching of which they disapprove, and that because they happen to be "indigent." The objection of the memorialists to the payment of a portion of the ratepayers' money to managers of denominational schools, "over which the school board has no effectual control," is answered by the fact that the Education Department—which controls the board—will have effectual control over the secular instruction to be given in those schools. In reply to the suggestion of the memorialists, that the board should take over the existing denominational schools, the committee point out that the clause in the Act on this point only allows this to be done with the consent of the managers. The memorialists say that "the payment of a portion of the ratepayers' money to managers of denominational schools would be regarded by a large number of ratepayers as a gross injustice, inasmuch as, in effect, it taxes Protestants for the support of Roman Catholicism, and Roman Catholics for the support of Protestantism, and every ratepayer for the support of some religious opinions of which he utterly and conscientiously disapproves." The committee's answer to this is threefold:—(1). The payments will not be made to the managers, or for the support of denominational schools, but to the parents, as above shown. (2). The existing denominational school system, which is the system of national education, is supported by Imperial funds, to which every one of the ratepayers contributes. And (3) "a portion of the ratepayers' money" is, at this moment, applied by the guardians of the parish of Liverpool in the payment of the school fees of Protestant and Roman Catholic Schools, for the children of paupers in the receipt of out-door relief, under the authority of an Act known as Denison's Act. The alleged "gross injustice," against which the memorialists protest, might, therefore, be equally charged both against the State and the parish authorities. In conclusion, "the committee cannot doubt that the first duty of the Board is to avail itself of a machinery ready to its hands, which at present is only about half employed; and, by a careful and judicious application to it of their compulsory power, to fill, so far as possible, the existing schools. When this is accomplished, the deficiency of public school accommodation, which it is the duty of the Board to supply, will still be considerable. They will, therefore, proceed concurrently, and with as little delay as possible, to ascertain by statistical returns the localities in which the most urgent need exists, and then to seek the sanction of the Education Department for the provision in them of school board schools."

Bishop Temple on Compulsion.—At a recent meeting of the Exeter Diocesan Board, the Bishop of Exeter said that nine months ago he believed permissive compulsion to be a mistake; he had thought it would be better to decide one thing or another, either that there should be compulsion or there should not. "But I confess," continued his lordship, "that my views are changed, and I think that, on the whole, the course taken by the government, if we were to have compulsion at all, was the right one. I cannot help seeing that there has been a most marvellous change in the opinions of a very large number of people on this subject, simply in consequence of this Act. It has already educated the people in their liking for compulsion to a degree that I had not the smallest idea of. I find a great number of people quite prepared for it now who a year ago would have said it was simply impossible."

Female Teachers.—Now that the subject of the employment of women is so much under discussion, a suggestion made by Mr. G. C. T. Bartley may be worth consideration. He thinks that, while the regular machinery for training schoolmistresses is being enlarged and improved, a supply of female teachers easily and immediately procurable seems to be wanted to make a commencement in the vast field of work which is now open, and that "any gentlewoman who has received a liberal education, and who possesses a natural aptitude for managing children, could be initiated in a short time in the most approved modes of instruction. She would be enabled, after two or three months' study, to conduct infant classes and girls' schools. Many of such teachers would even be competent to take classes of younger boys, and perhaps manage them as well as any master. Their superior education and higher culture would, in most cases, make up for the less technical nature of their modes of teaching." He thinks that "if the London Board were to advertise for educated ladies to conduct schools, and offer them £50 a-year, on the understanding that they would have to undergo a course of training for two or three months at the Home and Colonial or some other college, they would receive thousands, if not tens of thousands, of applications from excellent persons," and that thus the teaching staff would be ready as soon as accommodation could be provided.

Education and the Decimal System.—A correspondent of the *School Board Chronicle* points out how great a boon to the friends of education would be the adoption of a decimal system of weights and measures, which he thinks would be as valuable as an additional grant of near £250,000 annually from the Exchequer. He considers that "one-fifth of the time of a child at a national school is spent in learning and working exercises on the present varied and difficult tables. Substitute the simple and uniform decimal system, and we should attain in four years the standard which is now reached by a child in five. Or if we look, not to saving, but to the gain of increased efficiency, the time thus obtained would be devoted to the teaching of new and useful knowledge. We virtually add a year to each child's school time, and no grant from the Exchequer could give us this, as we shall never be able to keep our children longer at school than we do at present; we can only gain it, therefore, by an economy of our present time. Let the present generation be willing to submit to a great but temporary inconvenience, and they will be more than repaid by the thought that the weary, wasted hours which they themselves have spent on a useless exercise will be saved for their own children and for all future generations, to be given to the attainment of some useful knowledge."

CORRESPONDENCE.

THE PRINCE CONSORT MEMORIAL IN HYDE-PARK.

Sir,—Last year, beginning at April 15th, appeared in your *Journal* some letters of mine, of which the two principal points were, if there were a central statue of the Prince Consort in the memorial, that it should be devout, and that it should front to London. Now, however, that the memorial is further advanced, and the scaffolding removed, if in fact, as well as in appearance the structure of the memorial lack stability, a central support to the roof and spire seems requisite. This of necessity would take the place of the central statue. I believe this change would yield great advantages, if with it were combined a quadruple treatment of the representation of the Prince by means of four erect marble statues, so disposed that only one could be seen at a time, of moderate dimensions, representing different phases of his noble character, as suggested in my letter of the 17th ult. The reception of these in niches, north, east, south and west, coved into the central support, would present a separate and well protected statue for each front of the memorial, which structure, being equally elaborate on all sides, this treatment of the central feature would harmonise with its general design by affording four equally interesting centres of composition for the four fronts, and thus also would be escaped all the difficulties of the vexed question of frontage. It does not require much imagination or conversance with art to perceive what an extremely beautiful architectural feature this central support might be made, enriched by the employment of different granites, and perhaps variously coloured marbles and mosaics, and gilding. Its niches also would ensure the best backgrounds for the pure white marble statues of the Prince, which would thus, as well as in other respects, be seen under greater advantages than any central statue could be. I would add that, pretty as the gardening around the memorial promises to be, it appears as if each front should have an approach to it, *i.e.*, not only from the south and north—which last, by-the-bye, should be direct, and not askew—but also from the east and west. Especially the east front towards London seems to require opening out.—I am, &c., Epsilon.

March 27th, 1871.

[*Note.*—In the *Journal*, March 24th, there were two misprints in my letter—"perfect" for "protect," and "natural" for "central."]

DR. DRESSER ON ORNAMENTAL ART.

Sir,—Whatever differences of opinion may exist respecting the intrinsic merit of Dr. Dresser's paper on "Ornamentation Considered as a High Art," it has certainly had a very lively reception; the proof of which is that it has called forth an interesting if not a very instructive discussion, and a correspondence which has not been confined to the pages of the *Journal of the Society of Arts.* But it has done something more than this—it has drawn out a bright and suggestive thought from Mr. Cave Thomas, which he would do well to reconsider and elaborate.

That there is a marked distinction between fine art and ornamental, or as I prefer to call it, decorative art, no one who has carefully thought upon the subject can, I think, doubt; any suggestion, therefore, which leads to the drawing of a line of demarcation between these two branches of art must be of service; and it is as bearing on this point that I think Mr. Cave Thomas's suggestive thought has its value.

When writing on this subject for the *Art Journal,* in the years 1852-3, I attempted first to fix this line of demarcation; for without giving decorative art some tangible boundaries, it was simply impossible, as I believed, to deal with the subject in a precise or analytical manner. Having defined the province of decorative art, I proceeded to show what were the materials available for the decorative artist's use, and in what manner they might be legitimately employed. This, I think, is the only course open to any one who may undertake to instruct the public on the subject, no matter what his artistic abilities, or how great his fame as a writer.

To enlighten the public on any subject on which it is unknowingly ignorant, dogmatism is out of the question, but good, sound reasoning must be employed. But does Dr. Dresser employ this in his paper? Let us suppose that an artisan, skilled in the working of iron or stone, resorts to the learned professor for the purpose of gaining a knowledge of how to beautify his work by the introduction of art into it; and let us suppose the professor to teach this man from his own paper. He will direct the plastic mind of his new pupil to this great and sovereign fact, namely, that "true ornamentation consists of symbolised imagination or emotion only." This he will doubtless impress upon his mind by iteration, as he did to his auditors at the Society of Arts, and he will tell him that "there is no expression of which man is capable which is more godlike than that of truth." Having thoroughly imbued his pupil with these facts, he will then lead him to the natural deduction therefrom, and he will say, "Let truth be uttered with power and in the form of beauty."

These things having reached the ears of the skilful artisan, the learned professor will not doubt that they must, or at any rate will hope that they may "cause the much desired enlightenment of his understanding."

Assuming that the artisan takes upon trust the teaching of the profession, what will he, as a rational being, do towards applying this new-found knowledge. He will first, we may suppose, strive to comprehend it, and, in order to do so, he will try to fathom the meaning of that marvellous phrase "symbolised imagination or emotion." Resorting to his "Johnson" for the true meaning of the words employed, he will find that to "symbolise" is "to make representation of something," and that "imagination" is defined as "the power of forming ideal pictures." Thus, to symbolise imagination is to make an ideality visible to the eye. As Dr. Dresser is fond of asserting the intimate connection between ornamental art and religion, he could not object to the Scriptures being put under contribution by the ornamentist; those writings being manifestly better suited than any others to supply "symbolized imagination" subjects. It would be a good test of the value of the Professor's theory of "true ornamentation" were he to attempt the illustration of that expression of St. Paul, "the dividing assunder of soul and spirit." How would he treat it, and to what branch of decorative art would the ornament apply? What would our representative artisan think of this solution of the mystery? Even supposing he were a metaphysician, what could he think of it? Is it too much to say that he would consider it an absurdity? Yet this is the teaching which Dr. Dresser provided for the Society of Arts. But perhaps there may be something more in the expression that "true ornamentation consists of symbolised emotion." What, then, is emotion? It is a "disturbance of mind," a "vehemence of passion." A common expression of emotion is a sob. Now, this in itself would be difficult to symbolise. How much greater, then, would be the difficulty to symbolise that disturbing influence of the mind which produced the sob, and yet, according to Dr. Dresser, symbolising the cause of a sob is the true province of ornamentation.

Now, it is a fact, or, at any rate, it is my belief, that Dr. Dresser has, in the main, arrived at correct conclusions with respect to decorative art in its practical aspect; but all the indication which he gives of the manner of reaching his conclusions is, as I have attempted to show, so vague and incomprehensible as to throw ridicule even on his achieved results. His paper, therefore, if taken as illustrative of the principles of decorative art, must convince every thinking reader that these principles have no existence; and the inevitable inference will be that rules or canons of taste are inapplicable to decorative art work.

One reader may say, "I prefer as the ornamentation to my hearth-rug a tiger crouching in a jungle, and I leave to Dr. Dresser to ornament his with a symbolised disturbance of his mind, if he consider that to constitute the only true ornamentation." Another reader may say, "My carpet shall represent a lucid pool, with lilies floating on it, and no texts of Scripture shall intertwine the rushes on its margin. I leave to metaphysicians, such as Dr. Dresser, to find pleasure in a symbolised faculty of the mind. For my own part I cannot conceive what kind of ornament a symbolised faculty would present." Before this exposition by Dr. Dresser of the highness of ornamental art, good progress was being made in most branches of art-manufacture towards a correct taste; but now that this progress is somewhat jeopardised by the disturbance of the public mind on the subject, I think the true principles or laws that should guide and curb the imagination of the decorative artist should be enunciated with authority; and it would certainly be, under the circumstances, judicious for the Council of the Society of Arts to provide without delay this knowledge for the public.—I am, &c.,

Chancery-lane. A. V. Newton.

THE METHOD OF TEACHING GEOGRAPHY.

Sir,—It is a charge often brought against the study of geography, that it is dry and uninteresting; and indeed the very sight of the text books commonly put into the hands of students explains and justifies the accusation. Long lists of names, small crowded lines, bare *jejune* statements of facts, a rapid passage from one country to another, following in the description of each the same method and order, as if the things important in one country must needs be of equal prominence in every other. All this makes, for the most part, the discipline of geography, and at best the teacher enlivens the oral lesson with an anecdote or two relating to the country under consideration, and if the student should appear to have a tolerable knowledge of the statistics of a certain number of countries, the work of instruction is often looked upon as properly accomplished. The common result is, that the learner obtains a minute acquaintance with the facts relating to some countries, and knows little or nothing respecting others. So that the world in his mind is like the map which we see in ancient atlases—*orbis veteribus notus*—where Greece and Italy are minutely traced out, mountains, towns, and even villages marked with all the minuteness of accurate knowledge, while the outer regions are dotted round a blank space, with a single name or two scattered here and there in the waste.

Now, such a knowledge ought to leave a lad's mind in a state of extreme dissatisfaction. It should give him the sensation of being all on one side, unbalanced and ill-grounded. The fulness of facts which he can record of some countries ought to be the measure of his ignorance as to the rest. And so it would be if the object of his study were not in a great degree perverted to the mere passing of examinations. It may be, however, that the sense of this incompleteness makes itself felt, and is a cause of geography being, as I believe it is, an unpopular subject of study.

But even if he had "gone through" the text-book, and could answer with tolerable sufficiency the innumerable questions of facts which it suggests; if he had treated all lands as fairly as his text-book treats them, and had passed over none, could he be said, even then, in any proper sense of the words, to have a real knowledge of geography? No more than a man could be called a good historian who was able to repeat by heart all the dates of remarkable events, and who knew little or nothing beyond them. These facts of geography, like the dates of history, are the bones of the subject. But you might as well take a man "sitting in his bones" to be a complete and perfect man, as suppose that these bare skeleton facts are a full representation of the life and variety of geographical study.

Geography may be viewed under a great variety of aspects; and it is from an unmethodical use of these ways of looking at it, that the defects of teaching have principally arisen. Sometimes one view predominates over all the rest, driving them into corners, or entirely consuming them. Sometimes a little of half-a-dozen views occupies all the time, though why these more than the others it is not easy to say. Sometimes mere names embrace the whole that is taught; and I have known lessons given in geography without any reference at all to a map.

Now, I am not finding fault with this difference in itself. In many cases it is quite called for. But it too often happens that there is no principle or system to direct the teacher in his application of this or that view to the particular country under notice. The accidental stores of knowledge which he may chance to possess—the humour of the moment, some passing allusion, or some unexpected answer, may perhaps decide on the line to be taken. But this certainly is unreasonable and injurious. There should be rules and measures for distributing to each country its peculiarly appropriate treatment. There should be some well-understood ground of reason for assigning to every portion of the earth's surface the view under which it may be most advantageously regarded.

The first division to be made in the study of geography is one very often made in the text-books, and very often overlooked in the school—the geography of the globe, and the geography of particular countries. We may call it general geography, as offered to the facts relating to the several countries; or scientific, as opposed to the more popular descriptions which follow; or astronomical, dealing with the earth in great measure as one of the planets. But whatever we call it, its object is to give the pupil some true notion of the earth's form, size, and motions. And it is essential in every case that so much of this should be taught at the outset as may enable him to avoid mistaken fancies as to the proportion which the various parts of the earth's surface bear to the surface of the whole globe. I know that some teachers would begin with the size of the school-room, the parish, the county, and so at last reach the limits of the earth. And as a means of interesting the pupil, a lesson or two of that sort may be useful; but the notions of proportions, which become planted in the mind, if this teaching is carried on, are apt to cling there and become mischievous. The teacher should, at least, ground the pupils in the elements of scientific geography, leading them on, as circumstances allow, to the motions of the earth and their consequences, the climatic divisions of the globe, the effects of the disposition of earth and water, the winds, and tides, and currents. These things lay the foundation of a just estimate of the earth's surface, and enable him to carry on the study with a prospect of intelligence and profit. But from the very first he will need such "grounding" in the relations of size and distance as may prevent him from saying with the Frenchman in the steppes of southern Russia, "le chemin là vous conduire au Palais Royal."

When we pass from "scientific geography" to the more popular notion of the subjects, the real difficulty may be said to begin. There are at least eight lines of study along which the student may be led. There is nominal geography, giving the actual and relative situation of places. There is physical geography, dealing with the natural surface of the earth, its mountains, rivers, seas, and plains; and, carrying this on a little further, there is geological geography, which accounts for the actual condition of these things, and traces the steps by which it has been attained. There is historical geography, which associates with places and countries the events of which they have been the theatre, and endeavours to ascertain how far those events have been brought about or modified by the geographical accidents of the countries in which they took place. There is natural geography, which treats of the productions of every land, its plants and trees, its beasts, and birds, and insects, which, if followed out in full detail, would need to be subdivided into botanical, zoological, entomological, &c. Then there is the ethnological side of the subject, which searches into the various races of mankind, shows how, in their appointed order, one has risen up after another, and how the characteristics of each have been cherished and developed by its geographical position upon the earth, and how they in their turn have affected the divisions of kingdoms, and the actual condition of a large part of the earth's surface. Then we have commercial geography, which would include not only the trade and manufactures of the several countries, their exports and imports, and such-like statistics (which many seem now to consider the main feature of geography), but also the lines which traffic has followed in various ages, and the results to the civilisation and prosperity of the world, which these varying streams of intercourse have produced. To these we may add the theological branch of geography, which would make it a principal part of its study to trace the course of man, as indicated in the Bible records; the places touched by prophecy, and their state at different periods. It would interest itself in the various religions which have asserted their hold upon mankind; the effects for good or evil which each may have produced; and turning from the past to the present and future, it notes the actual condition of belief in the various tribes and nations of the world, and the aids and obstacles which the Christian teacher may expect to meet with in the characters and habits which have thus been formed. Besides all these, we should not omit the history of discovery, a subject not only accounting for many facts which would otherwise be hopelessly perplexing, but which, by introducing European races among simple savages, has brought about effects of infinite importance, which are still working on to yet greater results in the future.

It is obvious that every one of these branches of geography might be expanded into a great mass of detail, sufficient to occupy the whole time which a student could devote to this subject. Even the "nominal," which would appear at first sight a bare record of names, becomes, under intelligent guidance, instinct with interest and instruction. Open the map of Central America, for instance, and cast your eye over a few of the names; you see a place called "Vera Paz" (True Peace), and the story of the good Las Casas rises to the mind, how, by his simple-hearted goodness, "with four merchants before him, chanting in Quiché verse the great doctrines of the Christian faith, he went safely through that land of war (Tierra di Guerra), and changed the whole character of the people;" while, close at hand, the strange sound of such a name as Tugelutlan reminds us of a race, once mighty on the earth, but which now remains little more than a problem and a mystery.

With all this wealth of information, and these inexhaustible sources of interest, the difficulty is plainly this—how to teach the subject in any reasonable compass, and with systematic accuracy and method.

The ground-work of all true geographical learning is the love of the map, and this it is most important for the teacher to implant in his students. I am not sure that this will ever be effectually accomplished without a little practical experience of travelling. But, with the improved maps of the present day, with the liveliness of colour now given them, and the richer tones of the hills, bringing out the steepness of the slope and the form of the land, a good deal may, without doubt, be effected. Perhaps a little of the system adopted in Stanley's "Palestine," where the colouring is according to the outward appearance of the country, might be introduced with advantage.[*] At all events, if the map is to the teacher what it ought to be—a lively presentment of the land itself—let him hang it up before his class, and lecture them into his own delight in studying it. The rich plains, waving with corn; the swift rivers, running down from the mountains to the neighbouring sea, or winding more slowly, with wider sweeps, across the broad plain; the narrow valleys, with their margin of green herbage, and the vineyards climbing up the slopes; the trees thickly studded, showing the richness of the land, or more widely scattered in a poorer district; the frontiers of nations, taking their special line, not without peculiar reasons of race, or history, or of the physical structure of the land. Let him get them to look out for these things, to feel that these, and a multitude such as these, lie waiting on the face of the map for the intelligent student to pick up, and then the first great step in teaching geography has been fairly taken.

For "working in" the other branches of the subject, a teacher will need to consider very closely the nature and capacity of his class. The way in itself absolutely best might not in general be possible. It would be for the teacher to give out the various branches in which geography should be studied, and to arrange with his class for one or two students to undertake each branch as their special subject. Thus, one or two would be ready with all the facts connected with the outward appearance of the land, another group would supply the geology, another the natural history, and so on. The whole number of students would thus obtain a more distinct and accurate notion of the country under consideration than they could get in the ordinary way, while a few probably were laying up an amount of real and solid knowledge, which would far outrun the regions of "cram." In this way I suppose that a geographical lesson would attain the maximum of profit and interest. If this should, however, be impossible, perhaps the best way would then be to lay down for each country, as it came into notice, the special branches which needed to be chiefly studied, and the order in which they should come. It can hardly be doubted that different countries require to be differently treated; that in some, *e.g.*, the geological division, is comparatively unimportant; in others, the history might be very lightly passed over; in others, the commerce would need little attention. Instead of labouring, then, to make the most of these subjects, that all lands may be treated on a uniform plan, true uniformity will require that those points in a country which are really prominent, and have substantial claims to notice, should come forward almost to the exclusion of the rest, and a truer view of each country and of the earth will be the result.

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[*] In direct opposition to this is the very bad habit, adopted in some training colleges, of teaching the students to mark the mountain ridges by a single broad black line, as if they rose out of the plain like a wall. Contrast with this some of the plans in Napier's "Peninsula War," where the reader seems actually to look up the mountain gorges

Again, the exigencies of examinations may forbid this; and if they render the intelligent study of a great subject impossible, it is the greatest condemnation of the mode in which they are conducted; and in that case it may be advisable to take one branch as the principal object of study, the text, so to say, of the whole, and group two or three of the others round it, in orderly gradation, getting less and less full as they are placed further off from the centre of the system. Only in this case it is essential to make the learners feel at every turn how large are the gaps which they are compelled to leave unfilled, and how deeply the interest of the subject is compelled to suffer. The central, or key subject, would not be in all cases the same. It would depend upon the immediate object of the teacher, and also upon the degree of importance which he might wish to assign to the subordinate subjects.

Apart from all special reasons of selection, the "natural order" of studying geography would probably be this:—1. Physical (first meeting the eye apart from man). 2. Geological (explaining the origin of the outward appearances). 3. Natural (the earth before the appearance of man), 4. Ethnological (man's first entrance in rude masses). 5. Nominal (traces not only of tribes, in lands, rivers, &c., but also of individuals, and the existence of property). 6. Historical (man acting in civilised communities). 7. Commercial (man acting under advanced conditions of civilisation). 8. Theological (man viewed with respect to the highest motives of which his nature is susceptible). If "discovery" should be introduced into this scheme, it would take its place between 5 and 6.

Thus the earlier branches of the subject lead up to the appearance of man; and after his appearance it will be seen how powerfully he has affected the whole subject, and in some of the divisions the record is only of his work. But throughout we find that while he has fixed his mark on geography, he has, at the same time, received no insignificant impress from the earth in which he has been placed.

This may be sufficient to show the need of a somewhat more systematic study of geography than has been hitherto adopted, and to give a hint as to the mode of carrying it out. But it makes no pretence to exhaust the subject.

I am, &c.,

N. P.

WILD BEASTS IN INDIA.

Sir,—Sir Thomas Bazley, in alluding to the claims of Indian cotton, mentioned that there was somewhat of a drawback to its safe cultivation and transport, arising from the dread entertained by the natives of the attacks of wild beasts, and that in some parts of the country they were afraid to move on account of the ferocious attacks of predatory and bloodthirsty animals; and we need not be much surprised at the alarm manifested by the natives, when we consider to what extent they have actually suffered from such depredations.

The career of wild beasts of late in the Madras Presidency has been a distinguished and successful one, for in the short space of three years, namely, from 1866 to 1869, they hurriedly destroyed over 888 human beings, and leisurely devoured more than 52,439 head of cattle; and government have consequently felt the necessity of a "reduction" in their strength, and have offered rewards for their destruction, and thus expended a sum of 89,146 rupees in the three years above-mentioned, or £8,914 12s. sterling, being at the rate of £2,971 10s. 8d. per annum.

Now, setting aside the value of human life altogether as incalculable, and for the purpose of estimating the loss caused by the wild beasts of the Madras Presidency, we admit that each head of cattle is worth £1 only, we must credit these brutes with having robbed the presidency of cattle to the value of £52,439. Under such circumstances, might it not be prudent to increase the money-value of the rewards, so as to cause a more remunerative and anxious hunt in quest of such depredators?

At present, the maximum rewards paid for their destruction are as under, viz.:—

For a man-eating tiger, £10; for a destructive elephant, £7; a royal tiger, 70s.; a chetah, 35s.; a bear, 14s.; a wolf or hyena, 10s.; a jackal, 1s.; a venomous snake, 1½d.

A few ardent British sportsmen, if cotton could speak, would certainly be one of the claims it would advocate; and that they would have a fine field for enjoyment, the contents of the government game-bag for the last three years amply testify, for, during that period, the capture and death was officially reported of the undermentioned animals, whose valuable skins would be fine trophies for adventurous sportsmen:—3 elephants; 1,027 tigers, leopards, and chetahs; 774 bears; 535 hyænas; 106 wolves.

For bears, Gaujam district should be shot over, as 446 met their death therein, and 118 and 55 bruins respectively fell in Bizagapatam and Kurnool districts; while in South Canara, 499 tigers and leopards were disposed of; and in Bizagapatam, 125 tigers bit the dust; and again, in Kurnool district, 28 tigers, 80 chetahs, and 41 wolves were destroyed, but not before 97 human lives, and 180 cattle had fallen victims to their attacks. In Cuddapoor, 71 chetahs and 22 wild boars were depatched. On the Neilgherry Hills, 38 tigers, nine bears, and 42 other wild beasts gave up the ghost; while at the Uundikanama Ghaut in Kurnool, the tiger resident gentry had become landed proprietors, and the people dare not pass through it without an escort of shikarries; and although tigers do not relish cotton as much as bullocks do, they have no great objection to tasting such natives as may be travelling in charge thereof.

Some more decided steps should be taken to protect human life in the Madras Presidency; and it may almost be a question if the fear of these wild beasts may not, in a minor way, operate against extending cotton cultivation in the neighbourhood of places infested by them.

The district of Kurnool had, in 1868, no less than 267,202 acres of land under cotton cultivation, which yielded a revenue to government on assessment of £29,795; but in 1870, the number of acres under cultivation of cotton there had diminished to 178,124, showing a reduced culture of 89,078 acres, and a loss of revenue of £9,141, while 97 persons were destroyed by wild beasts in the district.

In the district of Bizagapatam 148 persons were so killed, and the acreage under cotton cultivation in 1870 was little more than one-half of what it was in 1869; while in the district of Madura, where only 21 persons were destroyed by wild beasts, cotton-cultivation had increased in 1870 to 41,519 acres from 8,456 in 1869; and in revenue from such assessment from £1,451 4s. to £7,405 14s.; and cotton is here cheaper than in any other district of Madras, and it has no railway yet.

The increased destruction of snakes, by more equitable rewards, should, I think, also not be lost sight of, for their agency deprived 760 human beings of life in the Madras Presidency, in the three years from 1866 to 1869; 144 falling victims in Gaujam, 34 in Kistna, 115 in North Arcot, and 446 in Malabar. In addition to which they swallowed up, or poisoned to death, 1,815 head of cattle. The Government received official report of the destruction of 20,989 of these concealed springs of death, but only awarded for their annihilation the sum of 1,312 rupees, or £131 4s. in three years, being an average annual expenditure of £43 14s. 8d. Snakes are certainly destroyed very cheaply in this presidency, and there are many of them; but we can scarcely refrain from thinking that if higher rewards were paid for their deaths they would be less numerous, and men and cattle more so. What good result in their wholesale destruction can be expected from the liberal maximum reward of 1½d. per head, which is the sum allowed by government? Surely greater encouragement should be given to those whose necessitous condition prompts them so to imperil life, in the hope of obtaining thus the means of sustaining it. Is it worth any native's while to trail along a dead and perhaps heavy snake that he has killed, first to the head-man of the village, then to the Talook Cutchery, and be interrogated by the tahsildar, and then, perhaps, have to toil, under a burning sun, a considerable distance to the office of the collector of the district, and finally, perhaps, only receive a fractional part of the maximum reward of 1½d.? And so, few demands are made for this reward.

In Malabar, wild beasts kill few, but snakes very many; but as the former are only found in the thinly-populated parts of the district, where the natives are accustomed to forest life, and know how to take the necessary precautions, and in such localities there is plenty of game to feed tigers and chetahs, they demand fewer victims; while, on the other hand, even in the most populous parts of the country, each family resides in a house surrounded on all sides by vegetation, giving harbour to reptiles, and the means of journeying to-and-fro is provided by innumerable narrow footpaths, with steep banks on each side, so that deaths from the bite of serpents accidentally trodden on are very numerous.—I am, &c.,

A. Romaine Wragge, Lieut.-Colonel.

COMMERCE OF INDIA.

Sir,—Kindly allow me to inform Mr. Thomas A. Welton that the reference in my paper to the political remittance from India to England is not as a grievance, but as an inevitable economic result of a foreign rule; and that to meet this extraordinary national want of India, it requires to be enabled to produce so much more than what is necessary for its ordinary wants. According to the facts and figures I have given in my paper, India is not able to produce at present enough even for its ordinary wants. I hope the Select Committee will ascertain the truth of the matter.

I would request Mr. Welton to give his views in a practical shape, as to how he thinks the Indian budget should be framed, were, as he says, "regard for Indian interests the sole idea of the framers."—I am, &c.,

Dadabhai Naoroji.

East India Association Rooms, 28th March, 1871.

COTTON SUPPLY ASSOCIATION.

Sir,—As I was one of those who gave publicity to the report that the Cotton Supply Association was about to discontinue its labours, I am glad to learn that a decision has been arrived at to persevere in its useful career. it appears that its conductors are not to be allowed to abandon their task, and at no time was greater appreciation shown of their exertions, and of the necessity of such an organisation, than when there was a prospect of their services being lost. It is now a source of additional satisfaction to learn that the efforts of the association will be concentrated on India, and there can be little doubt that the successful results which have attended it will be maintained.—I am, &c.,

Hyde Clarke.

32, St. George's-square, S.W.,
April 8th, 1871.

PREPARED COFFEE LEAVES.

Sir,—I am sure I ought to feel infinitely obliged to your correspondents in general, and Colonel Haly in particular, for the very able and practical letters they have written on the above subject. I will now crave a portion of your valuable space, that I may answer your correspondents collectively.

Colonel Haly has seemed to quote my words, but he is in error in doing so, that is to say, he has done so incorrectly. What I asked was:—"If it (coffee-tea) is really good, how is it that it has been recognised by no one but the natives of Sumatra?" But "experience, &c., &c.," is an old axiom, and I now find I must add your correspondents to the admirers of the beverage. I shall, however, hesitate before I add the coolies on the Neilgherry coffee estates.

Now, Sir, I know "coffee-tea has been recognised"—as utter nastiness, and I also know that, unless the essential oil (to say nothing of other qualities) is destroyed by great heat, coffee-tea cannot be borne on the table. Certainly such a volatile oil would not command "£100 per ounce," no, Sir, not even for flavouring purposes. Volatile oils are not always agreeable, or if so, how about the odour of *Arum dracunculum?*

So much for the supposed source of the odour. Now for the theine or caffeine. Your correspondent (Mr. Cochrane) has raked up all the possible analyses of all the possible teas, but he has omitted to mention that Peligot, by a more complete method, obtained as much as 6·21 per cent. of theine from a good tea. It would have been desirable that Peligot should have analysed the prepared coffee-leaves, and they then might have compared more favourably with the tea *plus* willow leaves, which Mr. Cochrane described awhile ago, and which he had best stick to, for the sake of comparison with his admired coffee-tea. As for what is said about "potent conservators of muscular substance," "activity of body," "clearness of intellect," &c., if coffee-tea is useful, I am certain the Society of Arts would be justified in chartering a ship, not to India, or Ceylon, or Burmah, but to Brazil or the West Indies, immediately, for a full cargo. I will tell the Society why—there are a great many people who require a potent restorative of the heal-all description.

I have another word or two for your correspondents, and then I will endeavour to explain why there is a desire to introduce coffee-leaves, a desire, by-the-bye, laudable enough in itself. Colonel Haly has been "out shooting on the Neilgherry hills." I have been out planting on the Neilgherry hills and in Coorg. I could purchase raw coffee in the bazaars for three annas (4½d.) per lb., and so could the coolies, but, in addition to this, the coolies could either steal (or pick up) theirs. There is always a quantity of coffee to be had on an estate at an infinitely cheaper rate than four annas per lb. Now, Sir, for my story. Colonel Haly has not told your readers about the growth and manufacture of coffee-tea, so I will. In 1864, Dr. Jamieson sent some Bengalee men to the Neilgherries to learn the natives the art of tea manufacture. On the estate where these men were engaged to fabricate the "tey yelley," there was also engaged one Rajee, a very shrewd native, of I don't know what breed, but he was distinguished for a love of shikaree, and such like. Well, Sir, Rajee was employed as a messenger to the bazaars, &c., and in course of time he established a connection and started business on his own account as a tea-manufacturer, and, as he could not procure tea-leaves, he took up his abode with his brother, who then lived at the little government garden at Coonoor; there he could obtain coffee-leaves in plenty, or if they were not in season he could manage to obtain orange or pomegranate leaves, or even the leaves of the *Eurya*, common to the Neilgherries. Now, Sir, I know that Rajee did a small business in this line at one time, and when the coffee shrubs were making their young growth, he might have had 1,200 lbs. per acre per annum of raw leaves from the Hill-grove coffee estate, just below the Government Gardens, at—what shall I say?—1 pie per lb. Now, I wonder if Colonel Haly was fortunate enough to taste Rajee's manufacture? If he did not, he certainly missed a treat. I do not claim that Rajee was the original coffee tea-maker, but I do claim that he was a most deserving and energetic man; and if the Society adopt Mr. Buchanan's suggestion about a prize for prepared coffee-leaves, and I am duly informed, I will do my utmost to procure a Tamil translation of the conditions for Rajee's behoof; he is a practical man, and he knows well that the red-hot pan he was taught to employ will do much towards destroying the disagreeable oil of coffee-leaves.

One word as to the growth used to make the coffee tea—it is the superfluous young shoots which are pinched or "handled" out in the growing season, and which the planters would of course rather utilise than throw away. In the present state of our knowledge, however, I would not venture to recommend any alteration (except, perhaps, that they might be buried green), Messrs. Haly and Cochrane notwithstanding. Finally, I shall be most happy to forward samples of coffee-tea, both from the East and West Indies, if the Food Committee of your Society desire to report upon them.

Thanking you, Sir, for your courtesy,—I am, &c.,

James M'Pherson.

April 3rd, 1871.

NOTICES OF PUBLICATIONS.

The Science of Colour.—Mr. W. Benson has published another treatise on colour, entitled "A Manual of the Science of Colour, or the True Theory of the Colour-Sensations, and the Natural System" (*Chapman and Hall*). He regards the theory and system he advocates as giving essentially the key to harmony of colour, and thinks that art will be benefited by the substitution of a physiologically correct theory for the theories of Field and others, which are founded on the effects of mixing pigments. The present manual presents the subject in a very compendious form and logical order. The frontispiece is a beautiful representation of the "colour-cube," in twenty-six colours, on a grey ground.

GENERAL NOTES.

Land Sales in South Australia.—The total quantity of land sold in 1870, in the colony of South Australia, was 168,885 acres, realising £184,399, being composed of 77,936 acres by public auction, and 89,949 acres by private contract.

Exports and Imports in South Australia.—The following statement shows the value of the imports and exports at Port Adelaide during 1869 and 1871:—

	1869.		1870.
Imports	£2,396,532	..	£1,660,529
Exports	2,206,023	..	1,585,019

showing a decrease in the imports of £736,003, and of £621,004 in the exports. The number of immigrants and emigrants was as follows:—

	Immigrants.		Emigrants.
Males	1,542	..	2,726
Females	723	..	1,441

The Queen Eleanor Crosses.—Now that there is a pause in the progress of the Prince Consort Memorial, it may be opportune to refer to other memorial crosses which have been erected in this country. Of these the most interesting are those which were raised by the affection of Edward I. over those spots where the body of his beloved Queen Eleanor rested in its progress from the place of her decease to Westminster. According to Walsingham, these originally amounted to twelve, beginning with Lincoln, whither the body was taken to be embalmed, following which were Grantham, Stamford, Geddington, Northampton, Stoney Stratford, Woburn, Dunstable, St. Alban's, Waltham, Westcheap, and Charing, the last stage where the royal remains halted before they found their final resting-place at the feet of Henry III. in the Confessor's Chapel. Only three of these elegant structures are now remaining, which, by their peculiar beauty, as specimens of architecture and productions of art, serve to excite regret at the destruction of the others. Historians differ as to the place and time of Queen Eleanor's death, but the most probable account is, that it took place at Hereby, in the county of Nottingham, 28th November, 1290, and that the 10th December of the same year was the date of her burial, within ten years of which time all these elegant memorials were completed. The first of the three above-mentioned is the cross at Geddington, about four miles from Kettering, in Northamptonshire, which is of a triangular shape, elevated on eight steps, and divided into three compartments. The first or lower one is solid, and decorated with ornamental sculptures. Above these, arranged under canopies, are placed three statues of the Queen, faced in different directions. The second is "Queen's Cross," near Northampton, the most perfect of the three that remain, and very similar in shape, general appearance, and decoration to the one at Waltham, although the latter is hexagonal while the former is octangular. The third is the well-known cross at Waltham, in Hertfordshire, which, although more dilapidated than either of the former, is more enriched in its architecture, and more elegant in its sculpture. This formerly stood on steps, but the ground having been raised round it, the steps are covered up, and it appears shorter than the others. It seems probable, from the example at Geddington, which is triangular, and possessed three statues of the Queen, that each of these memorial crosses was furnished with an equal if not larger number of these memorial statues, perhaps one on each face, with, may be, varied attributes. In the historical chronicles of Northampton it is added, in reference to these statues, that "Nothing but serenity and gentleness of soul beam in their soft and resigned expression, and this feeling of gracefulness and repose is observable in all her statues, which was, unquestionably, the faithful reflection of the reality." The cross which, by the graceful thought of the architect, now stands in front of the Charing-cross terminus, is a restoration, it may be supposed, on good authority, of that which formerly stood at Charing, whence the familiar name of Charing-cross, which is a time-honoured and perpetual memorial of the virtues of the Queen and the affection of her royal husband. It may be noticed that eight statues of the Queen are here present: four as Queen, and four as patroness of various good works.

Mining Statistics of Victoria.—The following statement shows the average number of miners employed in Victoria during the last five years, and the quantity of gold obtained:—

	Miners.		Ounces of Gold.
1866	73,749	..	1,536,581
1867	68,587	..	1,493,831
1868	63,181	..	1,474,127
1869	68,037	..	1,367,903
1870	60,367	..	1,281,841

It was estimated by the Mining Department that the quantity of gold produced in Victoria, during 1870, was 1,302,368 ounces, of which 584,986 ounces were stated to be from auriferous quartz reef, and 717,482 ounces from alluvial mines in the colony.

The Cattle Disease.—The Paris Academy of Sciences is occupying itself seriously with the question of the cattle disease, which has raged so fearfully in France since the war. M. Bouley is specially engaged on the subject. He declares the disease to be endemic in all that part of Europe comprised between the Ural and Carpathian mountains; that it is permanent, and constantly perpetuated by contagion. At the same time, he asserts that the disease has not the same serious effect on the cattle of the Steppes as it has upon other races. In Paris the mortality caused by it has been terrible, not more than 1 to 2 per cent. of the animals attacked having survived. Mr. Bouley having passed in review all the recorded cases of this epidemic, declared that it always arrived with the emigrations from the east of Europe since the invasion of the west by the Cimbri and Teutons. This fact he declared to be beyond question; the bovine disease, which ravaged successively Holland, England, and Spain, had no other origin. In reply to those who have asserted that the disease in question arises in Western countries from climacteric causes, or want of care, M. Bouley cites the following striking fact:—The 4,000 bullocks and 220,000 sheep enclosed in Paris during the siege were placed in peculiarly unfavourable circumstances; all suffered, but not a single animal was attacked by the epidemic during the whole period of the siege. When the armistice opened the circle around the city, cattle were purchased from Prussian sources, and the disease immediately made its appearance, the stock was affected, and the animals died at the rate of two hundred per day. In support of this view he cited also the case of England and the opinions there entertained upon the subject. On another point of great importance M. Bouley dwelt with emphasis. He declared the flesh of animals attacked by the disease was perfectly innocuous, that there was not the slightest inconvenience in the use of such meat as food, &c. He protested against the practice which prevailed in the department of the Nord, where even animals suspected of being attacked were killed and buried. Our supply of butchers' meat, said M. Bouley, is too precarious to allow of such waste, and, besides, the public health may suffer from the accumulation of so many carcases. He protested in like manner against what had been done in Brittany, where eight hundred diseased animals a day had been placed on board old ships and sunk by cannon shot in the Atlantic. Experiments are being made under M. Bouley's direction in the treatment of the disease with phenic acid, and Dr. Déclat is pursuing other experiments with an analogous substance. M. Bouley expresses great hopes of the success of these modes of treatment, the results of which will be reported shortly. M. Dumas, the perpetual secretary of the Academy, communicated another mode which had been suggested, namely, to surround the animal with an an antiputrid atmosphere by means of a considerable dose of napthaline in the litter, to wash it with water containing phenic acid, and to administer daily from ten to twelve litres of water, containing a one thousandth part of phenic acid, this by way of preventative. In cases of positively diseased animals, a like course is recommended, but with an increase in the quantity of the acid to 25 grammes (nearly an ounce) a day. In case the remedy should fail to save the animal, the flesh, it was observed, would be impregnated with the antiseptic, and cease to be an element for propagating the disease.

Merchant Shipping between France and England.—It was announced the other day that the new French government had informed the representatives of the ports of France that it intended, without delay, to put an end to maritime free-trade, and that necessary legislative measures would be immediately submitted to the deliberation of the National Assembly. It is almost unnecessary to state that the events which have occurred in Paris during the last few days have put a stop to this and all other business not immediately touching the state of Paris; but, should the existing government maintain itself, there is not the slightest question that it will attempt to reimpose protective, if not prohibitive, duties, not only on foreign shipping, but on all foreign productions. Possibly the Orleanists and some Republicans in the Assembly may oppose these measures, but the fact should not be overlooked that the new-born commerce between France and England is in the greatest danger of being destroyed.

Mortality in Paris.—Dr. Decaisne has read a note before the Paris Academy of Sciences on the public health of the city during the siege, endeavouring to discover the causes of the frightful mortality amongst the beseiged population, especially during the last three months, by studying especially the six most common typical maladies—small-pox, typhoid fever, bronchitis, inflammation of the lungs, diarrhœa, and dysentery. The prevalence of some of these diseases in England at the present moment renders such inquiries of special interest. Amongst the causes of the marked increase of small-pox after the first few weeks of the siege, M. Decaisne points out the billeting of the Mobiles from the provinces on the inhabitants. After having contracted the disease, they naturally helped to spread it afterwards amongst the civil and military population. The enormous number of deaths from typhoidal fever is explained by a well-known circumstance. This fever especially attacks young men newly arrived in a great city, and who, besides being badly lodged and ill-fed, are submitted to great fatigue and affected by nostalgia. As regards bronchitis and diseases of the lungs, which carried off so many victims, the mortality is referred to the excessive rigour of the season and insufficient or unwholesome food, the effect of which was to chill the whole organisation and to break down the power of resistance to exterior influences. In like manner the number of deaths caused by diarrhœa is attributed principally to insufficient nourishment, deteriorated and ill-cooked food, cold and damp, and, during the latter weeks of the siege, the unwholesome bread. In the case of infants, the small supply and bad quality of the milk are considered to have been the chief exciting causes. Dr. Decaisne drew attention to the fact that, during certain weeks, the mortality of infants reached to three-fourths of the total deaths of the city in average years. The note of M. Decaisne shows how a besieged city had its population decimated without the presence either of cholera or typhus. The official returns show that the number of deaths during certain weeks of the siege showed an increase of 300 per cent. as compared with the corresponding weeks of the previous year. The immediate diminution of the mortality on the siege being raised is a welcome fact. During the week ending the 3rd February, the deaths reached, exclusive of the army, 4,671; in the week ending the 3rd of March they had fallen to 2,993, being a diminution of 1,678 in twenty-eight days. During the last week of this period the diminution attained to 507. In the same week the deaths from small-pox only amounted to 85, the lowest weekly number attained since 26th March, 1870.

Trade in Fruit and Vegetables at Naples.—The exportation of fresh fruit and vegetables has of late become a matter of considerable importance, and a large quantity is despatched weekly by rail, not only for the north of Italy, but also for Vienna, and even St. Petersburg. The green stuff, such as cabbage, cauliflowers, spinach, &c., is chiefly produced in the neighbourhood of Castellamare, while the other vegetables are brought from Messina, Palermo, and Sorrento. The fresh fruit is almost entirely furnished by the province of Naples, and the dried fruit from Calabria and Salerno.

Mineral Resources of China.—Amongst the mineral productions which are so abundant in China may be mentioned the occurrence of gold in the beds of several rivers. It is found chiefly associated with iron pyrites. Beyond the most simple processes of washing, the Chinese are ignorant of any other mode of extracting this metal. Silver is found in larger quantities, and its extraction from the ore is an imperial monopoly. Tin is found in the south-west provinces, and zinc is produced at Canton. Copper is extremely abundant in China. Malachite and azurite is obtained in many places. With regard to the manufacture and the smelting of iron ores, the processes in use in China are identical to those in use in other countries. The best steel is produced from a magnetic oxide of iron.

Agricultural Exhibition at Stamboul.—From the *Levant Herald* of March 1st, we learn that "after next harvest an agricultural exhibition will be opened at Stamboul, under the auspices of the Minister of Finance, for the purpose of exhibiting and comparing agricultural products, and everything pertaining to the culture of the soil from the whole of the provinces of the Turkish empire." This is a step in the right direction. The agricultural products of the empire are very varied, according to soil and climate. Wheat, barley, and rice; the vine and the olive; tobacco, and the poppy, are all cultivated, and nature without much aid from art produces abundant crops. Fruits of many kinds, as figs, oranges, &c., grow luxuriantly, and would be much more abundant with superior cultivation, which must ensue in some degree as a result of the exhibition. Cotton cultivation languishes now for want of enterprise, but a few years ago there was an intention of having an exhibition in connection with agriculture, but, unfortunately, this intention was not carried out. That the Turkish government is anxious for the development of the agricultural resources of the empire was evidenced at the exhibition in Constantinople, when prizes were awarded to English exhibitors of implements.

Education in Prussia.—The following statistics respecting the education of the conscripts for the Prussian army, in 1869-70, will be found interesting. In Prussia, out of the 10,809 conscripts who were called upon to serve in the army, there were 1,183 who could not read, or 11 per cent. upon the whole number. Upon 7,836 in Brandenburg, there were 47, or 0·59 per cent. Pomerania gives 47 out of 4,955 conscripts, equal to 1·08 per cent. In the province of Posen, out of 5,577 there were 802, or 14·38 per cent. Silesia, 361 out of 12,605, or 2·86 per cent. Saxony, only 28 out of 7,516, or 0·87 per cent. Schleswig-Holstein, 19 out of 2,748, or 0·69 per cent. Hanover, 54 out of 6,188, or 0·87 per cent. Westphalia, 60 out of 5,806, or 1·03 per cent. Nassau, 10 out of 4,359, or 0·22 per cent. In the provinces of the Rhine, 84 were found out of 11,188, equal to 0·75 per cent. In Hohenzollern, out of 227, not a single conscript was found who could not read; and in Lauenberg, only one out of 174, or 0·57 per cent. Thus, out of 80,028 recruits, 2,696 could not read, giving an average of 3·37 per cent. upon the whole number. It will be seen that the majority of uneducated conscripts belong to the Prussian provinces, and this must be attributed, to a certain extent, to the predominance of the Polish element; but with the exception of the provinces of Prussia, Silesia, and Posen, the number of recruits who cannot read is really insignificant.

Botanical Gardens in Europe.—From a recently-published account respecting the principal botanical gardens in Europe, it appears that the first established was that of Padua, in 1545, followed by that of Pisa. Those of Leyden and Leipsig date respectively 1577 and 1579. The Montpelier garden was founded in 1593; that of Giessen in 1605; of Strasburg, in 1620; of Alford, in 1625; and of Jena, in 1629. The Jardin des Plantes, at Paris, was established in 1626, and the Upsal garden in 1627; that of Madrid dates from 1763; and that of Coimbra from 1773. At the close of the eighteenth century, according to Gesner, more than 1,600 kindred establishments existed in Europe. England comes late upon the list, the Oxford garden not having been founded until 1632, and long remaining the only one in the kingdom.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

April 19.—On "The Economical Construction of Workmen's Dwellings, and especially in reference to Improving the Health and Habits of the Class." By J. H. Stallard, M.D.

April 26.—"Photography in the Printing Press, being a description of the working of the Heliotype Process." By Ernest Edwards, Esq., B.A.

May 3.—"On the Production of Artificial Cold." By Professor John Gamgee.

May 10.—On "The Application of Steam to Canals." By Geo. Edward Harding, Esq., C.E.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...**SOCIETY OF ARTS**, 8. Cantor Lectures. Dr. T. Spencer Cobbold, F.R.S., "On Food-producing Ruminants, and on the Parasites which reside in them."
Victoria Institute, 8. Dr. E. Haughton, "On Evidences of Design in the Constitution of Nature."
Royal United Service Institute, 8½. Captain Mervin Drake, on "The Government Breech-loading Rifles of France, Prussia, and England."
British Architects, 8.
Anthropological Institute, 8.
Medical, 8.
Asiatic, 3.
London Institution, 4.

Tues. ...Civil Engineers, 8. Sir Francis Charles Knowles, Bart., "On the Archimedian Screw Propeller, or Helix, of Maximum Works."
Statistical, 8.
Pathological, 8.
Geologists' Association. Visit to Zoological and Hunterian Collections of the Royal College of Surgeons.
Royal Institution, 3. Mr. Pengelly, "On the Geology of Devonshire, especially of the New Red Sandstone."

Wed. ...**SOCIETY OF ARTS**, 8. Mr. J. H. Stallard, M.D., on "The Economical Construction of Workmen's Dwellings, and especially in reference to Improving the Health and Habits of the Class."
SOCIETY OF ARTS, 8. Second of a Series of Six **CONCERTS** in the **ROYAL ALBERT HALL** in aid of a National Training School for Music.
Meteorological, 7.
Royal Society of Literature, 4½. Annual Meeting.

Thurs...Royal Institution, 3. Professor Tyndall, "On Sound."
Royal, 8½.
Antiquaries, 8½.
London Institution, 7½.
Linnæan, 8.
Chemical, 8.
Numismatic, 7.
Royal Society Club, 6.

Fri.......Architectural Association, 7½. Mr. J. T. Perry, "Treatment of Terra Cotta."
Royal United Service Institute, 3. Surgeon-Major J. S. Morrat, M.D., "A Visit to some of the Battle Fields and Ambulances of the North of France."
Royal Institution, 9 Professor Blackie, "On the Pre-Socratic Philosophy."

Sat ......Royal Botanic, 3¾.
Royal Institution, 3. Mr. Lockyer, "Astronomy."
Royal School of Mines, 8. Dr. Cobbold, F.R.S., "Geology." (Swiney Course.)

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FRIDAY, APRIL 21, 1871.

PROCEEDINGS OF THE SOCIETY.

NINETEENTH ORDINARY MEETING.

Wednesday, April 19th, 1871; the Right Hon. the Earl of Shaftesbury, K.G., in the chair.

The following candidates were proposed for election as members of the Society:—

Clayton, Frederick, M.D., Millbrook-house, Navan, Co. Meath.
Ellerton, John Lodge, 6, Connaught-place, Hyde-park, W.
Fletcher, Banister, 24, Bedford-square, W.C.
Horwitz, Albert, Mus. D., 7, Victoria-road, Holloway, N.
Rae, Robert, 18, Fitzwilliam-road, Clapham, S.W.
Ritchie, Thomas Boldwin, 16, Gresham-street, E.C.
Smith, Frederick William, Sutton-lodge, Hackney.
Taylor, Capt. Robert Francis, 30, Cave's-terrace, Shepherd's-bush, W.
Wade, John Edward, 8, South-parade, Leeds.

The following candidates were balloted for and duly elected members of the Society:—

Biden, Lewis, 9, Victoria-chambers, Westminster, S.W.
Butt, Edward Northway, 13, Curzon-street, Mayfair, W.
Cotton, William James Richmond, Alderman, 47, St. Mary-axe, E.C.
Curtis, George, Limmer's Hotel, Conduit-street, W.
De Lacy, George, 38, Sekforde-street, Clerkenwell, E.C.
Hart, John, 10, New Bridge-street, Blackfriars, E.C.
Rawley, Samuel Henry, 2, Hart-street, Mark-lane, E.C.
Wright, Frank, 38, High-street, Kensington, W.

The Paper read was—

ON THE ECONOMICAL CONSTRUCTION OF WORKMEN'S DWELLINGS, AND ESPECIALLY IN REFERENCE TO IMPROVING THE HEALTH AND HABITS OF THE CLASS.

By J. H. Stallard, M.B. Lond., M.R.C.P.L., &c.

The question which I have undertaken to re-introduce this evening needs no preface. Its importance will, I am sure, be readily admitted by the members of this Society. The improvement of the homes of the people lies at the very foundation of political and social progress. Whilst the great masses of the people are compelled to live in filthy, over-crowded, and unwholesome dwellings, sickness and pauperism must flourish, and drunkenness and idleness increase. The cultivation of the arts and sciences becomes impossible, and morality and religion have no space to grow in. In this variable climate shelter is the first necessity of existence; it stands before food and raiment, and it is, unhappily, not necessary to look far around us for evidence to prove that adequate home accommodation is at present utterly beyond the means of a common working man. I do not intend, because I am quite incompetent to present to this meeting any history of the noble attempts which have been made by individuals, societies, and commercial speculators, to solve the great and difficult problem upon which depends the happiness and prosperity of this rich and productive country. But I should do violence to my feelings if I failed to acknowledge the eminent services which have been rendered by distinguished practical philanthropists, of whom our Chairman this evening is the president and chief. And if their efforts have not as yet succeeded to the extent desired, it cannot be doubted that the experiments already made under their auspices have resulted in very great improvements, and have, I think, indicated and paved the way to a more complete solution of the problem at a future date. All I can say is, that the men who designed and built the George-street Model Lodging-house, nearly a quarter of a century ago, deserve the deepest thanks of the entire community; and if, under the guidance and teaching of their experience, I shall this evening offer any suggestion for improvement on their plans, I shall feel that my appearance before you has been fully justified.

It is my intention to confine my observations to that part of the subject which relates to single persons. I do so because the instances of successful model dwellings are far more numerous than of successful model lodging houses; indeed, I am disposed to think that the possibility of providing good and suitable family accommodation on remunerative terms to builders and capitalists is all but proved. But, further, I do so because I consider that the case of the married should naturally come last. According to my view, the Peabody trustees, for example, are beginning at the wrong end. They are interfering in a case which capitalists can well afford to deal with, and they are offering artificial assistance to a class which, if prudent, should not require it. We require no new inducements to marriage; rather, on the contrary, new inducements for the single to remain so.

It is no argument to say that the pressure on the single man in respect to house accommodation is less urgent than on one who has a family. No doubt it is, but if the want of a decent home be not felt by the one, how shall it be felt by the other? Is it possible to conceive that the man who has passed a year or two in some dirty, common lodging house, will stop an instant to consider whether he will be able to provide a home and home comforts in the married state. But if by any means we can succeed in raising the standard of comfort amongst the young and single ever so little, we shall inevitably provide an additional safeguard against early and imprudent marriages, and also against the subsequent occupation of over-crowded and unwholesome rooms; whilst, on the other hand, we shall have created a "real want" in the mind of the labourer, and have created a demand for wholesome house accommodation which, under such conditions, the capitalist will certainly supply. There are also other objections to commencing with the married class. If a couple be sober, industrious, and cleanly, they will make any home tidy and salubrious, and as soon as the family outgrow the accommodation, they will make surprising efforts to economise or extend their dwelling. Such persons do not need to go to any school of cleanliness; and although the want of fitting home accommodation is undoubtedly most urgent, it would be a greater evil still if charity were to step in and relieve them of all their difficulty. But when the members of the family are idle, drunken, and dirty, they have already arrived at an age when there is little hope of radical reform. By the nature of their case they are excluded from those very influences of which they have by far the greater need. And when, by any accident, they are admitted to the model dwelling, they spoil and overcrowd the rooms, destroy their healthiness, and spend the savings, due to the help of charity, at the nearest public-house. Besides, any unnatural selection of the sober and industrious for special treatment is, as I believe, an evil. It removes from the debased and drunken the only influence which is capable of shaming them into better habits. The tendency on the part of society to separate itself into cliques—the rich here, the poor there—the honest here, the thief there—the pauper in one street, and the independent far away—

is one of the greatest evils of our time. We are perpetually ignoring the power of personal association. We do our charity by proxy, and seek to improve our race by raising up huge establishments in which the various classes of humanity are dealt with wholesale, in defiance of those laws of personal association which constitute the basis of a Christian life. I confess I regard with great jealousy and distrust all proposals for reforming society by taking away sections for special treatment. The only effectual means of reforming the idle is by associating him with the industrious, and we must therefore be careful not to isolate the good from the bad by any artificial means.

I propose, then, to commence at the very bottom of the scale, where indeed the chief difficulty is found. We have a maxim that the condition of the lowest independent labourer should be more eligible than that of the pauper, yet in respect to lodgings how far is this from fact. It is not necessary for me to contrast the warm, well-lighted, clean, and comfortable bedroom in the workhouse with the dirty, ill-fitted lodging-house, overrun with vermin, or the clean and comfortable day-room, with its roaring fire and well-provided dining table, with the dark and dismal cellars which form the kitchen of the common lodging-house. Still wider is the comparison between the very best chamber of a model lodging-house and a convict's cell. The one dark, close, and dingy; the other, light, bright, and well ventilated. The one with its unwashed floor and vermin-trodden walls; the other safe from the soil of a dirty boot, and clean as a dining table. In the one a hard and scanty bed, with grimy sheets and coverlet unwashed for seven years; in the other, a clean and comfortable hammock, exposed to the air daily, and hung up out of reach till bedtime. In the lodging-room, no jug of water, no basin to wash in, no towel, no night dress, no chair, no table, no book-shelf, no light to read or write by, no glass of pure water to drink—in fact, no comforts whatever; in the other, all these, and books for self-improvement also. I make bold to say that, barring the key outside the door, the convict is more comfortably lodged than the soldier, the sailor, or the labouring man. But it is not only in the chamber itself that the convict enjoys the greatest advantages; he can have a bath whenever he is dirty. At Chatham, the convicts have 300 baths a-day, and the expense is saved in washing sheets and blankets. When men are engaged in dirty work, as they are at Chatham, baths are necessary, and I venture to suggest that free baths shoud be considered as essential to every lodging-house as they are to the casual wards.

It will be gathered, from what I have stated, that I am altogether dissatisfied with the structure of existing lodging-houses; but I must not let it be supposed that I claim to raise the standard of cleanliness, decency, and comfort, at once and rapidly, to that of a workhouse dormitory or a convict's cell. No one is more sensible than I am of the impossibility of doing so. In this gloriously free old country a man enjoys the right of doing what he likes with his own person, and I have no desire to curtail his privilege. His hands may be dirty and his face unwashed. It is his discomfort, and not mine. He may sleep on the floor if he prefer it to a bed. He may wear a coat of cloth or shamble forth in rags, and society has no right whatever to complain. Discipline in matters of this description, officially imposed, savours too much of the pauper and the convict to be acceptable to independent men, and will be resisted rather than obeyed. Now, it is one of the failings of some model lodging-houses that they have attempted and have required too much. Deeply anxious for the moral and religious, as well as physical improvement of the classes with whom they deal, their promoters and managers have laid down rules which have had the effect of driving from the doors those who most require reform. That this is so, may readily be proved by the fact that, for every successful model lodging-house, there are probably a thousand which owe their existence to national, social, and economical laws, and in which the primary object is not to improve, but to supply a want. But let me be clearly understood. Some classification must of course be made, and some degree of discipline enforced; but the point is, that these should be left to those natural laws which regulate themselves. All things being equal, the class of lodgers bears a direct relation to the character of the inhabitants of the district in which the lodging-house is placed, and to the nature of the employment prevailing in the neighbourhood.

Let us stop a moment to admire the wonderful elasticity of the natural system. If the lodgers have to attend the early market, they must be roused in time; if they are employed at a printing-office half through the night, they must be quietly let in. What a folly it is to direct that the house shall be closed at this or that hour without the consent of the majority of inmates. And then, again, let us admire the tenderness with which the lowest class of lodgers overlook the faults and weaknesses of those with whom they are perforce associated, and yet how firmly they insist upon the discharge of an obnoxious inmate. It would be utterly impossible for any house to be conducted profitably without any sort of discipline whatever. Even the card-playing houses have certain limits to the game. I propose, therefore, to deal with this question solely on principles of profit. I would exclude no one whom the society to which he seeks admission does not exclude. Any action holding out a prospect of success must, therefore, begin as I propose, at the very bottom of the scale. It must be prepared to meet the wants of thieves, sharpers, and gamblers, as well as industrious and honest men. This class forms the large majority of those with whom it is desirable to establish a relationship, and from whom chiefly our profits are at first, at all events, to come. We must seek to enter into a real competition with the low, dirty, filthy, ill-arranged, and ill-furnished den of thieves. We must be content to woo all classes with simple structural advantages. We must carefully exclude all appearance of a desire to reform people. It will not be difficult to give a little cleaner bed, or a more wholesome room than is to be found in ninety-nine out of a hundred lodging-houses. The thief appreciates a comfortable fire and good cooking apparatus, and he will avail himself of these advantages if you offer them as a simple matter of business. As regards his character and occupation, leave him to the police, as is done in the houses which he now frequents. Be sure if the management becomes a public scandal the police will deal with it. Once get lodgers inside, and we may safely rely upon personal association for every possible reform. No regulations can exclude the good altogether, and no violence will prevent its influence. Personal association is the only leaven by which the standard of public opinion and public conduct can be raised, and a simple structural improvement is the fulcrum on which I propose to raise it.

In the next place I would observe that, in dealing with this question, we must carefully apply the usual principles of trade and competition. With respect to the erection of buildings, it is pretty generally recognised that they may be built by societies as successfully as by individuals; but it is equally certain that individuals can alone manage them. Societies cannot be manager, and if they employ a manager at a fixed salary, he either neglects his duty, or serves his relatives and friends, if he do not actually help himself. We must, therefore, let out our buildings to responsible tenants on fair terms, and if, like house builders, we have confidence in our scheme, we shall not only build with judgment, but we shall cheapen the property until, as in a new neighbourhood, the demand is increased by the excellence of our supply.

Having thus laid down the general principles which ought to guide us in our future course, I proceed to examine into the possibilities of profit, the danger which threaten to reduce the profit and convert it into loss, and then I shall proceed to inquire whether it is within the bounds of possibility to provide suitable buildings which shall yield a profit of at least five or six per cent. to the capitalist.

Now, in the first place, I would argue generally that 4d. per night, or 2s. per week, is within the reach of the poorest working man. This is the result of Mr. Archer's experience at Westminster, and I do not think it possible to find a poorer class. In the central parts of London it is quite as easy to obtain 6d. per night, or 3s. per week, as it is 4d., and the extra income will be rendered necessary by the extra cost of sites. But for the purpose of the proposals I am about to make, I shall reckon 4d. per night, or 2s. per week, as the sum with which we have to deal. Now, I scarcely think it necessary to offer observations to prove that this is, in the hands of the present proprietors of lodging-houses, a remunerative sum. How, otherwise, could lodging-houses flourish as they do at even 3d. per night. A man and his family live comfortably out of the profits of 20, 40, or 50 beds. When, a few years ago, a model lodging-house was opened in Liverpool by the Rev. Cecil Wray, there was not a decent lodging-house in the town. He opened with 134 beds, part at 4d., and part at 6d. per night. The profit, after paying every possible expense and adequate interest on every farthing of capital laid out, is, at least, one pound per bed per annum. Since then, the rev. proprietor has opened a second establishment, and there are at this moment in Liverpool more than a thousand beds managed on the same plan at 4d. per night. One proprietor has two houses, each containing 80 beds, and I have every reason to believe that the profits on the two establishments are not less than £400 a-year.

And yet, from a personal inspection of those lodging-houses, I am bound to observe that the accommodation is by no means equal to that of a workhouse. The improvised nature of the houses makes it impossible to secure adequate light and ventilation. The cubicles are more or less overrun with vermin. The lavatories, urinals, water-closets, and kitchens, are open to many objections, and these structural defects greatly augment the expense of firing, soap, linen, service, &c. All these objections apply with even greater force to the majority of London lodging-houses, and yet it is absolutely certain that they pay splendidly. Look at their number. At the present moment there are in London 1,310 registered houses, accommodating over 80,000 individuals. In Liverpool, there are over 1,000 registered lodging-houses; indeed, in every centre of industry, there is an enormous demand, which is very inadequately met. There is one proprietor in London who began with a few beds. He has now six lodging-houses in profitable occupation, and has recently taken a seventh. He lives in the country, and drives up to superintend his properties. But it may be objected that there are many failures. This, however, is not surprising when the general character of the keepers of these establishments is fairly reckoned up. Many are drunken bullies, without education, often without character. But even societies have failed. Yes, for how often do individuals succeed after a company's failure is complete. But there are, in such cases, reasons for the failure. Take the case of the Soho-chambers, opened by the Society for Improving the Dwellings of the Industrious Classes. They converted a large warehouse into a lodging-house for 128 single men, and they suffered a loss of more than £200 a-year. Now, it is surprising to find that although the rents, taxes, and repairs exceeded £500 a-year, it was not that great expenditure which caused the loss. If the beds had only been reasonably filled, that is, if there had only been 10 per cent. of empty beds, the income would have amounted to £850, which might have been expected to cover reasonable outgoings besides the rent. But the beds were never full; the place was only an adaptation; the dormitories were uncomfortable, overrun with vermin and ill-ventilated; whilst, on the other hand, service cost £226 15s. per annum, or near upon two pounds per bed.

At Albert-buildings, Mile-end, an opposite mistake was made. The building was all that an enlightened architect could make it. It was provided with numerous workshops, a laundry, a library, and special restaurant, none of which, however, were ever used. The house was erected for 234 single men, and was never more than two-thirds full. Lodgers were not even coaxed into it by a reduction of the charge. It was altogether above the requirements of a Mile-end and Whitechapel population, and it has been converted into family dwellings. Again, I observe, that it was not the high rent which was the cause of failure. If the building had proved really suitable, it might have been filled most easily, and the addition of another 20 per cent. of lodgers would have raised the interest actually obtained from one to five per cent. Nevertheless, it must be remarked that the same profit would have been attained if there had been no library, no workrooms, no restaurant, that is, if the building had been strictly limited to the actual requirements of the occupiers. But it was not simply a want of lodgers or excessive rental which contributed to the failure. The size and perfection of the building involved an extravagant outlay in gas, coals, and service. Contrast this service with that of Great Peter-street. In the one it was £350 a year for 170 lodgers, in the other it is less than £90 a year for 100 lodgers, and yet in the latter everything is against the cleaners. The rooms are small and ill adapted to the purpose, and nothing but the most constant labour would serve to keep them in a creditable state. I think, then, we may conclude that rent ought not to be the cause of failure, and will not be if the buildings are kept sufficiently simple in their character, and suitable to the requirements of the classes we desire should occupy them.

Now, it is necessary to lay down certain rigid but very simple rules for the construction of such establishments. There are three great sanitary agents which it is scarcely possible to provide too lavishly. They are light, air, soap, and water. Unseen dirt is never removed, and serves as the nidus of vermin and disease. Of air it is impossible to get too much in a lodging-house, if it can be brought in without the creation of a distinct draught, of which the lodger has an insuperable dread. No part of any lodging-house should owe its cleanliness to paint or varnish, but to plain soap and water, in fact, I would have no materials employed which would not wash. In the next place, all the materials must be cheap, and the fittings substantial. We must have no complicated machinery—nothing within the reach of our lodgers which can by any possibility get out of order. I would refuse to admit a water-closet, as being altogether beyond and above the capacity of the lowest order of labourers; indeed, under their abuse, it becomes a source of continual expense. We must have no boilers, no steam-engines, no ventilating apparatus, requiring adjustment; in fact, everything must be well within the experience of the most ignorant.

Then as to the accommodation, I regard three things as essential:—1st, a separate sleeping apartment, which may be used as a dressing-room, workshop, or study; 2nd, a good kitchen, with an open fire; and, 3rd, a general sitting-room, for reading, conversation, and amusement. Of these by far the most important is the first. The principle of separate chambers has long been adopted in the best model lodging houses; but, as I have previously stated, they are all inferior to a convict's cell. I propose that every chamber shall be 8 feet long, 4 feet 6 in. wide, and with a ceiling 8 ft. above the floor, made of perforated zinc. Above this ceiling is a passage, which communicates externally with the open air by means of perforated bricks, and internally with the interior of the building. As the door of the chamber ought not to reach the floor, there will always be an abundant supply of fresh air without the possibility of draught. A somewhat similar arrangement has, I believe, been adopted at the Woking Convict Prison, but, in my opinion, it is there spoiled by a perpendicular diaphragm within the passage, and the grating at the top of the cell is too open to keep out draught. The peculiar feature of this scheme of ventilation is, that it depends on the large extent of opening for the admission and discharge of air, whereby diffusion takes place without the possibility of draught. On this plan, every ceiling is practically open to the sky, and every room is for purposes of ventilation at the top of the house. Moreover, the arrangements are quite beyond the control of the inmates. No one can shut it up or put a stop to the interchange which goes on between the air of his room and that outside. The more open the passage is, the less will the violence of any extensive wind be felt, since its force will be expended in passing through the building, and not in passing through the room. The ventilation will go on just as well and just as imperceptibly when there is a storm as when there is calm outside; and if it should be thought that the rooms will be too cold, I have only to remark that I have never yet visited a barrack-room in which the air was satisfactory at twelve o'clock at night; that cold, pure air is not in itself dangerous to any healthy person, as has been abundantly proved by the recent Prussian campaign, and that an extra covering will meet the difficulty even in the depth of winter. The chambers have separate windows, and the doors open on a corridor, which commences from the first-floor of the building, and is lighted from the top by a sky-light, also made to open freely on two sides. There are three tiers of chambers, the upper stories being approached by a staircase at the end, and by galleries around the corridor.

Then, as regards cubic space, I would observe that the Army Sanitary Commissioners arrived at the conclusion that a man requires 600 cubic feet for the maintenance of health. Now, a soldier exists under peculiarly favourable conditions. He is well and regularly fed, he is only moderately worked, he has no really dirty work to do; but a labouring man has to undertake all sorts of dirty work, his clothes are rarely clean, and his skin is generally grimy with dirt and perspiration; and yet, curiously, the law only provides that he shall have 300 cubic feet in a common lodging-house, and 350 cubic feet in a sub-let room.

I maintain that space is far more essential to the working man than it is to the soldier, and that instead of being insensibly poisoned and protracted whilst breathing offensive and expired air, he ought to be secured an abundance of that which imparts new vigour and new life, and by which he is enabled to rise refreshed from his slumbers. Now, one of the great advantages of the plan I venture to submit is, that it will give to every occupant a space of more than 600 cubic feet, besides ventilation such as, I venture to believe, will not be found in any other form of building.

Having thus constructed our chamber, we have next to furnish it. And here again I notice, in model lodging-houses, a very great defect. The bedstead occupies so very large a portion of the space, that the lodger has no room to move, and the attendant is also unable to clean and scrub out the floor. We must have the means of clearing off the bedstead at a moment's notice, in order that the lodger may, if he please, wash himself from head to foot without wetting the bedclothes, or that he may set to work at his trade, or to mend his shoes or clothes; or that the attendant may properly wash the floor without hindrance. Now this may be accomplished in three different ways:—1. We replace the bed by a hammock, which, being taken off the hooks, may be rolled up and placed on a shelf provided for it. This is the method adopted at Chatham.

As, however, I am fearful that our land lubbers may have a prejudice against hammocks, I proceed to the other plans, viz., the bedstead may consist of an iron framework, fastened to the wall by a hinge; it is turned up close when not wanted, and the rolled-up bedding is, as before, put upon the shelf over head. The third is, I think, the simplest and the best plan. Let there be a low, wooden bedstead, strong and well jointed; it need not be more than from 8 to 12 inches from the floor, and it must be so made as to stand upright in the corner of the chamber. Of course the bedding will be treated as before.

There is yet another plan, but I have not included it, because I consider it somewhat above the capacity of the fourpenny lodger class, viz., an iron camp chair bedstead, which folds up, and has a recess underneath for the bed clothes. Having thus provided space for ablutions, it follows that every chamber must have a wash-basin, a slop-pail, a water jug, and a towel; all of which articles may be fixtures, that is, fastened so that they cannot be removed. Then we must have a looking-glass, a library shelf, a metal drinking cup, a table, stool or chair. I forgot to observe that the floor should be of asphalte. I should like to make a night-shirt part of the furniture, and perhaps its safety might be ensured by a small deposit. I am not sure that this would be practicable. If the house were erected for a sixpenny class I would give a special gas light, to be paid for at so much a week, if there was likely to be a demand for it.

Before we have done with the bed-chamber it is necessary to provide the service. And here allow me to say, that the question of having the cleaning done by men or women is one which must be determined in some measure by the character of the lodgers; indeed, if the tenant is also manager, the matter may be left to his discretion. But for myself, I may state, as the result of a very wide experience, that I am altogether in favour of employing women. Men rarely, if ever, go down on their knees to scrub a floor as they ought to do. They are slovenly cleaners and dusters; they want much more looking after. It would be necessary to keep the lodgers out of the bedrooms during certain hours of the day—say from 9 to 12—and during that time the beds would be hung out for airing, the chambers swept out, the slops taken away, fresh water brought in, and the bed either put up tidily on the shelf, or made ready for use, according to the requirements of the occupant. The slops would be emptied at the end of the gallery, where also fresh water would be drawn. Every chamber would have a private lock, and the superintendent a master key.

The other essentials are in my plan provided in a special way, and on a principle which adapts itself to the number of beds in the building, whether these be 30 or 300. When the dormitories, as in George-street, Bloomsbury, are only 23 feet wide, and there are three stories, it is found that the ground-floor is not sufficient for the kitchens, reading-room, and superintendent's offices, &c. In the plan I lay before you, I have widened the building without augmenting the quantity of flooring at the upper part, and the increased space thus provided contributes greatly to the wholesomeness of the bed-rooms. By having this space and the ventilating passages above the ceilings we get rid of all special apparatus for ventilation; indeed, I may here state that I have never yet found the air of lodging-houses, or barracks, or workhouses at night in a proper state; and I believe that what are called ventilating shafts are quite as often inlets as outlets, when they act, and that they often never act at all. But by this widening the building we obtain a large space for kitchens, &c., on the ground-floor, and we have also a large floor space on the first-floor, which may be used as a general reading-room or parcelled out into special sitting-rooms, as in the plan. The superintendent's apartments and staircase are placed at the entrance. They are simple; we must have no married men, children, or hangers on, and the offices, viz., day lavatories, urinals, coal-house, and general store place, may either occupy a portion on the ground-floor or be placed outside. Baths may be managed in the basement, below the entrance-hall and lodge. I think they are desirable where there are no baths near, but I would not erect them until the tenant was willing to pay full rent for them. There should be a cooking-grate for every 70 lodgers, and it is desirable that there should not be more than two cooking ranges in one room. At Liverpool, men who pay by the week use a superior kitchen. Those by the night one less convenient. As regards the living rooms, it is desirable that there should be as much variation in the building as possible, due regard being had to the economy of fuel and service. Where the numbers exceed 100, it will not be difficult to have a special smoking-room. After consultation with practical men, I am of opinion that a building for 200 will prove most economical.

And now as to the cost, and for this I must refer you to the estimate of Mr. Saxon Snell, in whose judgment and experience I have the greatest confidence. He has erected some most admirable infirm wards in the City-road at a price within the estimated cost. The accommodation provided in the plans he has been so good as to prepare for me, consists of 204 bedrooms, 8 feet long by 4 feet wide, with an available breathing-space of 720 cubic feet per bed, and adequate ventilation on the plan I have already noticed, on the first, second, and third floors; 16 private sitting-rooms, each 9 feet long and 8 feet wide, on the first-floor; porter's lodge, lavatories, water-closets, kitchen, reading, conversation, and dining-rooms, of adequate size, on the ground-floor. For the building only the estimated cost is £8,000. If we add bath-rooms, heating apparatus, &c., on the basement, the additional cost will be £750. As it would be sufficient to provide 600 instead of 720 cubic feet per head, there would be a slight reduction effected by narrowing the building three feet; but I propose to leave this out, and, for the purpose of calculation, adopt the plan as it is. I calculate that £2 per head, or say £400, will provide what may be called permanent fittings, to be let with the buildings, such as shelves, bedsteads, fire-grates, &c., and if we can get a site for £600, our total cost will be £9,000, which at five per cent. would entail a rental of £500 a-year, with an allowance of £50 a-year for repairs. If the site should exceed this cost (that at of the Albert-chambers at Mile-end cost £650), it might become necessary to add another 3d. per night to the rental of the rooms. Now the question is, could a tenant be expected to undertake the management of such a building with a reasonable prospect of profit? I am inclined to think so. His balance-sheet may be roughly estimated as follows:—

Capital Account.

	£	s.	d.
220 sets of bedding	300	0	0
Other utensils	100	0	0
	400	0	0

Income.

	£	s.	d.
204 beds, at 2s. per week	1,060	16	0
16 „ 3s. „	124	16	0
	1,185	12	0
Deduct 10 per cent. for empties	118	0	0
	1,067	12	0

Expenditure.

	£	s.	d.
Rent	500	0	0
Interest on capital employed at 20 per cent.	80	0	0
Rates and taxes	70	0	0
Gas, coals, water, ...	100	0	0
3 servants, at £30 a-year each	90	0	0
Soap and sundries	20	0	0
Newspapers	7	12	0
Balance of profit for manager	200	0	0
	1,067	12	0

It is necessary to observe that in the foregoing my primary desire has been to prove the possibility of providing a building which under fair management should give the lodger the same sort of accommodation which is provided for the soldier, the convict, and the pauper, and to do this at the cost of 1s. per bed per week. If the expenditure had been estimated at £10,000 instead of £9,000 this would still be done, as 220 beds would yield £572 per annum at that rate. I am confident that a good manager will be able to pay the rent I have proposed, for in a vast majority of cases he will be able to make half-a-crown, or even three shillings per week of the sort of accommodation here provided.

Lastly, I would observe that rather than forego the competition, with lodging-houses at 3d. per night, I would consent to give up the important point of cubic space. Mr. Snell informs me that by doing away with the corridor, and putting the kitchens half below the ground, we might narrow the building to 23 feet, and save not less than £2,000 on its cost. This estimate is supported by the cost of George-street. This would give 400 cubic feet to every occupant, and would enable the tenant to realise a larger profit at 3d. per night than under my plan at 4d. It appears to me, therefore, that a cautious execution of the plans I have proposed would enable us to compete successfully with the wretched, filthy, and ill-ventilated apartments which are now in use.

Before I close my remarks, I desire to put myself right with regard to one possible misapprehension, which is this—that I should be very sorry by anything I have said to cast the slightest imputation or make any deprecatory remark of any kind on philanthropic and benevolent efforts with regard to this question. I think I have left quite enough for benevolent persons to do who feel disposed to do it. They would confer an immense benefit upon society if they can show in any way, as the Rev. Cecil Wray has done in Liverpool, that it is possible to give a man a tolerably comfortable bed and a separate apartment at the rate of 4d. per night, or 2s. a-week. That gentleman has conferred an immense advantage on the people at Liverpool, and although that does not by any means meet the necessities of the case, philanthropy cannot do better than erect something of this sort on an economical basis, beginning with the simplest plan, and by publishing the accounts show that it is a *bona-fide*, genuine success. There is another point which I must say I think has been missed to some extent by those who are willing to spend time, thought, and money on this question. We have premiums for model farms, why should we not have premiums for model lodging-houses. I quite believe that it would be a most desirable thing that we should issue premiums for the best-conducted model lodging-houses, not conducted by servants of public societies, but by private individuals; and let us have, also, the profits, if we can in any way get at them, though I am afraid they are too good to make known. There is one other form in which it seems to me benevolence may step in with the very greatest advantage, that is, by giving these people a little space which they can call their homes, and have a premium for the best-conducted and cleanest-kept home, and the best-kept chamber. I think in that way we should do more to raise the character of the building than by attempting to exclude anybody by artificial rules, or by putting servants at the door, or by any direct interference. I think if some portion of the Peabody fund could be directed to this lower and simpler mode it would really render an immense service to the poor of London. There are many thousands of people living in a deplorable state of wretchedness, filth, and dirt in the lower lodging-houses of London, which, by-the-way, do not come under the notice of the police here as they would in Liverpool. There, every house with more than one family in it is visited in its turn; it is not the case here, and so a great many of these irregular lodging-houses escape public observation altogether.

DISCUSSION.

Mr. Prideaux asked if it were the fact that it was usual in the lodging-houses which had been referred to to charge 2s. a week instead of 4d. a night, thus giving the tenant the benefit of the seventh day for nothing?

Dr. Stallard said it was so certainly.

Mr. Botly said he was somewhat disappointed to find that the paper, which he thought would have dealt with the cheapest mode of erecting dwellings for the labouring classes, was confined really to model lodging-houses, though, of course, he was very glad to hear of any means for pushing forward improvement.

Mr. Fletcher asked in what way the down draught was affected by the zinc roof spoken of, whether it was really prevented; and said he did not quite understand what amount of light was got into the private rooms shown on the plan. They seemed to him to be some 30 feet below the roof, and only to have a borrowed light.

Mr. Espinasse thought Dr. Stallard had gone rather out of his way to sneer at what he called the philanthropic element in the construction of model lodging-houses, but his own belief was, that without that element nothing would have been done in this way. Some years ago he looked into the financial details of some of these societies, and he found that it was impossible for any of them to realise a profit. When efforts were made to adapt and improve old houses, it was possible to make both ends meet, but not otherwise; and if it were true that a slight profit might be made, as was suggested, it would still remain the case that if only a free-trade principle were to be applied, much greater profits would be made by the proprietors of the wretched poor lodging-houses which had been referred to, and which, no doubt, returned 50 per cent., or even more. If a man had £6,000 he could invest it much better, in spite of Mr. Bruce's Bill, in a public-house, and get a higher per-centage, than by the building a model lodging-house. The only way, in his opinion, to get over the difficulty would be by the assistance of the government, not by building such houses out of taxes, but by using the savings of the working classes which were now deposited in savings banks at 2½ per cent., the money being reinvested in Consols, Red Sea Telegraphs, and other sources, at 3¼ or 3½, the difference being swallowed up in the expenses of management. He saw no objection to the investment of this money in the erection of model lodging-houses, which, according to Alderman Waterlow, would return at least 5 per cent., and he was sure that the depositors would be better satisfied to know their savings were thus employed.

Dr. Hardwicke said he concurred heartily with all that had fallen from Dr. Stallard, and was much pleased with the practical manner in which he had gone into the question, and he spoke with some authority, having taken an interest in the subject for some twenty years, during which time he had continually done all he could to improve the buildings of the working class. He was sorry that the paper was confined to buildings for single men, and hoped the wider subject would be taken up at a future time. He himself had brought forward a scheme for public dormitories three or four years ago, very much on the plan now suggested, and he thought it would be not at all difficult to show that all local authorities, corporations, and parishes ought, in some manner or other, to provide in every district some such accommodation. Some years ago, Professor Kerr, of University College, introduced a plan of single large rooms, 16 feet square, for families, which could be let for about 3s. 6d. a-week, giving a large amount of cubic space for the family, which was very essential, and though it was but one room, still partitions might be erected so as to provide for decency and comfort in every way. This subject, he might say, came daily under his notice as medical officer for the district of Paddington, and he was constantly seeing the miserable state of labouring people in consequence of the unhealthy condition arising from overcrowding, and there were many cases which, as officer of health, he had no power to touch. For instance, a man and his wife with three or four children, or even more, were found living in one room. There was no power to compel them to have two rooms, and yet they had, perhaps, only 150 cubic feet each. The results were perfectly horrible. He believed that consumption and tubercular diseases generally, such as the wasting of children in early life, scrofulous affections, and so on, were quite as easily preventible as zymotic diseases, by a proper condition of the air. There was no doubt that this could be traced very frequently to the imperfection of the breathing-space. He had frequently seen cases where persons had gone into downright consumption by working, as in the case of a cobbler or a tailor, for three or four months in a little room without sufficient air, and without being in the slightest degree aware of their danger. They had often gone into consumption for no other reason than the simple impurity of the air which they breathed. The condition of the working classes at the present day was as bad as that of the prisons in Howard's time. When Dr. Letson visited the prisons with him, he said there could not be a better invention for destroying life, owing to the impure air and want of light, bad water, and so on, and it was well known that typhoid and typhus fevers were hardly ever absent. This had been all remedied in the case of prisons, but it was too prevalent in the case of the dwellings of the lower orders, and he did not see how at present it was to be helped. Houses were built for one family, and in a short time they were let to several, and there were as many as 18, 20, and 25 living in one house, while at the same time there might be no sanitary defects whatever, everything being in good working order. In such cases scarlatina might begin at the ground-floor, and it would soon spread through the whole house. There was, therefore, need of greater municipal authority somewhere, for this state of things went on from day to day, and month to month, and was getting more difficult to meet. He could not agree with what had been said about the philanthropical side of the question, for he believed that what had been done in the way of charity had frightened capitalists, and prevented their entering into building speculations, it being a general notion that such enterprises would not pay. This, he believed, often arose from the needlessly expensive manner in which they were erected. He was satisfied that capitalists might very well invest their money in model lodging buildings so as to pay five or six per cent.; and he had himself, in connection with an architect, drawn out a plan somewhat similar to that of Dr. Stallard's, but which he believed would show even a greater profit than that mentioned.

Dr. Collins thought Dr. Stallard's was a very good suggestion as far as single men went, but he should like to see it carried further. He had had an opportunity, as one of the Cholera Committee, of visiting different districts where the disease raged, and he had found in almost all cases that the common necessaries and decencies of life had been destroyed or removed, there being neither water, drainage, nor anything else. He quite agreed with Dr. Hardwicke that greater power was required by the local authorities. He did not think, however, that capitalists would come forward to invest in buildings to be let out at 4d. a-night, especially as from what he had seen of lodging-houses they did not pay very well. He believed that, unless something was done in the matter by government, the epidemic of small-pox in London would both continue and increase.

Mr. Carter said this question was one of very great importance, for the welfare of the working class was deeply involved in it, and that class was the substratum on which rested the foundation of England's greatness. It was impossible to elevate any class which was physically deteriorated by being obliged to live in such wretched dwellings as were to be found in great numbers in London and elsewhere. He had hoped, from the title of the paper, that it would have had some reference to the nefarious practices of speculative builders, who ran up houses merely for sale, and that some recommendations would have been included in it for an alteration in the Building Act, such as should compel builders not only to make walls of a certain thickness, but to construct them of proper materials, for it was impossible to construct any building economically unless it was well constructed in the first place. He was not altogether in favour of having large lodging-houses for single men, who he thought would do better as inmates of a snug family, and that the system proposed savoured too much of the barrack. In his opinion, a great deal was due to the philanthropists of the present day, who had done much for the working-man when they had provided him with a decent dwelling. This was perhaps one of the most difficult problems of the day, but certainly one could but ask the question, "Why should paupers and felons be better lodged than the working classes, who had made England what she was?" A great deal had been done by benevolent persons, but philanthropy could not do everything; and there was a possibility of carrying it to such an extent as to destroy that which was the honour of every Englishman, and the very quality which had made his country foremost amongst the nations—self-reliance. He believed that a great deal might be done by private effort, especially as it was within his own knowledge that a private individual was now building small houses at Stratford, four rooms each, with small gardens, at a cost of £115, which would be let at 6s. a-week, free of all taxes; and not only did he expect to get a handsome profit on his outlay, but the applications were so numerous that he was able to pick and choose his own tenants.

Mr. Vigers said he had been rather surprised, as a practical land surveyor, to hear that building model lodging houses had been financially a success. Where they had been so, it was not where they were built for what might be called the poor of London, but for thrifty working men. Those companies which were held out as being successful would not take a man as a tenant unless he was receiving from 25s. to 40s. a week wages. What was wanted, however, was accommodation for the labouring men who earned not more than £1 a-week, and it was possible to provide this, but it had not yet been done profitably. The trustees of Mr. Peabody's trust, to which he was consulting land surveyor, made it a rule to admit no one who earned more than a guinea a-week. They were doing great good by providing decent accommodation for this class; and he might mention one thing besides, that they never distressed a poor man if he was in a temporary difficulty from being out of work, but treated him with every consideration. The paying companies, on the other hand, if they had a tenant who could not pay his rent, either turned him out or seized his things; and this system of working made all the difference in the result. His clients were most anxious to do the best they could, and if anyone would kindly communicate any plan which promised to be of service to the working classes of London, he had instructions from Lord Derby, the chairman of the trustees, and his colleagues, to thoroughly examine it, and lay it before the committee, when it would receive the most earnest attention.

Mr. Jacob A. Franklin said it would be very interesting to learn what were the financial results of the Peabody buildings, worked upon the system which had been prescribed.

Mr. Vigers said he was not sufficiently acquainted with the financial arrangements of the trust, being simply their adviser and land surveyor, to be able to give a satisfactory answer.

Mr. Allen said he could give the results of his practical experience in this matter, being the builder of the houses erected by the Waterlow Company. It was quite a fallacy to say that such buildings did not pay. He had been a working man all his life, and when he first came to London, some forty years ago, it struck him as a lamentable fact that men who built houses by the hundred for other people, could not build one for themselves. Accordingly, eight or nine years ago, he set to work at the establishment of a company, and after building one block for Mr. Waterlow, and one for himself, with that gentleman's assistance the company was formed, and from that time to the present it had gone on. He must correct one statement made by the last speaker, for the company never seized, and yet they let their rooms at a lower rent than those in the Peabody building. Yet the company had always paid a fair dividend of five per cent., with a good working staff, well remunerated. As the builder, he was proud to say he had been able to erect the houses so as to pay a good dividend, and at the same time to put a good sum into his own pockets, being at present the owner of between 300 and 400 dwellings. He was now engaged as what was called a speculative builder, in providing healthy and well-ventilated homes for working men, with all necessary comfort, to let at a rent of 2s. per week per room, free of all rates and taxes, and this under a ground-rent of £1 per foot frontage, or 6d. per foot super. In his opinion charity had done more mischief than enough in this matter, and it would have been better for the poor of London if Mr. Peabody had buried his money. The opinion had got about that a working man's house could not be built so as to pay; but, as far as his opinion went, the farther you got from charity the nearer you got to justice. He was at that moment engaged in building houses for working men to the extent of about £40,000, and at about half the cost of the Peabody buildings; and he must add what, in his opinion, was of the greatest importance, that the company never attempted to give the joint use of anything, but in each tenement provided all that was necessary, so that each tenant had a home of his own. Other people might build houses, but his object was to provide homes, for, small as it might be, an Englishman liked to have a home on which he could turn the key, and feel himself master. He had lettings as low as 4s. a week, for which was provided a nice room, a bed-closet, and a little wash-house with a sink, and every domestic convenience. In the Peabody buildings there was no such thing; in fact, they did not provide homes at all. He had worked it out practically, and found it could be done, but still the help of the government was required in order to carry out the idea thoroughly. As for the term model lodging-houses, it stank in the nostrils of Englishmen, and he had always set his face against it. The directors of the company for which he had the honour of building called their structures industrial improved dwellings, and not only so, they endeavoured to make them as attractive as possible, both inside and out. His idea had been to try and provide for others what he should have liked himself, when he was a working man with 25s. or 30s. a week, and had just got married; and if people would only act on that principle of providing for others what they would like for themselves, they would not go far wrong. The system of building eight or ten-roomed houses, and then putting four or five families into them, ought not to be allowed—it was the root of all the mischief. It was much better to build a large house properly constructed, but it was necessary to go six or seven stories high. It took one storey to pay the ground-rent, and another to pay the rates and taxes, so that you were bound to carry them up high; but there was no objection to that, indeed, the upper stories let first. He would add that the company had only built two blocks in which an attempt was made to accommodate a lower class of tenants by letting so many have the joint use of the washhouse, and he had been engaged that afternoon in making out a contract to alter them and make them into distinct houses, for they would not let as they stood. With regard to lodgings for single men, his opinion was that they would be much better as the inmates of a domestic home, and most of them had some relatives with whom they could live. With regard to agricultural cottages, he was just going to see what he could do in that way, and he hoped he should be as successful as he had been in town; but, in his opinion, the great mistake had been in supposing that such cottages must be detached. This was the most expensive mode of construction, and there was no reason why they should not be built in a row in a village, just the same as a street of £50 or £60 houses in town or suburbs, particularly as the main point was to build them cheaply.

Mr. J. A. Franklin observed that the government were quite ready to help in such undertakings as had been referred to if good security were given, a quarter of a million being available for that purpose, and he believed the company mentioned by Mr. Allen had availed itself of this offer. It was quite a mistake on the part of Mr. Espinasse to suppose that the money invested in the Post-office savings bank was re-invested in Red Sea Telegraphs, or anything of the kind.

Mr. Allen said it was quite true that his company had received government assistance, in the shape of a loan on the security of the buildings, and he was himself applying for one. The government assistance he had referred to was of a different character. He thought they ought to interfere in other ways.

The Chairman remarked that the evening was so far advanced that there was hardly any time for him to make any observations, but perhaps he might be allowed to say a few words in consequence of what had fallen from different speakers that evening. And, first, he would rather like to direct attention to a strong expression which fell from Mr. Allen, who said that he not only disliked the term "model lodging-houses," but that it stank in the nostrils of the people of London. He (the noble chairman) would proceed to explain the term "model," as used in this sense, but would first remark that the speaker in question must have had a limited experience as compared with his own experience of these model lodging-houses. In the case of those of which he was the president, there was such a demand in the event of a vacancy occuring, that it rarely happened they had a vacant bed in the course of two days. The competition to have that odoriferous effect upon their noses was so great, that they preferred the stink to the accommodation which the honourable gentlemen would give them. The term "model" was first used in 1862, and it was adopted for this purpose—they did not undertake to say that they were going to build upon a large scale houses that should be a benefit to the whole population of London, but they undertook to say, that they would obtain money from philanthropic persons who, desiring no return, but only anxious to make an experiment, should build a series of houses which should prove this great truth, that the working people, if brought from the dismal and unhealthy localities in which they lived, and placed into a healthy and happy house, would, first, be improved in their health; secondly, that they would be greatly improved in their morality; and, thirdly, that they would be willing to pay, not a large, but a reasonable rent; and if they established these three things, they thought they would then be able to leave it to the commercial spirit of the country. Philanthropy having taken the lead, they thought that commerce would then come in to reap the fruits of their proceedings. He was astonished to hear from the gentleman who represented the Peabody lodging-houses, that the principle upon which they went was, not to demand the rent in case of persons falling into difficulties. That was all very well for a private proprietor, and it might be a matter of Christian feeling so to act, and if they chose to put the Peabody buildings upon that footing, well and good. At the same time did that not constitute these great buildings mere eleemosynary institutions—the very last thing they wished the workman to be subject to? Their object was to establish the workman in a complete state of independence, to let him feel that he paid his rent by the sweat of his brow, and that he was not indebted to any man for the Christian sympathy which he could give, as well as the great could bestow it upon him. He (the chairman) thought this discussion had gone a little beyond the point which his friend Dr. Stallard intended. He did not believe he intended to go into the wide question of lodging-houses and domiciles for whole families. So far as he could judge, it was confined to lodging-houses for single men. The rent was, under his system, still to be 2s. per week, and that was a sum of money which could not be paid by a large proportion of the poor of London. Mr. Vigers had told them that the Peabody trustees wanted to get the poorest classes into their buildings, and that they would take anyone who had a weekly wage not exceeding £1, but that was a large wage for a great proportion of the people. He would, for instance, take the dock-labourers—a very large class indeed, whose wages were most uncertain, because their employment was most uncertain. When employment was very active, they might receive as much as 17s. per week, but people living on the spot, and the clergymen in the district, having given themselves a good deal of trouble to make inquiries on the subject, had assured him that the average wages of these men barely exceeded 9s. per week. It was quite impossible that out of that sum they could pay 2s. a-week for their domicile—nay, they could not pay 1s. per week. All the efforts they had made, great and small, high and low, had not promised in the least degree to give relief to that numerous and most necessitous class. Then, there was another difficulty in respect of the lodging-houses for single men, and that might be one reason why they so often had a great number of vacant beds, and that was distress in trade. Whenever that took place, the lettings fall off very much indeed. In George-street, they had at one time from 30 to 35 beds vacant, simply because the men could not pay the rent. And they would find this, that the workmen in London, and also in the agricultural districts could not abide living by themselves; they infinitely preferred taking a lodging in a house where there was a family living, who would attend upon them and give them a little society in the evening when they came home. The difficulty was not so much in respect of the single man as it was in respect of large families. If they were to go to families who could afford to give 6s. or 8s. per week, the matter was perfectly clear; not only would they be able to construct houses on the Sir Sydney Waterlow principle, but smaller tenements in the suburbs, which might be availed of by means of the 1d. trains and other means, by which persons receiving 30s. or two guineas a week might be perfectly well accommodated. But there were great difficulties when they came to do anything in the interior of the metropolis, and in a great number of instances the houses must be built within the reach of the daily labour of the men, so that they would not have to rise early and get home late. It was a matter of great importance that they should not have to walk a mile or two to their places of work. There were many occupations in regard to which the men must be on the spot. For instance, take the watchmakers at Clerkenwell; no one man had a complete set of tools belonging to his own department, and the consequence was, a system prevailed of borrowing from one and another, and of lending in return such tools as might be possessed. With respect to this trade, therefore, it was absolutely imperative that these men should live near to their places of work; and, however bad the tenements might be in which they were dwelling, it was impossible to remove the men to further parts of the metropolis or the suburbs. The great difficulty to be contended with, was the necessity which existed for a large number of people living upon the spot near which their work was carried on, and the consequent necessity for making provision for persons whose weekly wages would not endure to the extent of 1s. per week for the purpose of domiciles. That was a matter to which they had to direct attention, and it was one that would puzzle philanthropists and statesmen for many generations to come. He thought his friend on his left (Mr. Allen) would agree with him that, until they could find a set of men who were able to pay a larger sum for weekly lodgment, they would never get the improvement in the people's dwellings carried out on a large commercial scale. That was the difficulty which had harrassed them from the time they began their inquiries and labours. Now, there was one mode of doing it to a certain extent, but not fully. He was sorry to say that Dr. Stallard passed over in a cursory way, and with somewhat of contempt, houses which he said had been made habitable by adaptation. Really and truly this was the only way in which they would be able to provide for the great mass of the population of London, and if they would only take the trouble to go to Tyndall's-buildings, Charles-street, Drury-lane, and see the alteration that had been made by adaptation, and compare the state of these buildings with what they were before the society of which he was president took them, and also with the state of the courts and alleys around, they would find that, although they by no means approached to perfection, yet they gave decency and health, and compared favourably, in innumerable instances, with that which was dear to every Englishman—and God grant that it might become dearer every hour—the possession of home and domestic life. They could then, to a large degree, meet the difficulty he had pointed out by adaptation. They had done it largely. They adapted, for instance, the house in Charles-street, Drury-lane, to all intents and purposes, for £1,200. That building held 83 single men; and if they had built it from the ground, they could not possibly have done it at the time for less than £6,000 or £7,000. Go to Tyndall's-buildings, and they would find there from 60 to 70 families. When he first went there, anything more disgusting in the whole course of his existence he never knew. He happened to have a peculiar taste for examining these miserable places, and wishing to find about the most detestable spot in London, a person one day said to him, in perfect simplicity, "My lord, I have found a place where the stinks are so intolerable, that I am sure your lordship will be gratified." It was perfectly true; and when he (the noble chairman) went there on a hot day in August, he saw Dr. Southwood Smith there, and diving into the cellar he found an open sewer passing through it, and a woman and three children were living in that place, though the stench was so intolerable that he could not remain there longer than two minutes. That place had now, by adaptation, become decent and healthy. The rents were regularly paid, and the occupants were enabled to have a tenement of three rooms at a much less figure than would be given in other places for a home in only one room. They were enabled to do that because they had not spent a large sum of money—not having had to build from the ground. He felt satisfied that was the only way in which they would be able to meet the present evil, and they could do that with a small sum of money. In the meantime, follow out the excellent plan of Dr. Stallard — work on till every workman should have three good rooms, well-ventilated, and with light before and behind. These were the requirements which were necessary for a Christian and a civilised being. But until they could arrive at that, let them be content with something more humble. Anything that would moderate those evils, however humble it might be; anything that would deal with the miserable, disgusting, alarming condition—alarming in a physical, moral, and spiritual sense, as well as in a political sense—of hundreds and thousands of people in this great and wealthy metropolis, should be welcomed and encouraged. They could, to a certain extent, moderate these evils, and, at least, they could show to the people who were now seething in suffering, sorrow, and indignation, that they were going forward, under God's blessing, to do their best, according to their means, to improve their spiritual, their physical, and their religious condition. In conclusion, he proposed a vote of thanks to Dr. Stallard for his interesting paper.

Dr. Stallard, in reply, said he could not endorse all that had been said by Mr. Allen with regard to giving homes to single persons; it was all very well to say that they would be better off in married homes; but in many cases they could not do so; and there were about 100,000 single men in London living in lodging-houses, which were barracks of the very worst description. He had, on a former occasion, written a paper to show that barrack-life was the curse of a soldier's life, for from the moment he entered the service until he left it he was never left alone a moment; and the peculiarity which he wished to introduce into these lodging-houses was that each man should have a chamber to himself. He was sorry this feature had not received more notice; and he had devoted his attention to the single men especially, because he considered their case the most important. With regard to their wages, he could not altogether agree with the remarks of the noble Chairman. No doubt, inquiries might lead to the conclusion that a dock labourer's average earnings were about 9s. per week, but he was satisfied that such men had other resources. If they were at work constantly they would earn 16s. a week, and their hours were only from eight to four, so that they had still the early morning and evening hours for other occupation. After all, he was inclined to agree with Mr. Archer, of Westminster, that a single man could afford 4d. a night, or 2s. a week, for lodgings such as he proposed to provide, and he would be much better off then, if he only earned 10s. a week, than married men who got 20s. or 25s. and paid the rent required by the Peabody trustees, or Mr. Waterlow's company. The great reason why adults in the metropolis only earned children's wages was because they were only able to do children's work, being deficient both in physical power and education. Government could help this object in one or two ways. In the first place, he should like to see powers given to local authorities to take sites compulsorily for workmen's dwellings where such were absolutely required, in the same way as public companies took them away for their own purposes. This, however, was a question which he would not enter upon then. He had not the least desire to find fault with the principle of adaptation, which was very good in its way, but it would never lead to anything like a proper standard of what was necessary, and he believed the houses so adapted were almost always dark, ill ventilated, and difficult to keep in order. In answer to Mr. Espinasse, he must say he was perfectly unconscious of any desire to sneer at philanthropy, and he had carefully guarded himself in the very opening of his paper against any such idea. At the same time he was thoroughly convinced that this subject could never properly be dealt with on philanthropic principles. It must be made to pay in some way, even if the commonest possible buildings were put up—anything better than the wretched holes now used for lodging-houses. With respect to the question of down draught, if the wire gauze were sufficiently fine, any draught would be impossible; but of course with such an arrangement it was necessary to have a large surface in order to get sufficient air. With respect to the lighting of the private rooms, it was quite true that they only had a borrowed light, but he did not wish to lay much stress upon them, and his impression was, that it would be better to keep the space open for the other purposes. In conclusion, there was one other way in which the law and the public might help in this matter, and that was by more stringent provisions with regard to overcrowding. There was no doubt that the proprietors of the wretched lodging-houses in London reaped enormous profits, but he saw no reason to prevent the law stepping in to alter this state of things. If they were unwholesome, why should not the standard be raised, and if 300 cubic feet were not sufficient, let it be increased. Nothing, however would be of any use until corporations and guardians of the poor saw the impropriety of giving relief to people living in these wretched conditions. It was really the poor-rates and charity which kept these miserable places open.

The Chairman said he must make one remark with reference to adaptation. He did not look upon it as doing all that was required, but it was the only means of meeting the present evil. He might refer Dr. Stallard to the statistics of Tyndal-buildings, from which, before they were altered, seven, eight, or nine cases of fever were annually sent to the hospitals, but since they were adapted as he had described, nearly twelve years ago, not a single case of fever had been known.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The Second of the Series of Six Concerts in aid of a National Training School for Music was given on Wednesday, the 19th inst. The hall was well filled, and, but for the uncertainty of the weather, every seat in it would, doubtless, have been occupied. The music performed was according to the following Programme :—

PART I.

1.—Overture .... (Ruy Blas) ....*Mendelssohn.*
2.—Duett...... "Giorno d'orrore" (Semiramide) ...*Rossini.*
Mademoiselle NATALIE CAROLA and Miss ENRIQUEZ.
3.—Allegretto........... Symphony, No. 7 ....*Beethoven.*
4.—Aria.............. Ah! rendimi quel cor" ....*Francesco Rossi* (1686).
Miss ENRIQUEZ.
5.—Overture ....(Semiramide) ....*Rossini.*

PART II.

1.—Overture ....“Ruler of the Spirits” ....*Weber.*
2.—Scena...... "Softly Sighs" (Der Freischütz) ...*Weber.*
Mademoiselle NATALIE CAROLA.
3.—Solo Ophicleide ... "Oh, Ruddier than the Cherry"......... (Acis and Galatea) .... *Handel.*
Mr. HUGHES.
4.—Duett................. "Dolce Conforto" ....*Mercandante.*
Mademoiselle NATALIE CAROLA and Miss ENRIQUEZ.
5.—Overture ....(Zampa) ....*Herold.*

The Society has every reason to feel satisfied with the results that have been attained at the concerts of the 12th and 19th April. In the absence of any experience as to the fitness and capability of so vast an interior as that of the Royal Albert Hall for musical purposes, the music performed was necessarily of an experimental character. As other societies had arranged to give performances of great choral works, the Musical Committee entrusted with the arrangements for the Society's concerts, under the direction of Sir Michael Costa, determined to confine themselves to instrumental music of a broad character, and vocal and instrumental solos. The success which has attended the solo performances has left nothing to be desired. The most intricate pianoforte music, as executed by Madame Arabella Goddard; the delicate shades of tone produced by Monsieur Sainton on the violin, and the clear and rapid utterances of the ophicleide, as played by Mr. Hughes, was all heard with equal good effect in all parts of the Hall. During the months of May and June, the Committee will be able to apply the experience that has been thus gained to the arrangement of the programmes for the concerts announced to be given in July, by which time the grand organ, by Mr. Henry Willis, will, it is hoped, have been completed, and rendered available for the use of the Society.

The *Times* says of this concert:—

"In our opinion, the performances in the new hall should now be allowed to proceed unquestioned until some definite result is obtained. It is of little use to go on criticising in detail faults and shortcomings for which time alone can devise the needful remedy. With so vast a structure to deal with, nothing of material consequence can possibly be effected within the short interval of a week; whereas, the longer the experience, the better chance there will be of getting nearer to the desired perfection. Meanwhile the concerts now giving by the Society of Arts are highly attractive of their kind, and will doubtless be listened to with more and more satisfaction as one succeeds another.

"The orchestral pieces in last night's programme, with one exception, were heard with the same apparent indifference as was remarked at the first concert, eight days since. Mendelssohn's fiery 'Ruy Blas,' and Weber's not less fiery 'Ruler of the Spirits,' which, at ordinary concerts in ordinary places, if well executed, rarely fail to raise the enthusiasm of a musical audience, were scarcely applauded at all; while the wonderful allegretto in A minor from Beethoven's 'No. 7' passed almost literally unheeded. About the unlikelihood of such works as elaborate orchestral symphonies ever under any circumstances being heard to advantage at Albert Hall we cannot help entertaining a strong conviction. With such thoroughly dramatic overtures, however, as the two we have named the case is very different; and there is no knowing what improvements may be contrived in this direction by persistent experiment and research. The overture which did succeed in rousing the audience last night, and in extorting an encore which, though by no means unanimous, Sir Michael Costa thought proper to accede to, was Rossini's 'Semiramide.' A great many of the most noticeable passages in this brilliant piece came out with unaccustomed distinctness. The repetition of the overture afforded an opportunity of judging of its effect from several parts of the hall; and it may be accepted as a sign of promise that what sounded best in the amphitheatre also sounded best in the balcony, and in the picture-gallery above the balcony. The melody for horns and bassoon, in the andante, the 'pizzicato' accompaniment of strings, when the melody is taken up by he 'wood;' the violins in the melodious theme of the allegro; the passages for various wood instruments when the second theme in triplets is heard; the crescendo, each time of its occurrence; and other points, were so effective in comparison with what had gone before, as fully to account for the unusual applause and the special tribute paid to Sir Michael Costa as he retired from the platform.

"The marked success of the evening, however, was obtained by Mr Hughes, who, accompanied by the orchestra, played Handel's "O ruddier than the cherry," with its introductory recitative, on the ophicleide, and played it admirably. That every note coming from the Polyphemus of musical instruments was heard in every part of the building may be easily imagined. Mr. Hughes was enthusiastically applauded and encored, and may justly be said to have carried off a chief share of the honours of the evening. The obligato for piccolo, so characteristic a feature of the accompaniment to this famous song, was also played in first-rate style by a gentleman whom we were unable to recognise from the place where we were situated.

"The vocal music, except the great scena from 'Der Freischütz,' which earned loud applause, and a 'recall' for Mdlle. Carola, was hardly suited to the occasion. Miss Enriquez gave the old air of Francesco Rossi in her best manner; but the tranquil and melodious duet from 'Semiramide' created little or no impression."

A correspondent writes as follows:—

Sir,—Will you allow me a little space in your valuable columns to state my personal impressions of the first of the six concerts in aid of a national training school for music, in the hope that it may serve a good end.

I occupied an excellent seat for thoroughly appreciating the music; and, as a subscriber, let me take this opportunity to express to the committee my best thanks for providing me with so good a place. I listened with pre-resolved attention, and I must say during the whole of the first part I felt puzzled. Whilst piano, and especially pianissimo parts, were not only distinctly audible, but left nothing to be wished for in their most delicate modulations, forte and fortissimo parts were sounds without proper distinctness, and, what is more, did not seem loud enough; and I had at first the impression that the orchestra was not large enough for the Albert Hall. But how could I reconcile with this, that those soft and tender notes of the singing, those delicate movements, legato and staccato, on the piano were all faultless? I listened with the greatest attention to see if there was an echo or a reverberation. I could not detect either. Whilst I was cogitating these matters in my mind, in the interval between the first and second parts, a sudden idea struck me; I rose from my corner seat in the arena, walked a couple of steps to the base of the amphitheatre, closed my eyes and listened. I fancied I was standing on the seashore, and that I heard the rushing of the waves when a strong breeze is blowing. It was not at all like the humming of voices. The puzzle was now explained to my mind after what I had experienced besides during the previous hour.

Visitors kept on coming in fully up till nine o'clock. Three or four seats on my left and in front of me were unoccupied for nearly three-quarters of an hour. The boys who vended the programmes took care that they should be heard, and were pushing their trade during the whole time. On my right two gentlemen stood for a considerable time, talking with subdued loudness. Behind me two ladies and a gentleman were talking with genteel loudness the whole hour through, except during pianissimo parts. For all the world like a drawing-room. Now, fancy the majority of 5,000 persons having a comfortable chat, and their voices going in genteel crescendo with the music, and the riddle is explained why the loud parts of the music became often comparatively indistinct. Fancy, again, when pianissimo parts are played people holding their tongues, and you will know why they were faultless.

No architect, no engineer, no scientific genius in acoustics can cure this. If at a concert, as in the drawing-room, a little pleasant conversation is carried on whilst a little music is going on, then the larger the hall the greater the failure.

That overture of the "Freischütz," at the mention of which people speak with enthusiasm of Sir Michael Costa's conducting, and of the performance of his orchestra, seemed to be lost. Ladies and gentlemen were only just coming in, and everybody walked and everybody talked as a matter of course.

The second part was much better in that respect than the first. Perhaps many ladies and gentlemen took a rest. I felt especially interested in the performance of the violin, and the "Adagio" was to my mind a piece which particularly tested the capacities of the hall. All the delicacy of the bowing could be fully appreciated. It is not, however, my intention to criticise the performance, because I felt perfectly satisfied with the whole concert and with the hall. All the fault was with the audience.—I am, &c.,

A Subscriber.

EXHIBITION OF 1871.

A dinner of the Council and Members of the Society, and the municipal and other authorities invited by H.M. Commissioners to be present at the ceremony of the opening of the London International Exhibition of 1871, on 1st May, will take place at South Kensington on Tuesday, the 2nd May. Dinner ticket, without wine, 5s. As the space is limited, an early application for tickets is necessary.

CANTOR LECTURES.

The first lecture of the course on "Our Food-producing Ruminants, and on the Parasites which reside in them," was delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., on Monday, the 17th inst. These lectures will be continued as follows:—

Lecture II.—Monday, April 24th.

The Bovine Ruminants, more particularly in relation to the question of Parasitism.

Lecture III.—Monday, May 1st.

The Ovine Ruminants, especially in relation to the Mortality caused by Trematode Entozoa.

Lecture IV.—Monday, May 8th.

The Cervine, Antilopine, and Cameline Ruminants, with some account of their Parasites.

Lecture V.—Monday, May 15th.

The general question of the Parasitism of Ruminants in relation to Sewage and Public Health.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. (now Sir) W. Fothergill Cooke and Professor (now Sir) Charles Wheatstone, F.R.S., in "recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. (now Sir) Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Council invite members of the Society to forward to the Secretary, on or before the 22nd of April, the names of such men of high distinction as they may think worthy of this honour.

INDIA COMMITTEE.

A Conference will take place on Friday evening, May 5th, on "The Conservation of Indian Fisheries." The opening paper will be read by Lieut.-Col. Haly.

ANNUAL INTERNATIONAL EXHIBITIONS

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

Opening Ceremonial.—The proceedings at the State opening, on the 1st of May, will probably be as follows:—Her Majesty the Queen has deputed His Royal Highness the Prince of Wales and the Princess Christian to act on her behalf. A number of other royal and distinguished persons will also be present, including His Royal Highness the Count of Flanders, President of the Belgian Commission, and the Countess. At about 11 o'clock, those who have been invited to take part in the ceremony, viz., the Municipal Authorities, the Chairmen of Chambers of Commerce, the Masters of City Companies, the Council of the Society of Arts, the Council of the Royal Horticultural Society, the Official Staff, Reporters for the Exhibition, and Members of Committees—all in uniform or official dress—will assemble at the chief Horticultural entrance, and be marshalled in order of procession. At about half-past eleven, the Prince of Wales, Princess, Christian, and royal personages, and Her Majesty's Commissioners, and Foreign Ministers and Commissioners will enter the east entrance of the Royal Horticultural Society in Exhibition-road, and proceed to the Conservatory of the Royal Horticultural Society. His Royal Highness the Prince of Wales and Princess Christian having received the authorities named above, a procession will be formed, which will proceed to the east picture galleries, and return through the pottery gallery, cross the gardens, if fine, and through the machinery gallery, up the south-west stairs, along the terrace, if fine, or, if wet, through picture galleries, through the gardens to the conservatory, when the Old Hundredth Psalm will be sung by all present, accompanied by drums and trumpets. Military bands will then proclaim the opening of the Exhibition. The procession will enter the Royal Albert Hall, when the following music, under the general direction of Sir Michael Costa, will be performed:—An overture by Weber; chorale, representing Italian music, composed and conducted by Signor Pinsuti (the words of this chorale have been written by Lord Houghton, who has presented them to the Commissioners); a piece representing French music, composed and conducted by M. Gounod; an overture representing German music, composed by Dr. F. Hiller; a cantata representing British music, composed and conducted by Mr. A. Sullivan, entitled "On Sea and Shore," words by Mr. Tom Taylor; an overture by Rossini; and "God Save the Queen," in which the audience will join.

Official Reports.—A meeting of the Publications Committee and of the official Reporters was held on Tuesday, Lord Northbrook in the chair. Present—Sir Coutts Lindsay, Bart., Sir F. Sandford, Sir Digby Wyatt, Dr. Lyon Playfair, C.B., M.P., Mr. Henry Cole, C.B., Miss Meteyard, Professors Abel, Goodeve, and Westmacott, Dr. Rock, Mr. Fortnum, Mr. Hullah, Mr. William Longman, Mr. John Murray, Mr. Philip Owen, and several other gentlemen. Lieut.-Colonel Scott, R.E., secretary, also attended the meeting.

General Purposes Committee.—His Royal Highness the Prince Christian presided on Wednesday, at the Exhibition buildings, over a meeting of the Committee. There were present the Marquis of Lansdown, Sir Francis Sandford, Mr. Edgar Bowring, Mr. Cole, Dr. Lyon Playfair, Mr. Thring, and Lieut.-Col. Scott, R.E., Secretary.

New Motive Power.—A new motive power for the Scientific Inventions Gallery will be supplied by a Warsop aëro-steam-engine, built expressly by Messrs. Easton, Amos, and Co., and exhibited by Mr. R. Eaton, of Nottingham. The principle of this engine consists in the continuous injection of heated air into the bottom of the boiler, whereby the water is kept throughout in a constant state of agitation or effervescence, producing, it is said, considerable economy in the consumption of fuel, and preventing incrustation in the boiler or priming. The exhibition will afford a favourable opportunity for testing in this engine the professed merits of hot-air injection on a large scale; and, in re-opening a question which has greatly interested scientific engineers, and promises to benefit both manufacturers and consumers.

Fine Art.—The space which can be allotted to British pictures in the picture galleries is wholly insufficient for their accommodation, but arrangements will be made to hang some of them in such other parts of the Exhibition as afford suitable light.

ON MILITARY DRILL, AND ON EDUCATED AND UNEDUCATED MILITARY FORCE.

By Edwin Chadwick, Esq., C.B.

I regret that I was accidentally prevented attending on March 22nd, to hear the excellent paper read by Major-General Eardley Wilmot "On Drill as the Complement of Existing School Instruction," or I should have asked to extend the discussion further—to school instruction in drill and discipline, as the complement to our existing military organisation. If I had been able to attend, I should have endeavoured to keep in view the evidence of the difference in efficiency between educated and uneducated, school and home trained, short-service and barrack-trained, and long-service soldiers, a new element which rules the whole question of army organisation. Thus the volunteers, as we know, are generally educated men, and they decidedly beat in shooting the picked men of the pothouse-recruited, or any of the long-trained force of the barracks.[*] We have not seen any returns of the comparative shooting of the volunteers and the reserves with heavy guns, but I have been informed, a long time since, that on board the *Excellent*, common, uneducated men, are, as a rule, beaten by educated men. It is, however, admitted that the shooting of the artillery volunteers is as good as that of the regulars, which speaks much for them, considering the inferior weapons hitherto allowed to them.

This being indisputably so, that school-instructed, home-kept men stand thus in the attainment of the necessary military object—shooting—for what are we to take men out of the regular productive labour market to keep them apart for a whole year of continuous service in barracks? To teach them discipline it is said.

And what is discipline? Prompt and certain obedience, is of course the military answer, including self-restraint, silence, patience. But these are moral qualities. The educated recruit having, in some three months at most, acquired the requisite mechanical skill in the use of the weapons, he is to receive nine months more of superfluous and wearisome exercise in those weapons, as exercise of moral qualities in applying them, or in obeying orders to apply them. All non-commissioned officers of the class whose testimony I have cited agree that obedience is as the general intelligence—the education—and that, however long the barrack training, to make men obey semi-automatically, the unintelligent are the least to be relied on for implicit obedience. The educated policeman acquires the technical skill in weeks instead of in months, and, having acquired that, he obeys at once and permanently.

The most able military correspondent of the *Daily News*, who had seen and vividly described the late campaigning, and who cannot be accused of being disinclined to military things as they are, in observing the last volunteer review at Brighton, asks, "Is the future fraught with the day when neat, smart, and exact marching past will come to be looked upon as an effete and exploded superstition, in which we, the ancestors of a future generation with its eye-teeth cut, were wont to take a pride as a triumphant illustration of the degree of woodenness into which a man might be drilled? Let Britain's well-wishers fervently hope not. In itself, a well-dressed and steady march past is not a matter of paramount importance. A company, a regiment, or a brigade can fight as well if its line be slightly 'wobbly' as if it were dressed to death. Spectators did not hear many calls from officers, 'Pick up your dressing, men,' when von Göeben's Rhinelanders were storming the Spicheren Berg. There was other work to do in such a pinch as that, and the stiffest martinet must own that there always is other work to do than to see to neat dressing when gentlemen over the way are firing ball instead of blank cartridge. But a march past is the great test and symbol of good discipline and good drill. * * * * 'Show me a regiment marching past,' a discriminating inspecting officer may safely say, 'and I can judge of its discipline.' Good marching is a token of many things that go to make a man a soldier. It tells of weary but necessary hours over the goose-step, of laborious and oft-repeated 'suppling motions,' of continuous company drill, of smart and prompt obedience learned to the word of command, of officers who know their duty, and have drilled with their men, of that indescribable spirit of mutual reliance between officers and men based on the knowledge of each other's efficiency, a mutual reliance which lies close to the very core of victory. Looking, then, at a march past, not as a mere pretty pageant, but as a test of those qualifications which I have enumerated, how did the Volunteers to-day accomplish this portion of their work? The question may, I think, be answered with a clear consciousness, in a manner entirely favourable to the Volunteers. I may be presumed to be somewhat *exigeant* as to marching past requirements, for I witnessed the Imperial reviews of the German armies at Longchamps and on the battle-field of Villiers; but I frankly own that I was surprised at what I saw to-day. I was prepared for good marching on the part of some regiments, and some uncommonly bad marching on the part of others. On the contrary, with the exception of one brigade, which was by no means wholly responsible for the shortcoming, the marching was so uniformly good as to make it almost invidious to refer to particular corps. * * * Fresh from the national army of the greatest military nation in the world, I am glad and proud to recognise the fact that we, too, have a national army in fact, and not in mere empty name. It may be interesting to state how the doings of to-day struck a member of that national army to which I first made reference. A Prussian officer was my companion on the field, and he was loud in praise, which I know must have been sincere, of the manner in which British volunteers did the work that was prescribed for them."

That Prussian officer, and other German officers present at that review, may go home and carry with them the facts, besides those within their experience in their own army, how much less of sacrifice of time and productive industry is required to impart military aptitudes to educated and intelligent men of the volunteer force, and justifying the rising demands of Germany to be relieved from the excessive and oppressive tax of mere militarism.

The *Times* military critic admits, in respect to the volunteer artillery, that "it is a fact beyond gainsaying that the artillery regiments are among the very best—as to drill, physique, or general intelligence—in the volunteer service. And this remark holds good, not merely in the southern counties, where special importance attaches to coast defence, but in other districts of the country as well. Taking the average, even of line regiments, it may be doubted whether, man for man, their ranks would stand comparison—the matter of drill of course excepted—with the average of artillery corps in the volunteer service. Any colonel of infantry would receive permission gladly to recruit to his full war strength from among the artillerists who filed before Sir Hope Grant yesterday."

And if (as these military critics failed to observe), this sufficiency of manual skill has been obtained in loose, irregular drills, and only one full field day, we may ask what may we not expect from the more regular sixty days of drill we propose, including, for all who can attend them, a fortnight of autumnal field exercises under canvas.

So much as to the testimony of military officers as to technical skill. Now, more especially as to *morale*.

That very distinguished officer, Capt. Henry Wilmot, V.C., stated, in the recent debate on the army estimates, that his experience of the volunteers led him to believe they would cordially accept the Mutiny Act, if the right hon. gentleman thought it would conduce to the efficiency of the service. He had treated the volunteers under his command with a strictness of discipline which he would be slow to enforce against his own company in the Line, and he had never met with an angry look from them. In fact, the commanding officers of volunteers might apply to their men a discipline which no officer in the Line would enforce.

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[*] "There is really no getting over the broad fact," says the *Pall Mall Gazette*, "that in 1868 1,293 volunteers averaged 9·26 at 600 yards, while 270 soldiers averaged only 7·41, and that the average results were much about the same in 1869 and 1870. Moreover, if we take the three highest in a competition precisely similar to the second stage of the Army Prize, we arrive at the following results:—1869, three highest scores, second stage, St. George's average, 20·66; ditto army, 16·00. 1870: ditto St. George's, 20·33; ditto army, 19·33. The first party of volunteers who went to Hythe in the summer of 1859, no one of whom had ever had a rifle in his hands, after ten days' training made a better average than any party of regulars at the school had ever reached up to that time. The figure of merit made by seven squads of regulars shooting during the long course of ten weeks with that of seven squads of volunteers shooting during the short course of fourteen days, both at Hythe, the average was—army officers, 45·12; army non-commissioned officers and privates, 42·85; volunteers (all ranks), 45·25."

A field-officer, writing his observations on the review at Brighton, states that, "as a rule, the battalions were composed of young men physically well fitted for soldiers. They turned out in a very creditable manner, fell into their places in the ranks quietly and without confusion, and showed considerable patience during the long delays inseparable from the movements of large bodies of troops. They certainly marched well, not only through the town and when passing the saluting point, but up and down the steep hills over which the manœuvres were performed. Some battalions gave proof of much power of endurance, as many of the men had paraded at a very early hour in London, and had marched to the station before their work at Brighton commenced. They appeared, moreover, thoroughly amenable to discipline, and, considering their imperfect acquaintance with drill, easily handled. In fact, they are troops that any intelligent officer would be glad to command if he had the power of military law in his hands. This would, of course, be absolutely necessary supposing the volunteers to be embodied for any length of time, although I feel covinced that the power would, except on rare occasions, remain in abeyance, as educated men, well commanded, seldom commit gross breaches of discipline. A proof of this was afforded by the conduct of M'Clellan's troops, constituted somewhat similarly to our volunteer force, at the commencement of the American war; and those who witnessed their good conduct, under very disadvantageous circumstances, will endorse my opinion that the more intelligent soldiers are, the more readily do they submit to discipline." The field-officer evidently considers his opinion on the latter point as an opinion peculiar to himself, which with officers of his class it has evidently been, and he states that what the volunteers "require is a month's training under well instructed officers, and if this month were given them to prepare for an invading force, they would form a most valuable adjunct to a regular army." This is a gain upon the opinion dogmatically asserted, and which, I regret to observe, has misled several members of Parliament, that anything less than a year of continuous service was utterly worthless for military purposes.

Now, we may ask, what right have the military authorities, the advocates of standing armies by the demand of long-continued service, to teach obedience to volunteers, or to men of education other than of the barracks, when there is serious occasion for prompt and exact obedience. Has the shooting of officers been known or thought of amongst the volunteers as it has been amongst the long-trained, continuous-service men of the barrack? Were the Ironsides disobedient, and had they a year's continuous training in the barrack? In looking to the use of force for the repression of rebellion in Ireland, are barrack-trained, long-service Irish regiments regarded with more confidence for the purpose than the school-trained, short-service Irish constabulary force? Is the lash or the brand needful for imparting discipline and habitual obedience to them?

But old military opinions are apparently giving way to evidence of facts on this point, and they rest on the objection to the expense of better-conditioned force. Thus, General Herbert, in answer to Mr. Mundella, said, in the recent debate in the House of Commons—"The hon. gentleman also stated that our police are better behaved than our soldiers. I would only ask him to try soldiers at a guinea a-week, and see whether he would not get better-behaved men. The hon. gentleman compared our soldiers with the men in continental armies; but he must recollect that in Prussia men are taken as it were by the 'scruff' of the neck for the army, and when they are taken by force and by conscription of course you may find men in the ranks of the Prussian army who are just as well educated as any man in this House. But how is that to be done in this country by voluntary enlistment for 1s. 2d. per day?"

Now, I am enabled to submit, with concurrent military authority, an answer to this statement, to satisfy the gallant general and the ninety-seven other military officers, as well as the fourteen naval officers, who, in the House of Commons, mostly entertain the like opinions. Colonel Dixon declared in the debate that the recruits enlisted during the past few month were narrow-chested, half-grown lads of 17 or 18, from whom they could not hope to obtain an efficient army of reserves; and any one seeing the batches sent away from Westminster will agree that this description is correct; but whilst the new arms require recruits of a higher character than heretofore, it is stated that nearly two thousand men are now wanting for the Royal Artillery, who cannot be got of a passable quality (for the present, at least) by voluntary enlistment on the present conditions. The pay, with the advantages of pension now given to artillerymen, is 1s. 7½d. per diem; but the average wages of artisans of the quality now more than ever requisite for artillerymen—not to speak of the quality of those who are now serving as volunteer artillerymen, and who, in gunnery at least, equal the "regulars"—averages from 4s. to 5s. per diem. In the north, some of the men serving as privates in the volunteer scientific corps get as much as 7s. a day as first-class skilled mechanics.

It is confidently stated by volunteer colonels of forces in the manufacturing districts, that a service of a better order of men as artillerymen, may be got on the voluntary principle in greater numbers than are wanted, with the condition of full military service in case of invasion and of complete training, provided they are not removed during any very long periods from their homes or their regular occupations, and provided also that they have pay equivalent, say, to that of the police during the periods of training, or such pay and accommodation as will fairly cover their expenses when away from home. The eligible conditions of enlistment, to ensure recruitment on this principle, would be for about sixty days of service during the year, distributed so as to accommodate their private occupations, namely, about forty Saturdays, or Saturday afternoons, when shops are closed, and some twenty days of continuous field service in tents, or autumnal exercises as a "manœuvreing field force." This would exceed the amount of service in Switzerland, and experienced officers declare that it would fully suffice.*

Now, let us see what is the relative expense of the two systems. The expense of the two thousand of artillery force now wanted, to be kept in barracks all the year round, with the commands, would be £100 per man; total, £200,000; but, on the scale of pay of the Irish constabulary force, a force of the educational quality needed, the expense of commands, stores, everything included, would be at the rate of £70 per man; for the 60 days' training less than £12 per annum, or less than £26,000 per annum for two thousand of superior artillery needed. Instead of being the better, it admits of proof that they would be lower in *morale* and efficiency for the the year of continuous service under what General Trochu terms the "deleterious influence of the barrack." As you do not really want more than one-eighth of the time of educated men for military training (and in Switzerland they have made a twelfth, or a month, to serve), so you may afford, with economy, the market rate of pay for the service required.

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* A number of experienced officers declare that an excessive amount of drill is required in the British army. General Sir Charles Napier declared that seven things are all that is necessary to be taught. "Do not," he says, speaking of infantry, "let anybody persuade you to learn more:—1. Pacing to the right or left. 2. Marching in line and column. 3. Extending or closing files as light infantry, with supports. 4. Changing front, in close and extended order. 5. Relieving skirmishers. 6. The formation of solid and rallying squares. 7. The formation of an advanced guard."

Major-General Sir Lintorn Simmons, an officer of distinguished service, now Commandant of the Royal Military College, Woolwich, speaks as follows:—

"The number of men between the ages of 20 and 21 in the United Kingdom exceeds one million. It need not be feared that if the wages of the army were increased, and the conditions of the service improved, so as to enlarge the area of the population from which recruits are drawn, that there would be any more difficulty in obtaining a sufficiency of eligible men as soldiers than a railway contractor would have in recruiting 10,000 or 20,000 men in a fortnight, as has been frequently done by them for the execution of any great public work. It will be no longer a question between compulsory service or drawing by ballot, and of enticing men by the vague assurances of recruiters, but the proud position would be maintained of our army being the only volunteer army in Europe; and it might, moreover, be weeded of bad characters, by the acceptance only of men bringing good ones, whereby its efficiency would be marvellously increased."

Supposing 250,000 of infantry to be the war strength, then the force is estimated to require 110,000 of artillery, cavalry, and engineers' trains, or a total of 360,000 men,

Suppose the Irish constabulary pay to be the standard. at £70 per head, this will require £25,200,000. Now, in peace, as a friend, a general officer, agrees, we can do with one-third of the war strength, say 150,000 men (and there is good ground for believing that less than half that force may be made to suffice), will provide for its expansion to 360,000 men. This force will, at £70 per man, cost £10,500,000. Suppose we allow as much as £1,000,000 for training the people for six weeks, total, £11,500,000; add as much as £1,500,000 for administration, total, £13,000,000, and you have an army "of an efficiency marvellously increased," and such an army as the officers who know the material would declare has never, in modern times, been yet seen on the battle-field.

We accept very much the existing army organisations as the basis of these estimates. But if any impartial person will examine recent demonstrations of experience, he will perceive how widely those organisations will have to be altered to meet the new scientific requirement. It is, moreover, to be borne in mind that science is still in steady progress, needing more and more of intelligence and special aptitude for its efficient and economical application, beyond anything recently displayed in the German armies.

It is surprising to find military men speaking of an amalgamation of volunteer forces with the militia or with the line regiments, which is very much like talking, as of a thing of common practice, of the amalgamation of oil with vinegar. General Simmons, for one, does, however perceive difficulties in the process. He says:—"The misery can scarcely be conceived which a respectable young man, brought up by worthy parents, with sound principles of right and wrong, must undergo when placed with a dozen or twenty men, swept together haphazard from the lower classes of society, in the same room, which serve them for eating, sitting, and sleeping, in which he can never be sure of a quiet moment to read or write a letter, or to give himself up to serious reflection, and in which, if he were to read a serious book or kneel down to pray, he would not improbably draw forth the ribald jest or the foul oath of the blasphemer. This great boon of the separate sleeping-berths has already been conceded in part to the metropolitan police, and there is probably no measure connected with the comfort of the soldier, which would tend more to the improvement, and respectability of the army in general, as a means of introducing a better class of young men into it."

It need not be pointed out how much the preservation of the home influence, consequent on the voluntary principle reduces the enormous moral evils of celibate standing armies.

EDUCATIONAL NOTES.

Fees in Denominational Schools.—This subject, amongst others, was brought under the notice of Mr. Forster on Tuesday last, by a deputation of Liverpool Nonconformists, who strongly objected to the decision of the Liverpool Board, referred to in last week's *Journal.* They represented that the action on the part of the Board seemed likely to revive the old religious animosities in the town, and they strongly urged that the Education Department should decline to confirm this proposed bye-law, Mr. Foster, in reply, said he should give his most anxious consideration to the statements which had been advanced on both sides, with a view, if possible, to suggest means for the removal of the difficulties complained of. The question was also debated at the meeting of the London School Board on Wednesday, but no final decision was arrived at.

The Endowments of Elementary Schools.—At a recent conference between an Exeter committee and Mr. J. G. Fitch, Assistant Endowed Schools Commissioner, on the question of the disposal of the endowments now belonging to elementary schools, the Bishop of Exeter said that the Endowed Schools Act required the Commissioners to use the endowments of elementary schools for the educational interests of the class for whom they were intended, but that these interests would not be best promoted by allowing them to remain as at present, for the endowments were now used to give a simple elementary education, which would for the future be provided in rate-aided schools. He thought, therefore, that to apply these endowments to the establishment of scholarships in higher schools would best promote the object in view.

The National Union of Elementary Teachers.—The second conference of this Association was held at Birmingham last week. This Union has only been in existence nine months. It was formed, after much preliminary deliberation, at a meeting of representatives at King's College last June, and the first conference was held in September, when it was resolved to meet in Birmingham this year in Easter week. It has been already mentioned that the promoters of the Union had three objects in view in its establishedment:—First, they wished the opinions of teachers to have their due weight in the discussion of educational questions. The second point was the improvement of the position of the teachers; and the third was the obtaining of retiring pensions for them. With regard to the second point the Union alleges that there are artificial obstacles in the way of elementary teachers, preventing them from rising to appointments in their profession for which they may be fitted by capacity and experience. Masterships of endowed schools, it contends, should be open to them, and inspectorships of elementary schools, from the latter of which they are now excluded by the Government regulations with regard to age. In reference to the third point, the scheme proposed was the establishment of a fund—by means of the deduction of a certain percentage from all Government grants to schools and colleges—out of which retiring pensions may be paid to teachers, after a certain length of service. It may be noted that the whole body of teachers appear to favour the compulsory clauses of the Act, and to be anxious to see them put everywhere into operation.

Secondary Training Colleges.—The Rev. Evan Daniel, Principal of the Battersea Normal School, in a paper contributed to the *Educational Review*, endorses a suggestion already made, that training colleges should be founded for the express purpose of preparing teachers for middle-class schools. He thinks that "these colleges should give such a course of instruction as would embrace all the usual subjects taught in such schools, and should be thrown open to all candidates of good antecedents who passed a satisfactory examination. The period of training might extend over two years; the first being mainly spent in grounding the students in elementary subjects, and the next in teaching them more advanced subjects for which they showed special aptitude. An examination should be held at the close of each year, and a diploma, based partly on his attainments and partly on his skill as a teacher, should be given to each successful student at the close of his training. To every training-college should be attached a large practising middle-class school, divided into as many departments as might be found convenient, so as to give the students the widest possible variety of experience, both in teaching children of different ages, and in teaching different subjects. In this school the principles laid down by the lecturer on the theory and art of education should be practically exemplified; and the students (who for this purpose ought to attend the schools for a considerable part of each year) should teach before the lecturer, so as to get the benefit of his criticisms and advice." He believes that these colleges will never be established without Government aid, or succeed without government control, and he thinks they would be a judicious and economical expenditure of public money. "The improvement of middle-class education is as desirable from a national point of view as was the great reform in elementary education; for our middle-class is as far behind, in scientific and other knowledge, the corresponding class on the Continent, as the English artisan is behind the Continental; and the artisans are as deeply interested in the education of their masters, as the masters are in the education of their artisans."

The Education Question in Victoria.—It appears that in this colony an Education Bill is now exciting the combative faculties of the constituencies. "As at home so here," says a correspondent, "the sticklers for religious teaching—which, of course, means, their own religious teaching—in the schools risk the losing the substance of education for our children in their unwise zeal in matters of form. The government plan, as proposed, embodies three principles. Four consecutive hours of secular education given in the schools; compulsory attendance; and facilities to all the sects alike to impart religious teaching in the school-rooms, but out of school hours, as may be arranged among themselves. The laity of the Protestants are in the main satisfied with the plan, but the Roman Catholic laity very generally defer on this subject to their priests, and these latter regard it as a matter of conscience to insist on religious teaching in the schools themselves. If they were allowed to prevail, equal rights must be conceded to every other sect, and thus we should be remitted to the old, expensive, and ineffectual denominational system, from which we have been so long striving to escape."

The Half-time System in Germany.—In an address on Prussian education, lately delivered by Principal Sir Alexander Grant before the Royal Society of Edinburgh, he remarked that in the cotton manufacturing districts of Saxony the government had made an equitable compromise between the claims of industry and school learning by allowing a system of half-time schools for children employed in the factories. The children, under this system, appeared to be ultimately as well instructed as those under a whole-time system. This experiment, he thought deserving of particular attention; for he believed that children up to nine or ten could learn as much in three hours at a time as they could learn in six hours, and that light industrial employment during the remainder of the day would rather tend to develop intelligence. In Prussia, the minimum age for children being employed in factories was twelve, and up to fourteen no child must work more than six hours per day. Thus plenty of time was left for attendance at a three hours' school.

CORRESPONDENCE.

WOMAN'S WORK.

Sir,—In the discussion which followed the reading of Miss Emily Faithfull's excellent paper on the above subject, the statement was made and supported that the fellowship of men and women in the same workshop was a means of mutual refinement, and productive of a higher moral tone on both sides. The subject has long occupied my attention, and I have had great opportunities of observing the effects of such companionship, not only in this large district of female industry, but in London and elsewhere. It may be true that the men "use much less bad language" in the presence of the women, but I have invariably found that instances of female degradation were more frequent when women worked with men than when they worked in shops exclusively occupied by women, with overlookers of their own sex. If it be true that "a bad girl will corrupt a score of boys," it is no less true that one bad man may corrupt a score of naturally weaker women; and where can be found any considerable shop of workmen that does not contain at least one black sheep? Women should be protected from temptation, but they are dangerously exposed when in the daily company of strange men. If this is so, those occupations will be most wisely provided for them which least expose them to the promiscuous society and seductions of the other sex.

In recommending hair-dressing as a fit profession for ladies, I hope the dressing of ladies' and children's hair only is advocated, as it would only prove a further means of exposing girls to the seductions of the idle profligate. Those female hair-dressers who possessed the larger share of personal attractions would come in for the larger share of business and of danger, and short hair would become the perpetual fashion of idle youth.—I am, &c., William H. Goss.

Stoke-on-Trent, April 4th, 1871.

COMMERCE OF INDIA.

Sir,—Mr. Dadabhai Naoroji's letter, dated 28th ultimo, published in to-day's *Journal*, is an unequivocal admission that, as I said in my previous letter, the disadvantage of which he makes mention resembles the Irish one of non-resident landlords, and, I might add, Norfolk might with as much justice be said to suffer under a disadvantage because so much of her substance is drawn to London.

India requires to produce as much as will furnish an equivalent for whatever advantages she enjoys. India requires strong and good government just as much as England requires tea, perhaps more. We think it no grievance, not even a noticeable disadvantage, when we remit silver to China in payment for tea. Neither need it be considered a matter deserving of comment that, to a certain extent, the cost of governing India takes the form of remittances to England.

The great, the only important consideration is, "Does India receive value for her money." She is sure to do so, as far as the mercantile transactions go; the only way in which it is possible she may suffer is, that perhaps her taxes are not expended, any more than ours, in the wisest and most economical manner conceivable. To wisely direct the expenditure of a nation's resources requires not only wisdom in the administrator, but the co-operation of many men; and I offer to the consideration of Mr. Dadabhai Naoroji, whether the most practical thing he can do is not to turn his attention that way, and devote his brilliant abilities to the task of criticising, in a friendly but thoroughly independent spirit, the financial management of the English governors of India.

To propose the task to me is to devolve upon an Englishman, not specially acquainted with India (but who knows, perhaps, something of first principles), a duty which cannot be properly performed except by the united efforts of many able natives of India.—I am, &c.,

Thomas A. Welton.

6, Offerton-road, Clapham, 14th April, 1871.

MILITARY QUARTERS IN INDIA.

Sir,—In the *Journal of the Society of Arts* of April 7th, under the head of "General Notes," p. 442, on the subject of Indian Colonisation, is detailed the sad sanitary condition of Peshawur, or the Valley of Death; and that article also quotes the number of admissions into hospital from the 38th regiment, owing to the prevalence of fever and ague, and recommended that a hill-station may be found for the men.

They would not have far to go for such a desideratum, for many years ago, namely, in 1856, Sir Sydney Cotton, when commanding at Peshawur, recommended the occupation, as a sanitarium, of a spot on the Cherat Hills, not more than 30 miles from Peshawur, at an elevation of from 4,500 to 4,700 feet above the sea-level; and Dr. Farquhar sent in a report, showing that it had many natural advantages; and it is so extremely desirable to find a healthy and mild climate near Peshawur for those whose constitutions have suffered from the destructive malaria of that valley, that the proposition ought not to be lost sight of.

Now, it is 15 years since such a desirable locality was pointed out, and the correspondence thereon has of course been duly noted, pigeon-holed, and taken care of; but what about H.M.'s troops; do they still continue to die in as great numbers notwithstanding? Has their health been really considered, and if so, what steps have been taken to improve it, beyond occasionally sending a few invalids to Rawul Pindee, on the selection of their medical officer? As far as real interest in their welfare is concerned, such might be described as *vox et preterea nihil.*

But why continue to shatter constitutions on the plains, and then send them for repairs to hill-stations? Why not quarter them on the hills permanently, where they could always be efficient for service on the plains when required.

Such a course would certainly be a far preferable one to that at present pursued, of torturing them for a lengthened period during the service in India, by exposing them in unhealthy quarters on the plains, framing sanitary statistics on their condition, detailing their annual mortality, and deeply regretting its continuance. Until some governor-general of India and a commander-in-chief are found who really have the welfare of the British soldier at heart, and will insist that the various suggestions offered for his healthful existence should receive other consideration than mere talk, and see that they are practically carried out, I much fear that the soldier will everlastingly continue to be a martyr to neglect while serving in the East, and either lay his bones there, or return home with a shattered constitution, with twinges of bodily pain incessantly reminding him of the care bestowed upon him by the authorities he has so faithfully served, and will constitute a living caution to others against going and doing likewise. Enlistment is not thus encouraged.

Now, when a course of humanity is the cheapest to adopt, perhaps the Secretary of State for War might also interest himself in this matter, and thus save much money annually in sending out fresh victims to the East, to supply the place of the *dear* departed ones.—I am, &c.,

Sentinel.

London, April 8, 1871.

WILLIAM SANDFORD.

Sir,—The papers announce the death of William Sandford, on the 10th of April, at Bath, aged 63.

This event should not pass without notice, and particularly so far as the Society for the Encouragement of Arts, Manufactures, and Commerce is concerned. Mr. Sandford was a man of independent property, and a native of Manchester, I believe. After spending many years in travel in Hungary, Turkey, and Egypt, he devoted himself, in conjunction with the Cotton Supply Association, and before the cotton famine, to the promotion of cotton culture in the East. He had no personal interest in the cotton trade or in speculation, and was solely influenced by the desire to do good to his native land, and those countries in the East for the welfare of which he felt an earnest sympathy. Many years were spent by him in negociations with the governments of Turkey and Egypt, and in correspondence with the Foreign-office, the Association, the press, and individuals, and he was ultimately successful in increasing the growth of cotton in Egypt, and in inducing the Ottoman government to pass a series of legislative and administrative measures, which were productive of great benefit. I am glad to bear testimony that it was to Wm. Sandford we were indebted for these great results, and they will find a worthy record in the forthcoming history of the Cotton Supply Association, by its secretary, Mr. Isaac Watts.

Had the voluntary and gratuitous mission of our distinguished countryman been followed up, as it might have been, by a systematic government agency in the form of a Commercial Councillor of Embassy, the movement would not have flagged, and we should be receiving still more cotton, and exporting still more cotton goods. These disinterested labours of William Sandford, often carried on at considerable personal sacrifice and inconvenience, must have bestowed on this country many hundred thousands of pounds.

The Ottoman Government was never wanting in demonstrations of regard for Mr. Sandford. He received their thanks on many occasions. On the institution of a decoration for Merit in Science and Art, they sent to him the very first diploma of the first class. He likewise received a decoration of the second class for services in promoting cotton cultivation, the first being devoted to the Sultan. On the visit of the Sultan to this country, one of the first persons sought after by his Minister was Mr. Sandford, but his suffering from paralysis deprived them of the opportunity of paying further tributes to him. The Cotton Supply Association was ever mindful of his claims, and bestowed on him their gold medal. The Italian and French Governments treated him with great attention. The Foreign-office here listened to his representations, but it is needless to say that he received no recognition of his services from our government.—I am, &c.,

Hyde Clarke.

32, St. George's-square, April 15, 1871.

GENERAL NOTES.

Twickenham Economic Museum.—It is with great regret that the members of the Society will learn that the collection which Mr. Thomas Twining, Member of Council, has, with much care and expense, got together for the purpose of illustrating all the various branches of domestic economy, has been destroyed by fire, which originated in one of the cellars. Mr. Twining has for many years most persistently brought before the public the benefits that must arise from the systematic teaching of domestic economy.

A New Fibre.—A new fibre, obtained from the bark of the mulberry-tree, has been produced by Mr. G. B. Marasi. It is expected that the new material will answer almost all the purposes for which hemp and flax are employed.

A Novel Use for Asphalte Pavement.—It appears that during the siege of Paris the asphalte pavement was largely used, both for fuel and for the distillation of gas to fill balloons.

Economic Entomology.—The following prizes for collections of economic entomology are offered by the Royal Horticultural Society:—1. A prize of £10 for the best collection of British insects injurious to any one plant, as the oak, pine, cabbage, wheat, &c. (the choice of plant to be left to the competitor). The insects to be shown as much as possible in their various stages of development—eggs, lava, chrysalis, and perfect insect. In judging, a preference will be given to those collections which most successfully illustrate the life history of the insect, and exhibits the mischief done, whether shown by specimens, drawings, models, or other means. Examples of the application of drawings, models, and specimens to this purpose may be seen in the society's collection in the South Kensington Museum. 2. A second prize of £3 for the second best collection. 3. A prize of £5 for the best miscellaneous collection of any branch of British economic entomology, similarly illustrated. 4. A second prize of £2 for the second best collection. The collections to be sent to Mr. James Richards, assistant-secretary, Royal Horticultural Society, on or before the 1st of May, 1872, each collection bearing a motto, and a separate sealed envelope, with the motto on the outside, and the name of the competitor inside. The society is to be entitled to take from any of the collections sent in, whether successful or not, whatever specimens or illustrations they may choose, at a price to be fixed by the judges. The judges to have power to refrain from awarding the prizes should the collections seem not worthy.

The Walter Scott Monument in Edinburgh, and the Schone Brunnen at Nuremburg.—The well-known Memorial to the great novelist, poet, and historian of North Britain forms a striking and welcome feature among the architectural attractions of our "Modern Athens." It is a Gothic edifice of elegant but substantial proportions, lofty, and of an ecclesiastic character, like the spire of a cathedral, but it is not surmounted by a cross. Its stability and the thrusts of the structure are provided for by its tapering regularly from base to apex, and by the substance of its lower portion being supplemented by flying buttresses resting on massive foundations. It contains a seated marble statue of the bard on a low pedestal, so that this posture, unsuited to elevation of position, is not disadvantageous in this instance. The architect was George Mickle Kemp, born 1794, died March 5th, 1844. One of the most elegant examples of this kind of structure occurs in Germany, in the "Schöne Brunnen," or "Beautiful Gardens," standing in the corner of the market-place at Nuremburg, and of which Mr. Fergusson says that "it is one of the most unexceptionable pieces of German design in existence. It is octagonal with much openwork, and much resembles the contemporary crosses erected by our own Edward I. to the memory of his beloved Queen Eleanor," of which a notice appeared in last week's *Journal*, "but it is larger and taller, the sculpture better disposed, and the whole design, perhaps, unrivalled among monuments of this class." It is 56 feet in height, and was enriched originally with painting and gilding. The artists employed as architects and sculptor were the same as those of the neighbouring Frauenkircke, which was built between the years 1355 and 1361, namely, George and Frederick Ruprecht for the architecture, and Sebald Schonhofer for the sculpture. Becoming by time in a ruinous state, it was, in 1821-24, restored with great fidelity to the old work, and of the 24 statues it contained, it was requisite to re-execute not less than 16." It is figured by Chapuy, and also by Fergusson, with the restorations. The latter authority, to his other remarks respecting it, says that "the lightness of the upper part and the breadth at its base gives it an appearance of stability which greatly contributes to its effect." Its finial is not a cross, but appears in the engravings, which, however, are not in this respect very distinct, to be a triton holding a bird.

Whalebone.—The following is a table of the receipts, in the United States, of whalebone from the Arctic, Greenland, and Southern Fisheries, and of the quantities exported from the United States to Europe during the last 10 years:—

	Receipts. lbs.	Export. lbs.	Consumption. lbs.
1861	1,039,000 ..	1,112,000 ..	105,000
1862	691,000 ..	967,000 ..	97,000
1863	562,000 ..	443,000 ..	60,000
1864	770,000 ..	590,000 ..	152,000
1865	651,000 ..	373,000 ..	202,000
1866	891,000 ..	754,000 ..	195,000
1867	949,000 ..	737,500 ..	132,500
1868	898,000 ..	756,000 ..	256,000
1869	577,000 ..	318,700 ..	167,400
1870	782,700 ..	348,000 ..	210,700

Stock of whalebone in the United States on 1st January, 1871, 499,000 lbs. The actual catch in the Arctic Ocean in 1870 (there was no whaling in the Octorsk) was 670,000 lbs.; of this quantity only 244,000 lbs. reached the United States last year, leaving 436,000 lbs. to be received from that source in the course of the present year.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

April 26.—"Photography in the Printing Press, being a description of the working of the Heliotype Process." By Ernest Edwards, Esq., B.A.

May 3.—"On the Production of Artificial Cold." By Professor John Gamgee.

May 10.—On "The Application of Steam to Canals." By Geo. Edward Harding, Esq., C.E.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...**SOCIETY OF ARTS, 8.** Cantor Lectures. Dr. T. Spencer Cobbold, F.R.S., "On our Food-producing Ruminants, and on the Parasites which reside in them."
Actuaries, 7. Mr. Henry Harben, "On Industrial Assurance."
Medical, 8.
Royal Geographical, 8½.
London Institution, 4. Mr. R. A. Proctor, F.R.A.S., "On Astronomy." (Educational Course.)
Philosophical Club, 6. Annual Meeting.
Antiquaries, 2. Annual Meeting.

Tues. ...Civil Engineers, 8. Mr. John Grant, "Further Experiments on the Strength of Portland Cement."
Medical and Chirurgical, 8½.
Royal Institution, 3. Mr. W. Pengelley, F.R.S., F.G.S., "On the Geology of Devonshire, especially of the New Red Sandstone System."

Wed. ...**SOCIETY OF ARTS, 8.** Mr. Ernest Edwards, B.A., "Photography in the Printing Press, being a description of the working of the Heliotype Process."
Geological, 8.
Archæological Association, 8.
London Institution, 12. Annual Meeting of Proprietors.
Social Science Association, 8. Mr. Francis Fuller, C.E., "On the Undeveloped Resources of the Soil of the United Kingdom, and the necessity of Enlarging the Area of Production and Employment."
Royal Society of Literature, 8½.

Thurs...Royal, 8½.
Royal Society Club, 6.
London Institution, 7½. Prof. Bentley, on "Economic Botany."
Royal Institution, 3. Professor Tyndall, LL.D., F.R.S., "On Sound."

Fri.......Royal Institution, 9. Professor Odling, F.R.S., "On the revived Theory of Phlogiston."
Quekett Club, 8.
Sat ......Associated Arts Institute, 8¼. Mr. W. Davies, on "Some Characteristics of the Venetian School of Painting."
Geologists' Association. Excursion to Belvedere and Crayford.
Royal School of Mines, 8. Dr. Cobbold, F.R.S., "Geology." (Swiney Course.)
Zoological, 1. Annual Meeting.
Royal Institution, 3. Mr. Joseph Norman Lockyer, F.R.S., "On the Instruments used in Modern Astronomy."

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FRIDAY, APRIL 28, 1871.

PROCEEDINGS OF THE SOCIETY.

TWENTIETH ORDINARY MEETING.

Wednesday, April 26th, 1871; Hyde Clarke, Esq., Treasurer of the Society, in the chair, which was occupied later in the evening by T. Roger Smith, Esq.

The following candidates were proposed for election as members of the Society:—

Barratt, Thomas James, 91, Gt. Russell-street, W.C.
Carte, R. D'Oyley, 20, Charing-cross, S.W.
Harcourt, George, 21, Stafford-terrace, Kensington, W.
Hovenden, Robert, 5, Great Marlborough-street, W.
Hughes, Robert, 52, Clifton-street, E.C., and the Mount, Devonshire-road, Forest-hill, S.E.
McKenzie, James, 19, Osnaburgh-street, Regent's-park, N.W.
Stainbank, William Henry, Hoolikul, Coonoor, Neilgherry Hills, Madras.
Strode, Wm. Winstanley, 19, Osnaburgh-st., Regent's-park, N.W.
Williams, Philip, 19, Osnaburgh-st., Regent's-pk., N.W.
Wood, Wm., Winchmore-hill, N.

The following candidates were balloted for and duly elected members of the Society:—

Beazley, Captain, Army and Navy Club, S.W.
Day, Charles, 16, Mount-street, Berkeley-square, W.
Dykes, Robert C., 4, Devonshire-villas, King's-road, Peckham, S.E.
Francke, Abel P., 84, Portsdown-road, Maida-hill, W.
Francke, D. O., Gottenberg.
Phipps, Capt., R.N., *Warspite* Training Ship, off Charlton.
Routh, William Dehague, 14, St. James's-square, S.W.
Sevastopulo, Michael Alexander, 18, Leinster-gardens, W.
Thompson, Robert F., Hooghly, Bengal.
Verity, Richard, Ph.D., 35, Warwick-street, Regent-street, W.

The Chairman said it had been intended that Mr. Warren De la Rue should preside on that occasion, and nobody could have been better suited, from the personal interest which he had taken in this subject, to occupy the chair. He was sorry to say, however, that another engagement had prevented Mr. De la Rue being present, and he, therefore, had been called on temporarily, as a member of the Council, to preside. He said temporarily, because he also was under a prior engagement to read a paper at the Royal Society, and must, therefore, after introducing Mr. Edwards to the meeting, retire. Before so doing, however, he desired to give his personal tribute, as far as he had been able to judge, to the value of the process about to be described. Without wishing in any way to forestall the criticism which would no doubt follow the reading of the paper, and in which he had no doubt that many of the gentlemen present connected with art would take part, he was fully convinced that this was an invention of great practical value, and this fact had induced the Council of the Society to invite Mr. Edwards to explain it. This being a process of reproduction, and therefore what might be called to some extent of an inferior character to true art work, it was not calculated in any degree to rouse the jealousies of artists, but, on the contrary, it should claim their sympathies. There were but few who could afford to purchase a great work of art; but art was required for the million as well as for the select few, and some process of reproduction, therefore, must be looked to for creating the public opinion, which was of equal if not greater value to the artist than the pecuniary compensation which he received. An artist, no doubt, depended for a considerable portion of his reward on the profits of his profession, but he also looked for something more—the appreciation of the great body of his countrymen. This was his truest and greatest reward, and in order to obtain it it was necessary that his work should be brought before the public at large. To a certain extent that was done by means of public exhibitions; but in looking at the history, or, as in some cases it might be called, the fate of a picture, it would be seen how important were such processes as that about to be explained. When a picture was sold, its inspection was confined to the purchaser and his friends, or, if exhibited, it might be seen by some few thousands, but if it were to be brought home to the houses of the people, and to exercise its real influence as a work of art, it must be reproduced in some cheap and convenient form, such as he would now call upon Mr. Edwards to describe.

Mr. Roger Smith then took the chair.

The Paper read was—

ON PHOTOGRAPHY IN THE PRINTING PRESS, BEING A DESCRIPTION OF THE WORKING OF THE HELIOTYPE PROCESS.

By Ernest Edwards, Esq., B.A. (Cantab.)

It will be well, before entering into a detailed explanation of the special process before us to-night, to revert for a few minutes to the past history of photographic printing, and especially to the past history of permanent photographic printing. It is but a few years since the paintings of the sun took the world by surprise, but the wonder that they caused soon gave place to the commercial value that attached to them. Speedily a new trade, of enormous dimensions, was found to have sprung up; photographs were manufactured and supplied to the public by millions, and the public was satisfied so long as what they obtained *appeared* good. This lasted for a time, and then came a reaction. It was not long before it came to be known that, at all events in photography, the proverbial thing of beauty was by no means a joy for ever. The possessors of collections of photographs opened their portfolios to find, too often, little better than blank paper, where they had last looked on treasured gems. A whisper, the forerunner of the voice which now speaks with no uncertain sound, was heard next, that silver photographs not only might, but, sooner or later, must fade, and a cry was raised for photographic printing which should admit of no reasonable doubt of permanence. Experimentalists soon produced satisfactory results in this direction, but, in the meantime, silver printing (that is to say, the process by which what we are accustomed to call photographs are produced) had established, most unfortunately, a certain standard,—a standard, that is, as regards results, by which all new processes were to be judged. This is what the workers in the new field have had to contend against; this is what, more than anything else, has barred their progress. No matter how beautiful the results of a new process may be; no matter that these may be proved to demonstration to be permanent, to be cheaper, to have a thousand other qualities not possessed by silver prints, and to be more artistic, the first point raised always is, can they be mistaken for silver prints—not are they more artistic, but are they so like silver prints as to be mistaken for them? This method of comparison is what I protest against, for a silver print is what nothing but the fugitive salts of silver can produce. It is impossible for a silver print to be so like a drawing in black chalk as to be mistaken for it. So I conceive it is impossible for a drawing in black chalk, executed by light (which is neither more nor less than a photograph in carbon), to be so like a silver print as to be mistaken for the latter. Silver photographs are things *per se*—unlike everything else. Artists do not admire them; they are not in effect altogether pleasing, nor can any known pigment match them. Nevertheless, unfortunately for carbon-printing, the standard is set up, and unless we can show a print that shall be mistaken for a silver print from the same negative, our efforts are in many quarters esteemed all but useless.

The ordinary method of photographic printing is based on the fact that paper treated with certain salts of silver darkens on exposure to light. If certain parts of such paper are shielded or screened from the light, these parts will remain white, and the remainder will darken and form a picture. This is what (by protecting certain parts and allowing light to act on others) the photographic negative (or shield) does. When the picture has been thus formed it requires to be fixed, to prevent the further action of light. Unfortunately, after fixation, there remain in the proof certain combinations, which of themselves, contain the elements of instability, and which it is not possible entirely to eliminate, so that, sooner or later, the silver print fades.

The action which is at the bottom of nearly all the permanent photographic printing processes is that of light on gelatine in presence of a bichromate. Gelatine, or glue, which is simply a common form of gelatine, is, as is well known, readily dissolved in warm water. If we take gelatine, dissolve it in hot water, and having added to the solution some bichromate of potash, again dry it, we have a compound which is sensitive to light, but sensitive in a way entirely different to ordinary photographic paper. If we expose this compound to light, we shall find, not that it has changed colour to any marked extent, but that it is no longer soluble in hot water. If we shield a portion of the dried gelatine and bichromate from light, that portion will dissolve as readily as before, but the portion which has been acted on by light is now unaffected by the hot water. The discovery of this action was made in various steps, the first being announced by Mr. Mungo Pouton as early as 1839. It is most important to keep this fundamental principle clearly before us, for if we fail to do so, we shall fail to comprehend all that is built upon it. I may be allowed, therefore, briefly to restate it. Gelatine, or glue, is readily soluble in hot water, but if a sheet of dried gelatine containing a bichromate is exposed to light it is found to be converted into a tough, tawny substance no longer soluble as before. This remarkable property was speedily laid hold of by experimentalists, and two groups of processes have been founded upon it. In the first group, this action is brought into play in the production of every proof. That is to say, every picture is produced by the action of light on bichromated gelatine. In the second group, one picture is produced by the action of light on bichromated gelatine, and this picture is made by various devices to serve as a printing matrix, from which any number of impressions may be struck off by mechanical means.

In the first group is included what is ordinarily called carbon-printing. If we take a sheet of paper prepared with a coating of bichromated gelatine, and, having exposed this to light under a negative, wash it in hot water, the portions unacted on by light will be washed away, that is to say, in those portions no gelatine will be left on the paper; but where light has acted, the water no longer dissolves the gelatine, which, therefore, is left on the paper. In other words, we have a proof, not in light and shade, but in relief and depression, some parts of the paper having gelatine left on them, others having none. Now, if previous to coating the paper we mix with the gelatine some pigment, such as carbon, and proceed as before, we shall have obtained not only a picture in relief and depression, but also in light and shade, for where gelatine is left on the paper, there will also be colour in virtue of the carbon which is imprisoned in it; but where the gelatine is unacted on by the light, and is washed away by hot water, there the colour is also washed away, leaving the paper bare,—and thus we have a carbon photograph. Herein it is true we have the rudiments of a process, but something more than this is wanted. A negative does not consist simply of parts where the light entirely passes through, and of parts where it is entirely obstructed. The whole beauty of a photographic negative consists in what is called half-tone, that is, where the light is partly obstructed and partly passes through, and a good negative contains a thousand variations gradating in intensity from black to white. The difficulty of reproducing these was the first great obstacle to the progress of carbon-printing. The action of light through such a negative on to a sheet of gelatine and bichromate is like that of cold on a sheet of water. The whole surface of the latter may be frozen over, and the ice be apparently of equal thickness throughout, but where bridges, and banks, and trees have afforded shelter, the ice is thinner, so that though the upper surface is perfectly level, the lower surface varies with the degree of cold to which it has been exposed. So it is with the picture on gelatine. The whole of the upper surface—that surface which has been next the negative—is acted on by light, and the part that has to be washed away is underneath, between it and the paper. Directly, therefore, such a proof was put in hot water, the picture, being on the surface, and having nothing to support it, floated away, and the paper was left bare. To obviate this, a very ingenious proceeding is adopted. Paper is coated with bichromated gelatine, and the carbon or pigment which is to form the picture. It is printed on by light under a negative as described. But, before being put into hot water, it is glued face downwards, that is to say, the side which has been exposed to the negative downwards, on another sheet of paper. Then comes the washing with hot water. As before, the intermediate layer between the first paper and the gelatine picture is dissolved, and the first paper is left bare, but the picture itself, instead of floating away, has been glued to the second piece of paper, on which you thus have a print containing all the gradations of the negative. This, broadly, is the basis of the present method of carbon-printing. The magnificent reproductions by Braun, of Dornach, and those of the Autotype Company are produced by such a method. It is difficult to conceive anything finer than Braun's reproductions of the paintings in the Sistine Chapel, and each one of these, and of the autotype prints, has been produced in the way indicated, and consists of a film of bichromated gelatine, having imprisoned in it any convenient colouring matter.

In the second group, the gelatine picture is used as a matrix for producing a printing base, or is itself used as printing base, which is then in either case printed from by mechanical means. The first successful attempts in this direction resulted in the process which is known as photo-lithography. A print is produced by the action of light on gelatine in the way first indicated. It is found that lithographic-ink will adhere to those parts where light has acted. The gelatine print is accordingly inked with a lithographic transfer-ink, and the print thus produced is transferred to the surface of stone or zinc. But a lithographic stone does not do more than discriminate between black and white; it will not recognise half-tone. The process is not, therefore, suitable for the production of aught else than bold work, either in dots or lines. For this purpose, it is very extensively used by the Ordnance Survey-office at Southampton, by Mr. Griggs, at the India Museum, and commercially in many other places.

In photo-galvanography, introduced by Herr Pretsch, of Vienna, the picture in gelatine having been obtained, a gutta-percha mould is made from it. On this an electrotype is formed, which is printed from as in copper-plate printing. Here, again, as in the lithographic stone, the copper-plate does not do more than discriminate between black and white; it will not recognise half-tone, save by the conventional methods of dots and lines of greater or less degree of fineness. And it was found in practice that so much work was necessary to prepare the electrotype-plate for printing, that it became almost equivalent to an entirely new engraving. Accordingly, the process soon fell into disuse. Various improved forms of this principle have been from time to time introduced, and some are now in use—notably Mr. Dallas's photo-electric process, and, in Paris, Garnier's photo-engraving process.

Mr. Woodbury proceeds on an entirely different plan. A gelatine picture, having been obtained by light, is placed in contact with a sheet of soft metal, and submitted to heavy hydraulic pressure. Bearing in mind that the gelatine picture is a picture in relief and depression, the metal counterpart obtained by pressure will also be in reversed relief and depression. A mould will have been obtained, which it will only be necessary to fill with a solution of gelatine to obtain a duplicate, so to speak, of the gelatine picture from which the metal mould was struck. The resulting picture will be one in relief and depression; but if, as in the case of carbon printing, colouring matter is poured into the solution of gelatine used to fill the metal moulds, it will also be in light and shade. The mode of proceeding is extremely simple. A little solution of gelatine in hot water, containing suitable colouring matter, is poured into the metal mould, a piece of paper is placed on the top, and a level lid pressed down on it, so as to squeeze out superfluous gelatine. In a few minutes, the lid is opened and the paper removed, bringing with it the adhering gelatine, which, with the colouring matter, forms the picture. This is repeated indefinitely, and it remains only to fix the proof to prevent the further solution of gelatine, to possess—produced by mechanical means and independently of light—the analogue of the carbon photograph previously described. At present no pictures have been produced by the Woodburytype larger than about 11 in. by 9 in., and there is a necessity for subsequent mounting, but the cleverness and ingenuity of this beautiful process cannot be too highly spoken of.

I have now to describe the heliotype process. The action of hot water on gelatine is to dissolve it; the action of cold water is not to dissolve it, but to fill up the pores and swell it up, just as in the case of a sponge. And as, after exposure to light in presence of a bichromate, hot water will no longer dissolve gelatine, so, after exposure, cold water will no longer expand it—can no longer penetrate the pores. The light has, in fact, had the effect of closing the pores, and thus rendering the gelatine waterproof. If, then, we cover a glass plate with bichromated gelatine, and expose it to light under a negative, there will be certain parts of it which will be completely waterproofed, having the pores completely closed by the light; certain parts—the half-tones—which will be partly waterproofed, having the pores partly closed; and certain parts where the condition of the gelatine will be unchanged. Now, if we steep this plate in cold water, some portions of it—those where light has not acted—will absorb water, and others will refuse to do so, having been waterproofed by light. If we take grease, and rub it over the plate, the result will be that where the pores are full of water—that is, where the light has not acted—the grease will not touch the gelatine, but where the light has acted the pores are closed, there is no water, and grease attaches itself readily; where the light has partly closed the pores, the small quantity of water absorbed does not prevent a small quantity of grease attaching itself. Lithographic ink is simply grease to which colouring matter has been added, and a lithographic roller charged with such ink, and rolled over such a plate, speedily reveals the light-produced image.

This method was discovered by Poitevin, and even patented by him, as early as 1856. But I doubt if he understood its true principle, for he appears to have considered that the action of light converted the gelatine into something of a waxy or resinous nature, which, on that account, took the greasy ink. However this may be, no results were produced by him, and the method in that form did not come into use. The practical difficulties met with in attempting to work it, arose first from the spongy and delicate nature of the gelatine film in those portions where light had not acted; and, next, from the difficulty of obtaining intensity in the inking and sharpness in the image, and from other technical obstacles. Bearing in mind the character of the image on the gelatine, it will be understood that those parts of the gelatine not acted on by light were in much higher relief, from the presence of the water which they absorbed, than those parts which, having been acted on by light, did not absorb water. But it is the depressions which take the ink, and the walls on each side of the depressions prevented the roller from reaching them; and again, it is the depressions to which the pressure must be applied, in order to allow the paper to pick up the ink. It was found that when the requisite pressure was applied the gelatine was speedily destroyed, more especially as the description of pressure employed was that used in lithography, where the force is a scraping one over the surface of the stone.

MM. Tessie du Motay and Marechal were the first to make use of Poitevin's method in any way commercially. They attempted to provide against the swelling of the unaltered gelatine, by using a very thin layer of it, and only printing such subjects as gave but slight contrasts. The results produced, though sadly wanting in vigour and firmness, were, at the time (1868), considered satisfactory, but it was found that after a very few impressions the gelatine was crushed, and became useless, more especially as the film, to be at all manageable in inking, had been made very thin.

Herr Albert, of Munich, next produced some results by a similar method. We do not find that his plan of working has been published, but it is believed to be somewhat as follows:—Instead of a lithographic stone, a glass plate is employed, of considerable thickness. On this is placed a layer of gelatine and bichromate, which, when dry, is hardened all over by exposure to light. On the top of this is placed a second thin coating of gelatine and bichromate, and this is exposed to light under a negative. In this manner a compound printing film is obtained, having the necessary degree of thickness to stand a certain amount of wear and tear, whilst, from its construction, the difficulty of the swelling of the gelatine is to a great extent got over; the plate is then inked and printed in the usual way. Some of the results produced by Herr Albert are most beautifully soft and delicate, but the whole are wanting in strength and robustness, and the process seems unsuited for the production of lines or subjects where firmness and strength are required. The films, moreover, are only mechanically united, and are very liable to injury in working, whilst the use of glass plates as supports, from their liability to fracture, introduces an element of uncertainty into the process that is very undesirable. But the results produced were so fine that, on seeing them, I was at once convinced that in that direction lay the future of permanent photographic printing.

There are many ways of closing up the pores, or of waterproofing gelatine. We have seen that the action of light in presence of a bichromate will do so completely. Admixture with alum, more especially chrome alum, will do so as completely without the action of light, and after such treatment the gelatine is converted into a tough, tawny, insoluble substance like leather or parchment, capable of standing an apparently unlimited amount of rough usage. In the course of my experiments, I discovered that gelatine might be converted into this substance, but that it still retained its property of being acted on by light in presence of a bichromate, and of receiving and refusing greasy ink. The merest trace of water is sufficient to secure the repulsion of grease, and in chrome alum we have the means of closing up the pores of gelatine to any desired extent, and under the most complete control. Here, then, was a most important point gained—instead of having to deal with a soft, spongy mass of gelatine, so swollen with water as to be useless, secured by this means a tough film of sufficient thickness, which, while it would absorb sufficient water to repel grease, was yet so little swollen as to present no difficulty in inking or printing—a film which was sufficiently dense to give perfect firmness of line with entire freedom from the grain which is sometimes seen, and which was so tough that 1,000 or 1,500 impressions might be pulled from it without the least loss of quality. But I found in practice that when these films were used on glass supports there was great difficulty in getting contact between the gelatine glass-plate and the negative during exposure to light. The slightest inequality in the surface of either negative or gelatined glass, the slightest speck, prevented contact, so that line subjects were practically unobtainable, and many plates were failures on this account. Moreover, but a comparatively small amount of pressure could with safety be applied to a glass plate in the press—not nearly so much, indeed, as was desirable, and even with the greatest pains fractures were of frequent occurrence. To obviate these difficulties, I devised the following method:—The solution of gelatine and bichromate, to which has been added the requisite amount of chrome alum, is poured on to the surface of a carefully levelled glass plate, and dried. But the surface of the glass plate has been first rubbed over with a little wax, so that when the film is dry it is readily detached. We then have a film only, not a thick glass plate, to deal with, of the thickness of stout paper, and just as manageable. With this film there is no difficulty in getting contact with the negative, and we are able to obtain the most intense sharpness. There is no risk of breaking the negative, and the management of the film is as easy as that of the paper on which photographs are ordinarily printed. A piece of such a film is placed in contact with a negative, and exposed to light, the sufficiency of the exposure being indicated when the whole details of the picture are apparent. The next step is to attach it to the support on which it is to remain during printing in the press. For this purpose, a plate of metal is taken, such as zinc or pewter, and the exposed gelatine film is placed in contact with it under water. We have now to get rid of the water which is between the film and plate. This is done by means of a tongue of india-rubber let into a strip of wood, just such an instrument, in fact, as is used in cleaning pavements in dirty weather, and which is known by the name of the "squeegee." This instrument is passed sharply over the surface of the film, and squeezes out the water between it and the metal. Then the absorbing property of the gelatine is brought into play, and the film is attached to the plate by exactly the same force that a boy with a leather sucker is able to lift a stone of considerable weight, that is to say, by virtue of atmospheric pressure. The plate, with its printing film attached, is steeped in water for a sufficient time to soak out the superfluous bichromate, so as to prevent the further action of light, and is then ready for printing at the press. Instead of a glass plate, of necessity fragile, we have now a printing film to which we may apply, without risk, any pressure we please, and which, when the requisite number of impressions have been taken from it, may be removed from its metal support, and stowed away for future use. At any time it may be again laid down and the printing proceeded with; and, as it is of a bulk but little greater than a sheet of paper, there is no difficulty in storing. I do not hesitate to say that this method of transferring the films increases the value of the process ten-fold. Having obtained our gelatine matrix on its metal support, we now come to the inking and printing. In previous processes of this kind, either a lithographic scraping pressure, or a copper-plate rolling pressure has been employed. I have discarded both, and use in preference a simple vertical pressure, such as is obtained in an ordinary Albion printing-press. By this means I obviate the risk of displacing or scraping the film, and greatly increase its power of wear. The plate has now to be inked, and in this operation I have been fortunate enough to introduce an improvement which gives a value to the heliotype process, possessed, I believe, by no other printing method in existence. If in inking one of these plates, we use what is called a very stiff ink, we shall find that it will only adhere to the deepest shadows; if we thin down the ink we shall succeed in getting the delicate half-tones, but we shall no longer get depth in the shadows. This has been the notable fault with the productions of analogous processes; either shadows of intensity were produced with no half-tones, or half-tones were produced with no intensity. My method is to use two or more inks in succession, of different intensities, one after the other—to begin the picture with a stiff ink, and to continue it with a thinner. To produce different effects the colour of these may be varied. For instance, a stiff black may be used, which will give us the deeper shadows, and on the top of this may be rolled a thinner purple or brown, which will give us the half-tones. Many of the pictures on the wall are produced with two or three inkings, and you will notice presently what a very marked effect the double inking has in the production of the picture. This ability to produce a bichromatic effect in a single printing places a great power in the hands of the heliotype printer. In order to produce prints with a margin, so as not to require subsequent mounting, a mask of thin paper is made having an opening in it exactly the size and shape of the finished picture. The plate having been duly inked, this mask is placed on it, and over the mask the paper on which the print is to be produced. The press having been pulled, the picture is peeled away from the plate with a perfectly clean margin, being, in fact, mounted. The dispensing with the cost and necessity for mounting gives this method of printing a great advantage, especially in the case of book illustrations; indeed, I may say in almost all cases. With the mounted print, as it comes from the press, comes also the end of the process. The prints have only to be looked over, and any slight casual defects remedied, when they are ready for issue.

There are two questions regarding the process that I am continually asked—how many impressions can be produced from one plate, and how many impressions can be printed in a day? In reply to the first, we have printed as many as 1,500 impressions from one plate without any loss of quality, and the plate was only then stopped because no more were required. From accidents to the films, however, we are by no means free. We have to bear in mind that though our films will stand any usage of the right kind, they will not bear the kind of usage that lithographic-stones or copper-plates are accustomed to receive; and we have, moreover, to bear in mind that in a new process everything, from first to last, has to be provided for in a new way—new materials, new hands, new appliances. At present, therefore, we cannot look for freedom from such accidents as novelty necessitates, but when I mention that a fresh plate may be prepared in an hour, at the cost of a few pence, you will see that these are of comparatively small moment. In numbers, one man will print between 200 and 300 impressions in a day. As regards this point, it is to be borne in mind that a dozen subjects may be printed together, or the same subject laid down on the film a dozen times, so as to produce a dozen impressions at one pull. Compared with lithography, it will probably not be so cheap for large numbers, but for small numbers it will be cheaper, as the cost of drawing will be saved, and in either case the result will be far finer and more accurate. It is, of course, infinitely cheaper than any photographic or carbon process, or any other photo-mechanical process. Touching its applications, I need only point to the results which we have already obtained, some of which are on the walls for your inspection, to indicate many of them. But there are others equally valuable which we have not yet had opportunity of working. Amongst these latter, I may point to the use of heliotypes for pottery and enamelling purposes. It is only necessary to use an ink mixed with suitable oxides, and print on a suitable paper, to have on all descriptions of pottery, and at a lower price, pictures of art value in place of the anything but art pictures we are accustomed to accept. Again, this process provides a ready means of making prints in suitable ink for transfer to stone or zinc, or to wood for the purposes of the wood engraver. Having for its base a coloured, or partly coloured, design, a new kind of photo-chromo-lithography is within reach. But the direction in which I conceive it has the greatest value is in the artistic and scientific education of the people, where it affords a means of bringing within the reach of all, reproductions of works of art and records of science which would be otherwise unattainable.

It is true that the reproductions of drawings by such men as Raffaelle and Michael Angelo contain the inevitable faults of the photograph produced by their discolouration from age, nevertheless it is impossible to look at some of these—such, for instance, as the heads and hands of two of the apostles for the painting of the "Transfiguration," by Raffaelle, or a sheet of studies of heads by Michael Angelo—without feeling that you have there the veritable work of the master, that his hand alone, that no other hand but his, has produced the copy as well as the original. In point of price, there is no reason why pictures such as these should not take the place of those which, at present, are used to decorate even the walls of cottages.

It is true, too, that, as in all processes depending on a photographic negative for their base, colour is unfaithfully reproduced. Hence, oil-paintings depending on colour for their effect require an intermediate translation. A copy must first be produced wherein the defects so arising must be corrected, and this copy must then be again reproduced for issue. It seems to me probable that as progress is made there will be a distinct class of artists, who will be "translators of colour into light and shade" for use in this and analogous processes. Where paintings depend for their effect on light and shade or form, and not on colour, this intermediate translation is not so necessary. It is pictures such as these last of which we are accustomed to say that they photograph well.

For the reproduction of old or rare prints or engravings, this process is especially valuable, or for the reduction and enlargement of existing ones. Where there is a copperplate in good preservation, there is obviously no point in the use of any repeating process, for there is the certainty that there can be no *gain* of work by the operation of photography. But where a reduction is desired, or the plate is destroyed, such a repeating process as this comes in with overwhelming force. To the inevitable question, will not engraving be superseded? I would say no; engraving is an art of itself, and as such can never die. But one of the special objects that all workers in this direction have in view is, to supplement engraving. Engraving is a costly and a tedious process. The execution of one of the great engravings will occupy years of time, and cost thousands of pounds. In the Academy exhibition of any year, how many pictures are engraved? And in pictures that are engraved, has not the interest in them greatly ceased when the engraving is issued? Surely, here, then, there is room to supplement engraving with some means for issuing swiftly permanent and faithful reproductions of works of art contemporaneously with their exhibition. I venture to think that English artists have a lesson to learn in this respect from the French, who find their account in publishing photographs of their work in such a manner.

For book illustration, the heliotype process is especially valuable. The rate of production is rapid and certain, the cost is moderate, and the necessity for mounting is done away with.

For scientific record it is equally valuable. It retains the literal faithfulness of the photograph, and is, moreover, permanent, and far cheaper.

We are not slow to recognise in every direction the value of the photographic art, with its many drawbacks. The heliotype process, in a word, is an attempt to put this art into the printing press.

DISCUSSION.

Mr. George Wallis said he must congratulate Mr. Edwards, not only on the character of his invention, but also on that of his paper, in which he had given so lucid an explanation of the process of which he was the inventor. It often happened, that when papers were read in which, as in his own case, appeared great promise for the future, subsequent events showed that the inventor had calculated on the public help more than he had a right to do; and he could therefore heartily sympathise with the lecturer when he said that this was a process in which new materials, new methods, and new skill had to be employed. It was on account of these things that many new and useful processes hung fire, and were not carried out. He had generally found that those he employed to carry out any particular part of a process knew much better than he did what he wanted. The result was, that you always had a great deal to get out of people's heads before you could get what you wanted into them. There were three points in this invention which appeared to him of great importance. First, the ingenious method of using a mask for the purpose of keeping a clean margin to the paper, thus avoiding the expense and trouble of mounting, which was a matter of great importance in book illustrations, for those who had bought books illustrated with mounted photographs generally found that a trouble arose from the curling of the film on which the subject was printed. The second point was, the ingenious and artistic process of employing two or three gradations of ink, that of a stiff character in the first instance, and thinner ink afterwards, by which the picture was built up, and produced in a manner which no single ink could ever obtain. Finally—and this was of immense importance in the economy of the invention—the film itself, after having been used for as many copies as were required at the time, could be put aside and brought out again, whenever necessary. In the case of lithography, if you wished to produce a second edition of impressions, it was necessary either to pay for re-drawing on the stone, or to pay a rental for keeping the original picture upon the stone; but in this case the gelatine was, by the process itself, really converted into leather, and, therefore, being equally durable, there was no reason why the printing surface should not be kept as long as was required.

Dr. Ryley said no process was perfect at first, and, from what he had seen of the beautiful one before them —for up to the present time nothing had been produced at all equal to it—it appeared to him that there was a kind of water-mark on the paper, which he had particularly noticed in one print called "The Kind Sister." He should like to know, having paid particular attention to photography, what was the cause of these faults, for faults they undoubtedly were. It occurred to him they might be caused by the whole of the water not being squeezed out in the course of printing.

Mr. Saddler asked how long the film took to dry?

Mr. Edwards said from 24 to 36 hours, at a temperature of 90 degrees.

Mr. Saddler said he had noticed in all the impressions more or less evidence of that which he supposed attached to the gelatine process of drying. This was one of the fatal objections to the Pretsch and Dallas processes, which required 48 hours to dry the film. When it afterwards came to be moulded in gutta-percha, every particle of dust was moulded also, and in the transfer to the copperplate this was again repeated in little speculæ of copper which stood up, and had to be scraped off the lines afterwards brought out by a graver.

Mr. Spiller, as a photographer of long standing, desired to offer his congratulations on the very beautiful process which Mr. Edwards had succeeded in perfecting. He had watched the various methods which had been brought out for mechanical printing, but certainly, until the last year or 18 months, with the exception of the Woodburytype, which Mr. Edwards had referred to, there seemed no prospect of substantial success until the appearance of the Albert-type, by which most glorious specimens of art were certainly produced; and every one must have admired the magnificent specimens sent to this country. At the present moment, however, the public were in ignorance of the precise details of that process, and he believed Mr. Edwards was the first to give a connected account of the operation. With regard to the water marks which had been spoken of, he must say that, although he had noticed this on some of the early carbon prints, there was in the specimens of Mr. Edwards' printing which he had seen great whiteness and brilliancy in the high lights. With regard to the dust attaching to the film in the process of drying, that could easily be got over by employing a desiccating process, by which the gelatine might be dried without contact with the external air. He should like to ask what was the minimum of copies required in order to enable the process to successfully compete with the ordinary method of silver printing. For instance, in the event of 250 copies being required, would it be found more economical?

Mr. Suarez inquired what would be the absolute cost of printing 500 copies. He had recently had to pay £12 for such a number of photographic prints, including mounting, and he certainly should have preferred the present process, one great advantage in it being that all the copies were absolutely alike, which was never the case in photographs, which varied greatly; and in the second place, the curling and crinkling, which had been already referred to, was entirely avoided.

Mr. Yapp said some months ago he had the pleasure of exhibiting a few specimens of this process to two gentlemen in Paris, M. Lemercier and M. Rosa, who were very much pleased with them. M. Rosa afterwards took him into his press-room and said, "I have brought this gentleman to introduce him to you; he has brought to France specimens of a process which is about to ruin us all. We are only able to work with a lithographic press, but he is going to put it on the steam press." That was going a little beyond what he had stated, but he did not despair of the time coming when Mr. Edwards would be able to fulfil these words. He was quite certain that when poor, unfortunate Paris was again in a position to do anything in the way of art, this process, or something analogous to it, would find great favour.

Mr. Bedford asked whether the paper was damped, as in ordinary lithographic and letter-press printing. He said it seemed an admirable process for reproducing *fac-simile* works of art, such as those in Turner's *Liber Studiorum.*

Mr. Bailey asked if this process had ever been applied to glass or china, by using oxides instead of ink.

Mr. Edwards said they had produced prints on paper with a suitable ink, mixed up with oxides, specially for the transfer to pottery, but they had not yet had time to carry it further.

Mr. Bailey said something similar had been attempted a few years ago by Mr. Joubert, but there were so many failures that it had to be abandoned.

Mr. Fitzcook said this process would undoubtedly be a very great boon to artists, because they could get every touch of their work reproduced in a manner which no other process could imitate. Photo-lithography had lately been creeping much into use, and this process would no doubt be of great assistance in giving a transfer, which might be placed upon stone and afterwards printed by steam, which was not possible in any other way.

Mr. Ticknell asked whether the process was adapted to transferring to glass, so as to produce transparent pictures for ornamental windows in galleries, staircases, &c.

Mr. Edwards, in reply to the observations which had been made, said the dust on the surface of the films had been to a great extent disposed of by Mr. Spiller. He might add that it was owing to its being a new process, working with new appliances and new hands, which occasioned the water-marks. Really, a great difficulty to contend with was, in getting a suitable kind of paper. Messrs. De La Rue had recently made some admirable paper for the purpose, but they had not elsewhere been able to obtain any on which they could rely, one sample being very good, but a second quantity proving quite the reverse. He was now referring to papers with a slight surface upon them, because such papers better produced the effect of photographic printing; when he found it impossible to get a reliable paper of that character, he fell back on ordinary plate paper, which for many subjects gave quite as good results, indeed, in some respects, far better; it did not however answer so well when it was required to imitate the effect of photography, one difficulty being that the pressure had to be kept on the plate for some little time, and if the printer was not careful to damp the plate properly, the continued pressure made the plate go into lumps, which occasioned the water-marks. This, however, was a technical difficulty, which was disappearing day by day. The dust could, of course, be completely got rid of, as indicated by Mr. Spiller, but he did not think the appearance spoken of was due entirely to that cause. The dust did not act in the same way as in the copperplate that had been referred to, for dust was practically transparent, so that the light acted through it. If, however, spots did arise from such a cause, there was another remedy, viz., to use the under-surface of the film, where there could be no dust, to print from. The cost, as compared with silver printing, was a difficult matter to enter upon, but he might say that, for one or two impressions only, it would not be worth while to prepare and make ready, as it was termed, the printing surface. For large-sized pictures, however, they could compete with the silver process, even for six impressions. In such cases the cost would be about 1s. per foot. Book illustrations, 8vo. size, could be supplied ready for the binder at 1½d. each; smaller sizes would cost more, comparatively speaking, because the labour would be almost as great; but larger sizes less, in proportion. They were at present a long way from steam-printing, but he believed that time would come, for the inking of the plates was so purely a mechanical operation that he saw no insuperable difficulty in the way. The plate seemed to discriminate for itself how much ink was required, and when the proper quantity was supplied no additional amount of rolling would add to it. He was at the present time engaged in experiments with a view to putting these films into a lithographic machine. This was the first step towards steam-printing, and he anticipated no difficulty with regard to the inking part of the process. The paper was used dry, just as it was supplied. Turner's *Liber Studiorum* was a magnificent subject for the process, and it was in contemplation to publish a complete *fac-simile* edition of the whole series, under the auspices of a very distinguished author. As to transferring the impressions to glass, pottery, &c., he might remark that it was quite different from any photo-enamelling process, in which the colour was printed directly on the surface of the glass or china. The impression was printed on thin tissue paper in the proper colours, the paper being then handed to the manufacturer to be used in the ordinary way. In fact, a picture was produced in the same material as in the methods ordinarily used, but by photographic means. The transfer to stone was similar. He had specimens printed from the stone, which had been produced from impressions taken in transfer ink, and then laid down in the ordinary way, but this was only suitable to drawings in which the effect was produced by lines and dots.

The Chairman said Mr. Edwards had been justly congratulated on the particularly clear and lucid manner in which he had treated his subject, and on the openness with which he had described the whole process, and the steps which had successively led up to it, and he thought they must all feel very much indebted to an inventor who thus threw away the usual and often unnecessary reserve, and took them so thoroughly into his confidence. He was also much to be congratulated on having, in so short a time, made a new process so successful, for it often happened that an invention involving two or three, or even one mechanical process, was very difficult to deal with; you might get excellent results in laboratory experiments, and yet it would sometimes appear impossible to carry them out commercially, all sorts of unforeseen obstacles presenting themselves in the practical carrying out of the invention. He had no doubt that this process, like others, had met with a fair share of these practical difficulties, but what had been exhibited that evening was sufficient to show that they had been successfully overcome, and the process had been actually at work in several directions, amongst others in that for which he ventured to think it was specially adapted—book illustration. There was, for instance, a periodical, the illustrations of which had been, in many respects, remarkable, and highly artistic, which had been published for some months, and the illustrations in *Art* would convey some idea of the way in which it might be hoped that the works of great artists and the works of nature might be made fairly accessible to the readers and buyers of books. He had himself experienced the difficulty which there was in efficiently illustrating works of art without going to a very great expense; and one difficulty was this, that almost all the processes which could be applied with anything like cheapness, such as lithography, zincography, or wood-engraving, involved the translation of the artists' works through another pair of eyes and hands. If you wanted a large number of copies of any work of art, almost beyond an architectural elevation or perspective drawing, for the purpose of illustrating a book or periodical, it was necessary to have it re-drawn and engraved, or drawn and engraved by one process, as in lithography. But in either case a fresh hand was introduced, and in nine cases out of ten the whole spirit of the artist's work was lost. The field open to such a process as had now been described was immense, and it certainly seemed to possess advantages which could not be claimed for any of its predecessors. Mr. Edwards had not only been candid in explaining his own process, but had also generally recognised the services of others, and he was, therefore, more than ordinarily entitled to the vote of thanks which he begged to propose to him.

The vote of thanks was carried unanimously.

Mr. J. A. Franklin writes:—Would it be possible to print, say circulars, written upon gelatine, the writing only being pervious to a printing fluid, which fluid being supplied from one side the gelatine, could be taken off by paper rolled over the other side? In that case, the gelatine being supported on a cylinder of india-rubber sponge, and the paper being an endless roll, what might be the speed and economy of printing?

INDIA COMMITTEE.

On Friday, March 24th, a conference was held on "The Establishment of an Oriental Congress of Great Britain and Ireland." The subject was brought forward by Mr. Hyde Clarke, and the conference was presided over by Mr. John Cheetham, President of the Cotton Supply Association.

Mr. Hyde Clarke said the main object he had in bringing forward a proposal for the establishment of an Oriental Congress was the same as that arrived at by the India Committee of the Society of Arts, under whose auspices the present meeting was held, and by the East India Association. That object was the awakening of the public mind to the extent of the undeveloped or insufficiently developed resources of India. The apathy of the British Parliament, and, indeed, of the nation generally, with regard to India was well known, although there were many and distinct interests in this country whose existence depended upon the well-being of our eastern dependencies. It was a curious fact that, while in the great metropolis of London politicians and publicists were apathetic in regard to the government and future welfare of India, in the provinces, at large manufacturing towns, such as Manchester, the prosperity of India was viewed with the most active sympathies and the strongest desire to develop the resources of the country. When it was considered how many persons there were in the city of London also directly interested in the commerce of India, it would soon be seen how important it was that some means should be taken for the purpose of watching over its interests, and for the purpose of promoting other matters necessary for the well-being of India. That country would never be regarded in the light in which it ought to be regarded by the British public and Parliament unless steps were taken to bring it permanently forward and to force attention to it. Acting under the advice of influential friends, he had framed a proposition for an organisation which he thought would achieve the objects desired, and he hoped that having been discussed that evening, and amended in the India Committee of the Society of Arts, it would be found practicable. There were three sections that already took a special interest in Indian matters. The East India Association, which had its own defined objects; the India Committee of the Society; and the Social Science Association. Such a congress as he proposed would, however, look for a larger auditory than these, because it would deal with a larger range of subjects, and though those interested in commerce would perhaps say that a man who made language his study was not likely to take any practical interest in India beyond his own subject, still it was important to get persons interested in India in any and every way possible, for it would be found that a man interested in language would soon be found taking an interest in other subjects, and if all persons who had the common subject of India at heart, no matter in what particular way, were got together under one flag as it were, a better and more powerful means of affecting Parliament would be in existence than there was at present. It was well known how large were the gatherings at the meetings of the British Association, which awakened public feeling and public attention in every city of the empire; and did not India present the same opportunity, the same multifarious objects for discussion? And then, if they looked to the other feature of the periodical assembly in the different cities, it would be readily seen how important would be the influence of such a meeting with regard to India. If he were asked the place above all others where such a congress as he proposed should be inaugurated, he would say Manchester, for that city had already done much with regard to a few commercial subjects, and had manifested a very deep degree of interest in the welfare of our great eastern possession. Mr. Clarke then read the proposed scheme for the formation of an Oriental Congress, which had been printed and distributed among those present at the meeting. It was as follows:—

Oriental Congress of Great Britain and Ireland.

That an association shall be formed, to be called the Oriental Congress of Great Britain and Ireland, for promoting the development of the East, and for the discussion of all subjects, except those of a political or religious character, relating to India, the Transgangetic Peninsula, China, and Japan.

That the congress shall be, so far as possible, based on the plan of the British Association for the Promotion of Science.

That it shall consist of subscribing members.

That it shall meet once a year in some town in the country.

Such towns may include Manchester, Liverpool, Glasgow, Bristol, Birmingham, Leeds, Sheffield, Belfast, Aberdeen, Dundee, Bradford, Huddersfield, Dublin, Edinburgh, Oxford, Cambridge, Bath, Cheltenham, Leamington.

That the congress shall be divided into convenient sections. These may include:—

Geography, Geology, Mineralogy, and Mining.
Natural History and its Economic Applications.
Biology, with Ethnology.
Languages and Literature.
Archæology and Art.
Social Science.
Agriculture, Manufactures, and Commerce.
Statistics.

Meetings of sections may, if found convenient, be divided into sub-sections, for India, China, and Japan, separately.

As the great purpose is to enlist throughout the country the sympathy of all the various classes of persons interested in the development of the East, the places of meeting should be so arranged in successive years that the commerce, and statesmanship, and learning of the East may be severally represented.

Some distinguished statesman or man of learning should be invited to act as president each year.

The General Council, or the Committees of sections or sub-sections, will become permanent organisations for the promotion of the various interests concerned.

Mr. Clarke said it would be seen that in adopting the system of the British Association, the Oriental Congress would, as stated, be a travelling body, and visit once a year successively the large towns of the provinces, commencing with Manchester, for instance, and taking in due course for its future sittings those centres of manufacturing industry and commerce whose trading interests were associated with those of India. At the provincial meetings of the Oriental Congress subjects would be discussed suitable to the wants and requirements, as regarded India, of the particular manufacturing towns visited. The business of the congress would be to ascertain in what intercommunication between those towns and India could be facilitated and extended. The educational system of the Oriental Congress would embrace the delivery of lectures, and the reading and consideration of papers treating of all branches of knowledge calculated to throw a light upon the material resources of India, and her capacities for the reception of political and social improvement. The papers read would show how the vast and splendid capabilities of our Oriental dominions might be more readily elicited by scientific investigation and commercial activity. The natural history of India would form a leading subject of inquiry and discussion: for the purpose of reducing it to practical adaptations beneficial to trade and commerce. Excluding politics, except indirectly, and religion, the sections of the Oriental Congress would deal with questions of economical science in regard to India. Thus the geological section would take up the subject of mining resources and metallurgy of India. There would be an agricultural section, which would consider questions connected with the development of the products of the soil and the protection of agricultural labour. A biological section, under which medical subjects would come under consideration, with a view to sanitary improvements. A philological section would deal with the Oriental languages and literature, and so on. In conclusion, he expressed a hope that the propositions he had laid before the Society would meet with their favourable consideration, and that an Oriental Congress, or some similar institution, would be adopted for the benefit of India.

Mr. Quaritch expressed his approval of that part of the programme which promised a section for Oriental literature. As one connected for many years with the dissemination of Oriental literature, he saw the advantages to be derived from the encouragement of the study of the languages of India. However, his moral courage sank when he reflected on the apathy manifested by politicians and social reformers in respect to India. It was strange that this should be so, because a much wider intercourse had taken place with the country under the Imperial rule than occurred under that of the East India Company. The East India Company's rule had been a system of middle-class administration, but it possessed merits of its own. The youths of middle-class families, who under the old *regime* filled the services, civil and military, received a form of political and judicial education which rendered them able men for official employment on their return home. But since 1857, the time of the Mutiny, and the subsequent abolition of the East India Company in 1858, the administrative system in India had, he considered, retrograded; and, although the present generation of civilians and officers no doubt performed their duties as conscientiously as any previous generation of officials, still he thought there was not now the same amount of interest felt in the social condition of the people as before. At home the interest in Indian affairs was still less. One of the principal means of facilitating the general prosperity and social advance of the natives of India was, the speaker contended, the encouragement of the study of the native languages. Our acquaintance with the institutions of the country extended with our knowledge of the languages. Had not the famous Oriental scholar, Sir William Jones, opened the way to a knowledge of the colloquial languages by his discoveries of the connexion between the Sanscrit and the vernacular languages—had it not been for the philological studies of other eminent orientalists, the results of which were preserved in the *Asiatic Researches*, the *Bengal Journal*, and other repositories of Oriental literature, our knowledge of the people of India, their religion, history, &c., would have been still in a retarded state. The importance of the encouragement of the study of the language he could not too strongly urge; as of course such knowledge would greatly assist in aiding us in the future civilisation of the natives of India.

Mr. W. S. Fitzwilliam said that every word that had fallen from Mr. Hyde Clarke had his hearty sympathy, and any small ability he had he would gladly devote, as far as he could, to the realisation of the proposed scheme. His experience of India was a long one, and he felt in a peculiar degree how sad was the apathy displayed by the public in England towards Indian affairs.

Mr. W. Maitland was glad to hear of this proposal, and wished every success to Mr. Hyde Clarke and those who were to be associated in this good work. Anything by which a knowledge of India and its affairs could be extended must be of great benefit at once to India and to England; and if there was any country in the world which stood in urgent need of being better known, it was India. It was at once an extraordinary and lamentable fact that so little should yet be known generally in this country about the magnificent empire we possessed in the East, but it was, so far, satisfactory that of late the subject seemed to be exciting much more attention, both among the public at large, and especially in Parliament. He thought this was shown, among other things, by the increased number of newspapers and periodicals devoted to the affairs of India and the East, to the more frequent references to Eastern affairs in the *Times* and other general papers, and to the public meetings which took place in that room and elsewhere. In Parliament, the Indian financial statements were now brought forward at earlier and more convenient periods than before, and to much better audiences, and great interest was being excited by the inquiries made by the Committee of the House on Indian affairs now sitting.

Mr. Dadabhai Naoroji said that, as a native of India, he could not but wish all success to such a proposal as that before the meeting. Anything which tended to promote discussion on Indian matters did good, no matter of what kind it was. The great thing was to get India talked about, and to create an interest in the minds and hearts of the British nation in India. Mr. Naoroji then defended some remarks he had made on a previous occasion as to the condition of India, and concluded by heartily wishing success to the proposed Oriental Congress.

Mr. Ashworth said no one could doubt that if such a proposal as that which had been submitted to them by Mr. Hyde Clarke could be carried out, great benefit would accrue, not only to India but to England. He had helped, years ago, to start some of the efforts made in Manchester with regard to the improvement of Indian cotton, and he was thankful that those efforts had been largely successful. He felt, however, that there were difficulties in the way of a general congress which did not seem to him easily got over. Manchester, for instance, took an interest in cotton, but he questioned if any other subject would find much sympathy there, and he did not think there were a sufficient number of outsiders, so to speak, to create a meeting. Then, again, he did not see how politics and religion were to be kept out of the discussions. The political policy of the home government with regard to India was at the very root of the matter, and no commercial question could be discussed without in some measure an attack on the government policy being made. He did, however, wish success to the proposal if it could be carried out, which he begged leave to say, not from any feeling that it would not be useful, but because it did not seem practicable, he doubted. His own impression was that it would be better to merge such a congress in the annual meetings of the British Association or of the Social Science Association.

The Chairman said he had been unexpectedly asked to preside that evening, but he had done so with great pleasure, because he could not help feeling that some such action as that proposed by Mr. Hyde Clarke was absolutely necessary. It was true that Manchester had worked hard—in her own interests some would say—to induce successive governments to take action with regard to Indian cotton, and the Cotton Supply Association had come to the conclusion that it had virtually done its work; but such being the case, it was all the more important that a larger organisation should force upon the home government various other matters that ought to be considered, bearing as they did upon the well-being of so large a country as that of India. He then alluded to the various questions that had been raised by Mr. Dadabhai Naoroji and others, and concluded by moving a vote of thanks to Mr. Clarke for his valuable paper.

Mr. Fitzwilliam seconded the resolution, which was carried unanimously.

Mr. Hyde Clarke said that what had been said that evening was of a most encouraging character. Many valuable suggestions had been made, which he should carefully consider. It was gratifying to have the support of Mr. Quaritch, the Orientalist, and also of so able an Indian reformer as Mr. Naoroji. The wish had been expressed by more than one member that the Oriental Congress should be associated with the British Association, or the Social Science Association; but he believed that the congress would best carry out its purpose by being an independent body. He proposed, then, first to go to the Society of Arts with his plans, and placing the influential recommendations and support they had already received before the Society, say, "Will you take the Oriental Congress upon its independent basis and merits, or will you allow it to be merged in the British Association, Social Science, or East India Association?" He concluded by stating his conviction that the Oriental Congress, through the influential support it had received, was destined to be soon established.

FOOD COMMITTEE.

The Committee met on Wednesday, the 26th instant; present, Benjamin Shaw, Esq., in the chair, Sir Antonio Brady, Messrs. F. W. Rowsell, J. Youl, W. H. Michael, E. C. Tufnell, E. B. Savile, and E. Jenkins.

Mr. Jenkins reported that he had, as requested at a former meeting of the Committee, communicated with Birmingham and Coventry on the subject of fish consumption in the neighbourhoods of those towns. The secretary of the Birmingham Chamber of Commerce and Exchange had replied to the effect that he had placed the questions before the Chief Clerk of the London and North Western Railway Company's Parcel-office, and that he would endeavour to supply the information. The secretary accompanied this information with the remark, that while butchers'-meat has, within the last twelve years, risen fully 25 per cent. on the retail, and will maintain that price, the supply of fish in the same period has increased 300 per cent. Mr. Streetly, of Coventry, says that the corporate authorities in that city had no available information on the subject, and recommended an application to a large local dealer. Mr. Jenkins stated that he had conversed with the local dealer in question, who said that it was no use carrying fish into the country, as the people would expect it for nothing; the very perishable nature of the commodity rendered it dangerous to take it to any other place than one where the sale would be tolerably certain.

The Committee had before them specimens of meat preserved by a process devised by Mr. Sloggett, of Plymouth, the particulars of which had not been furnished. One of the specimens was cooked.

Mr. Huxtable brought before the Committee specimens of meat preserved in tins by the Victoria Meat Preserving Company.

Some specimens of dried and powdered meat from Queensland were laid before the Committee, and the Secretary was directed to get the same analysed and reported upon.

ANNOUNCEMENTS BY THE COUNCIL.

DINNER.

It having been found impracticable to make the arrangements for the proposed dinner on the

2nd of May, announced in last week's *Journal*, it will not take place.

CONVERSAZIONE.

The annual conversazione of the members will be held on Thursday, June 1st, at the South Kensington Museum. Cards of invitation will be issued in due course.

CANTOR LECTURES.

The second lecture of the course on "Our Food-producing Ruminants, and on the Parasites which reside in them," was delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., on Monday, the 24th inst. These lectures will be continued as follows:—

Lecture III.—Monday, May 1st.

The Ovine Ruminants, especially in relation to the Mortality caused by Trematode Entozoa.

Lecture IV.—Monday, May 8th.

The Cervine, Antilopine, and Cameline Ruminants, with some account of their Parasites.

Lecture V.—Monday, May 15th.

The general question of the Parasitism of Ruminants in relation to Sewage and Public Health.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. (now Sir) W. Fothergill Cooke and Professor (now Sir) Charles Wheatstone, F.R.S., in "recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. (now Sir) Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Council invite members of the Society to forward to the Secretary the names of such men of high distinction as they may think worthy of this honour.

INDIA COMMITTEE.

A Conference will take place on Friday evening, May 5th, on "The Conservation of Indian Fisheries." The opening paper will be read by Lieut.-Col. Haly.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

On Monday next, May 1st, the ceremony of opening the first of the series of Annual International Exhibitions will take place. Her Majesty has appointed His Royal Highness the Prince of Wales and the Princess Christian to represent her on the occasion, and the order of the proceedings will be something like what was given in last week's *Journal*. The official programme has not yet been issued, but when it is a copy will be sent to every person invited to take part in the ceremony.

Among the features of the Exhibition will be a daily newspaper, which will contain a programme of all that goes on in the Exhibition, Horticultural Gardens, and Albert Hall, and be a general directory for visitors.

On Saturday last a large number of working men and their friends attended for the purpose of having the Exhibition, and the buildings in which it will be held, explained to them. Mr. Edward Hall attended, and delivered a short address in the picture gallery of the Royal Albert Hall.

On Monday a meeting with the same object, presided over by Archbishop Manning, was held at the Islington Scientific Institution.

At Rochester, a public meeting was held in the Guildhall on Tuesday last. Mr. J. C. Buckmaster attended, and delivered an address on the objects and scope of the Exhibition.

Iron and Steel.—Mr. Gerhard, metallurgical chemist, of Wolverhampton, is proceeding with his experiments in the manufacture of iron, and he has succeeded in producing from the ore refined iron of a high order, at much under the cost of a similar quality very much sought after by certain machine founders and producers of finished iron. Mr. Gerhard, however, aims at the making of steel at much less cost than any of the methods now in vogue, and he has much confidence that he shall soon succeed. He believes that he can see his way to producing finished iron in a pure state without the interposition of the puddler.

EXHIBITIONS.

THE NAPLES MARITIME EXHIBITION.

The Naples Maritime Exhibition was opened to the public on the 17th inst. The Prince Humbert and Princess Margherita were present at the ceremony of inauguration, which was attended by upwards of 500 persons. After a speech by Signor Imbriani, the Vice-President of the Commission, and by the Minister of Agriculture and Commerce, the exhibition was declared open, amidst a salute of artillery from the forts of Naples and from the guns of the ships in the bay, which were gaily decorated with flags. The classification of the exhibition is as follows:—

Group I.—Naval Construction.—Class 1. Sailing vessels, in wood, or iron, or composite. Class 2. Steam vessels. Class 3. Ships of war, built in government dockyards or by private firms. Class 4. Vessels adapted for river navigation. Class 5. Boats, both row and sailing, and steam launches. Class 6. Models and plans of ancient ships. Class 7. Masts. Class 8. Sails. Class 9. Rigging and equipments.

Group II.—Steam Engines.—Class 10. Marine engines of various systems. Class 11. Machines and tools for working metals, wood, and rope. 12. Large forgings for marine engines, boilers, and propellers. Class 13. Fixed engines, portable engines, locomotives, and weighing machines.

Group III.—Ports and Naval Establishments.—Class 14. Hydraulic works, ports, piers, breakwaters, and lighthouses. Class 15. Naval arsenals. Class 16. Graving and dry docks in masonry, building slips and hauling slips. Details for the execution of submarine works and diving apparatus. Class 17. Floating docks and hydraulic lifts for ships; principal works for naval arsenals, marine hospitals, workshops, rope-walks, &c. Class 18. Mechanical appliances for ports; machinery for masting ships, both fixed and floating.

Group IV.—Timber, Metals, and Combustibles.—Class 19. Various qualities of timber used for shipbuilding; preservation of timber; resins; coopers' work. Class 20. Maps showing mineral strata and deposits of coal; various kinds of fuel, both natural and artificial; compressed fuel, charcoal. Class 21. Mineral; metals in bars, ingots, plates, &c., of various dimensions; tubes, wire, &c. Class 22. Various articles in metal—steam and hand cranes; pumps, anchors, chain-stoppers; mooring-buoys, castings in iron, gun-metal, brass, and other metals for ships' fittings.

Group V.—Various Materials and Articles used for the Rigging and Fitting of Ships.—Class 23. Cotton, linen, hempen, and woollen fabrics, with respective raw materials; sailcloth in cotton or hemp, or of other material; various other fabrics. Class 24. Ropes in hemp, or of other materials; machinery used for making wire ropes; chain cables. Class 25. Fatty and oily matters; stearine candles, oils, tallow, soap; colours, oil, white-lead, &c. Class 26. Articles of india-rubber, gutta-percha, leather, and hides.

Group VI.—Instruments for Navigation, Apparatus for Saving Life at Sea, and Weapons for Mercantile Service.—Class 27. Various instruments for navigation, ships' compass, instruments for nautical astronomy, telescopes, and other optical instruments, chronometers, barometers, &c., maps and charts. Class 28. Life-boats and apparatus, ships' life-boats, life-belts, and other appliances for saving life at shipwrecks. Class 29. Light-houses and coast illuminators, floating lights, fog signals, lamps, signal lights, lamps for signalling, and portable weapons for merchant service.

Group VII.—Ships' Provisions and Seamen's Clothing.—Class 30. Ships' furniture, crockery, carpets, oilcloth, porcelain. Class 31. Substances used as food—biscuits, preserves, salt meat, and other provisions; ice-making machines, machines for distilling sea-water, medical and surgical stores for ships. Class 32. Clothes, boots, bedding, and other articles for seamen.

Group VIII.—Fishery.—Class 33. Fishery of the Mediterranean; river and lake fishery. Class 34. Nets and apparatus used for fishing. Class 35. Apparatus used for the coral fishery in the Mediterranean. Class 36. Pisciculture and aquariums.

Group IX.—Scientific Section.—Class 37. Antiquities relating to naval industry. Class 38. Books on maritime subjects.

Group X.—Principal Articles of Export from Italy.

One of the principal objects of attraction at the exhibition is the monster sea-water aquarium.

The lady visitors seem to favour Group X. with their presence, and the corals exhibited by Pucciani, Barucci, Mazra, and Casalta, attracted universal attention. The inlaid work of Labriola, the cameos of Schiavoni, and a magnificent necklace of pearls, emeralds, and diamonds, of an English jeweller (Phillips) are worthy of special praise. The porcelains of the Marquis of Genoa, which will be remembered by visitors to the Paris Exhibition in 1867, still retain their reputation, and are one of the sights of the exhibition.

Venice still retains her ancient renown in the art of glass-blowing, and the exhibits of Dr. Salviati and Signor Bassano bear the palm for the great delicacy, clearness, and variety of form and colour of their productions. The mirrors and chandeliers, ornamented with leaves and flowers, are exceedingly beautiful.

Signor Izzo's display of firearms is also worthy of inspection, as also a model of a mitrailleuse and breech-loading gun made by the late Biagio Ignesti, the first in 1816, and the second in 1831.

Signor Bonifacio, the well-known shipbuilder of Castellamare, exhibits a model of a composite ship, of 1,700 tons, named the *Principessa Margherite*, which he is now building for the Eastern trade.

The models of the galleys of the Venetian Republic and that of Genoa recal the time when Italy was the first maritime power in the world. One of these is a model of a galley of the seventeenth century, built at Venice, with three masts, three lateen sails, and 49 oars, and intended to be manned by a crew of 700 men and 36 guns. There is also a model of a motor boat of the fourteenth century. Five other models, showing the progress of naval architecture, from 1829 to 1870, are well worthy of attention.

In Class 9 there are two very interesting antiquities relating to navigation. The first is a stone representing in bas-nitro two war-galleys without masts, the rowers being protected by soldiers with shields, and armed with lances. The second is a cast in terra-cotta representing the ship with Ulysses *en route* for Italy, who, arriving at the island of Capri, is invited on shore by the sea nymphs. The first was found at Cuma, in 1858, and the latter near the theatre of ancient Capri, in 1851, and are exhibited by the Chevalier Gennaro Riccio, a well-known archæologist and numismatist, who has also a splendid collection of engraved stones, ancient Grecian and Roman coins, in gold, silver, and bronze, and also other antiquities.

The price of admission is fixed at two francs. The Southern Railway Company have made a reduction of 40 per cent. in the price of return tickets, available for 10 days from Bologna, Ancona, and other towns, to Naples.

Two regattas are announced to be held in the bay of Naples during the month of May.

Jersey Exhibition.—Active preparations are being made in Jersey for a grand exhibition of Channel Islands manufactures, natural products, and works of art, to be held in that island in June next. Though chiefly for the display of specimens of the islands' produce, it is not to be confined to the islanders, but will be open to English exhibitors, with the restriction that imported articles of manufacture are not to be allowed to compete with *boná-fide* island manufacture. A prominent feature will be a grand display of the cattle for which the islands are so greatly renowned.

THE ENDOWED SCHOOLS COMMISSION AND EMANUEL HOSPITAL.

It was only to be expected that when this Commission got fairly to work, and began to exercise the very large powers confided to it, considerable opposition would be provoked on the part of those specially interested in the endowments affected by it. This has been the case, as is well-known, in reference to the Bristol endowed school and elsewhere, but the most formidable attack upon the proceedings of the Commission has been provoked by its action in reference to Emanuel Hospital.

It may be briefly stated that there are four foundations in Westminster—Emanuel Hospital, with a net income of £2,000; Green-coat Hospital, with £740, and £840 in immediate prospect; Palmer's School, with £1,000; and Hill's School, with £200—total, £3,940 present income. About £600 or £700 of this has been accumulating, so that the total amount available is about £3,300 a year. The present results of this sum of money are these:—Boys maintained, clothed, and educated in Emanuel Hospital, 64; in Green-coat Hospital, 28 — total, 92. Boys supplied with outer clothing and educated in Palmer's School, 20; in Hill's school, 35. Grand total, 147. Thus Emanuel Hospital does actually support only 64 boys. The scheme of the Commissioners is to unite these endowments, and extend the advantages of them. Under the proposed plan there will be 150 boys educated freely, 150 half-freely, and 600 with a part remission of payments. The amount available for free tuition and exhibitions is to be divided equally; one-third is to be given between boys of the elementary schools of St. Margaret's and St. John's, one-third to orphans; and one-third is to be open to general competition.

In opposition to these proposals, a public meeting was held at the Mansion-house on Friday last, the Lord Mayor in the chair, when a resolution proposed by Lord Buckhurst, and seconded by Mr. R. W. Crawford, M.P., was passed, to the effect that "the threatened confiscation of the property of Emanuel Hospital, and the extinction of that and other endowed school charities, upon the principle pronounced by the Endowed Schools Commissioners, that 'there shall be no gratuitous education, except as the reward of merit,' is a measure which this meeting emphatically condemns, not only as a violation of the rights of property, but as tending to obstruct the working of the great scheme of national education, and as being at once untenable and pernicious." Other resolutions, proposed and supported by Lord George Hamilton, Sir J. C. Lawrence, Bart., Mr. W. H. Smith, M.P., and other influential men, were also passed, especially complaining of "the proposed abrogation of the charter of Emanuel Hospital, the obliteration of the very name of the charity, the removal of its governing body, and the contemplated diversion of the design of Lady Dacre, its benevolent foundress, as being a measure calculated to destroy the sources of charity, and to establish a precedent for the annihilation of some of our noblest charitable institutions."

On Monday evening, the subject was brought under the notice of the House of Lords by the Marquis of Salisbury, who contended that the Commissioners had acted capriciously, had unnecessarily disturbed the arrangements prescribed by Lady Dacre, the foundress, and had installed an inefficient body of management in the place of the Corporation of London. He contested the soundness of the principle laid down by the Commissioners, that there should be no gratuitous education except as the reward of merit, and condemned the system of competitive examination for children between seven and thirteen as giving an undue advantage to the rich over the poor. This was not an isolated case. From all parts of the country complaints had reached him that the poor, who had hitherto benefited by these endowments, were to be driven out by the new principle of competitive examination.

The scheme of the Commission was defended by Lord Halifax, and especially by Lord Lyttelton, the chairman, who said that the principle adopted by the Commission was that merit, and not nomination, favour, or poverty should be the test, and, as to the competitive examination, it was in the simplest possible subjects. Instead of 147 now in the school, the consolidation scheme of the Commissioners would provide education for 900. One-third of the scholarships would be confined to children who might come up from the primary schools, and another third would, as an exceptional condition, be reserved for orphans. The education of the upper classes was provided by the Public Schools, and that of the lower classes by the Education Act of last session. Nothing had, however, been done for the great middle class, and the present action of the Commission would have the effect of giving them the lion's share of the benefit of the endowments intended for them.* He asked the House to suspend their judgment upon the statement issued by the Corporation until the reply of the Commissioners could be issued. The Bishop of Exeter said that the evidence obtained by the Commission of Inquiry into Endowed Schools as to gratuitous education satisfied them that the wisest use of endowments, in the interest of the poor themselves, was to give them for the encouragement of merit, which meant the promotion of higher education. It was for the benefit of the poor that there should be middle-class schools, and that their children should have access to them; and he, for one, would have been well content if all these endowments were converted into scholarships for the primary schools established under the Education Act.

Everyone must rejoice that the main principles upon which the action of the Commission is founded have been so far fully discussed, especially the fundamental one that there shall be no gratuitous education in the endowed schools, except as the reward of merit. Upon this the *Times* says:—"We can understand that to many people this may seem pedantic in the extreme. They will say it is the examination system run mad; that it is bad enough to dig up the seed continually to see whether it is growing, but that this is to search for a sprouting seed when in the nature of things none can have been sown. This criticism, however, is set aside by a very brief consideration of what is actually passing. The Endowed Schools Act must be taken in connexion not only with former legislation respecting the universities and the leading public schools, which represent the apex of national instruction, but with the Act of last session on the elementary schools, which are its base. In the system which the Legislature has established, and in conformity with which we must direct our efforts, every child throughout the country is to receive primary instruction. To provide this is the duty of the ratepayers, and large sums will be granted in aid of it from the Consolidated Fund. Private zeal and benevolence will supplement these grants, as they have done heretofore. It may be assumed, then, that the primary education of the country is provided for, and it remains to consider how, in this case, the endowments which come under the operation of the Endowed Schools Act can best be utilised. The Commissioners are of opinion, and we decidedly agree with them, that the best use to which they can be put is to furnish an education of a grade above that which rates, and grants, and voluntary contributions give to the children of the poor. How is this to be done with fairness to all and advantage to the country? Obviously, by taking the most promising boys and girls, and teaching them something more than is necessary for those whom nature has plainly destined never to rise above the rank they were born in."

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* In a letter to the *Times*, Lord Lyttelton says that it would be more correct to say that 'it will be 'to furnish an education of a grade above that which rates, and grants, and voluntary contributions give to the poor.' That education is inevitably mostly for the middle class, taken in a somewhat wide sense. But there is no exclusion, and by our measures we hope to see it largely shared in by the best, the ablest, the most industrious of the labouring class."

CORRESPONDENCE.

THE PRINCE CONSORT MEMORIAL IN HYDE-PARK.

Sir,—There can be no doubt, whatever may be the amount of stability existing in the memorial at present, that this would be much increased by the introduction of a central shaft of support, which, if it be clothed with architectural grace and skill, there is no chance of its presenting the appearance of an afterthought, as it would be strictly in symmetry with the surrounding structure, and from its being so evidently conducive to its permanence. That a square baldacchino, or tabernacle, supported on four clusters of columns, is peculiarly unsuited to the display of a central figure, is evident from the fact of these columns on either angle of the front, necessarily obstructing the best—the three-quarter-views of any central statue. On the other hand, in the event of the central figure being abandoned, and a central support substituted, with niches for the quadruple treatment of the statue—which arrangement finds so apt a precedent in the Queen Eleanor crosses—the case with respect to these columns would be quite altered. Instead of being in the way, they would be of service. As the central core of support would occupy a considerable portion of the space at present covered by the central statue, each of the four standing statues of the Prince backing against this would be so far in advance of the centre each way that the columns would no longer obstruct the three-quarter views, while also, under these changed circumstances, the clusters of columns would prevent more than one statue being seen at a time, thereby producing unity of effect. As shrines also are properly free in the centre so as to leave space for the central image, if this central space be solidified, it in degree relieves the memorial from this character, which has given rise to comment.

And then as to the art-presentation of the Prince himself. He was so good, and noble, and intellectual, and beneficent, that it might be alleged that in a great national memorial his presentation should scarcely be left to the mercy of one statue. In a certain sense, the Prince may be said to have been "all things to all men," and it might be added that, in degree, the different aspects in which he appeared on the world's stage were due to the different pursuits, qualities, and industries of those who approached him. Those who did so knew how well-informed he was by natural ability and by study on every worthy subject of interest; and often would those who were received by him remark, after their interview, that he was informed better on their several departments of art, or of industry, or of public or beneficent questions than they themselves who had made them a life-study. He turned his back on no subject; and so it should be in the memorial. No department of human interest absorbed the Prince to the exclusion of, or interfered with, his attention to other departments. And so in respect to the statues of the four principal phases of his noble character, they would not interfere with each other in the memorial, as but one could be seen at a time; while, on the other hand, the presentation of the Prince would thus not only be true to the fulness of his nature, but would be in accordance with the four-square character of the memorial, with its equally-elaborated fronts, and with the subjects of the various enhancements of art by which it is surrounded.—I am, &c., Epsilon.

April 24th, 1871.

MILITARY AND INDUSTRIAL QUARTERS IN INDIA.

Sir,—The question of placing English troops in the hills is more than a military question. If the unhappy men doomed to Peshawur, or the Valley of Death, were sent to the Cherat hills, as urged by "Sentinel" (p. 477), not only would the military purposes be served, but the men would be able to occupy themselves in workshops in a healthy climate. Thus, not only would the men acquire a useful occupation and wholesome exercise, to the improvement of discipline, but some would learn trades, so as to enable them to remain in the hills as tradesmen, foremen, and overseers, while others would teach their trades for the improvement of native workmen. There is a fashion in India of purposely mistaking the colonisation question by pretending to confuse it with the importation of English agricultural labourers to compete in the burning plains with natives at two or four rupees per month. Real colonisation, as real as that in many of our possessions, is going on in Darjeeling, Assam, and along the whole Himalayan and sub-Himalayan border. Military efficiency and industrial progress are bound up together.—I am, &c., Hyde Clarke.

OUR STANDARDS MENACED.

Sir,—The letter from Mr. J. A. Franklin, under the above heading, in your impression of March 31st, teems with mistaken premises and conclusions. I must request your permission to make a few remarks on each of the paragraphs it contains.

1. Against the Bill introduced into Parliament in this session, by the hon. member for Stockport, to establish the metric system of weights and measures, Mr. Franklin indulges in invectives, as "a Bill for rendering penal the employment in Great Britain of any other than French measures." And he goes on to speak of the advocates of the Bill as "indomitable levellers, enlisted for the promotion of a revolutionary Bill." A more unhappy indictment can scarcely be conceived. Whatever is good in itself is unaffected in its goodness by the irrelevant circumstance of the country whence it may have have sprung. It so happens, however, that the origin of the metric system was distinctly attended by international invitation and concert. Moreover, it is not only amongst our forty millions of French neighbours that its use is obligatory, and its disuse penal, by statute; but it is so also amongst some 100 or 110 millions of souls of other nationalities, European and American. To these will very shortly be added forty to fifty millions of Germans, as the metric system will become obligatory amongst them from the 1st of January next. The vast populations of British Asia will soon be subject to the same *régime*. The United States are anxious to adopt the system, and so, too, are the Scandivanian nations. Mr. Franklin declaims against coercive legislation. Who ever got any good out of permissive legislation? Is not coercion the handmaid of law and order?

Mr. Franklin then goes on to insinuate that we, "amiable propagandists of communism in matters of weight, measure, value," &c., would receive a check if Sir William Brown and Professor de Morgan, whose deaths many of us regret, were alive to come to the rescue of the standards. This is a great mistake. Sir William Brown told me himself that the objections on international coinage he had urged in a now by-gone letter, written in December, 1858, to the then President of the Liverpool Chamber of Commerce, were simply based on the *then* existing difficulty of getting Americans, and Englishmen and other Europeans, to agree effectually as to an international system of coinage. But, since Sir W. Brown's time the question has made strides of great importance, difficulties have vanished, and now upwards of 130 millions of the Latin, Teutonic, and Slavonic races have already agreed to an international coinage, and use it to their great advantage. Sir William Brown, like Cobden, was a man who could appreciate the advantages to trade of the extension of such a system to the British Empire, home and colonial. Now, as to Professor de Morgan. Although, in the last few years of his life, he had given up all active movement in matters relating to coinage, I only know that whenever I had opportunities of learning his opinion upon international coinage, he was decidedly friendly to it. The pound, brought to the level of 25 francs exactly, as *one* of the international units, was no bugbear to him. And I need scarcely tell your readers that the Paris Monetary Convention of December, 1865, which Austria, Hungary, and Spain have just actually joined (notwithstanding the revolution), does not exclude the pound—made equal to 25 francs, 25 pesetas, 5 dollars, or ½ eagle—but warmly welcomes it as one of the leading coins and multiples of 5 francs.

2. Mr. Franklin reiterates a complaint of "tumultuous forces arrayed in opposition to him," when he read a paper last year to the Society of Arts (*vide Journal* 913, p. 589). All I can say is, that I attended, and spoke as was my right as a member of the Society, and that I neither knew nor heard of any array or opposition, and believe it to be purely imaginary. And I recollect that nearly everyone differed from Mr. Franklin, as appears from the report. Of course, he may have been right, and we others wrong, in argument. That your readers may decide from the report above quoted. But that there was any tumult—which would imply discourtesy—I expressly contradict. We had too experienced a chairman on the occasion, in Sir David Salomons, to have allowed anything of the kind.

3. Mr. Franklin takes occasion to import into the discussion some remarks upon what took place at a meeting elsewhere—the Statistical Society—in February last, and upon "his gratification at finding his quondam antagonists occupied in exposing each other's heresies." As our meetings at that society are not reported, I may explain that we are not there in the habit of considering our discussions upon difficult points of political economy as exposures of heresies. My friend, Mr. Seyd, and Colonel Tomline, M.P., both entertain strong views upon the policy of our reverting in England to a double standard of free silver and gold coinage. The opinions of these gentlemen have been widely published. I need hardly say that I differ from those opinions, and I took occasion to explain why, and on what grounds of past and present historical teaching and experience. But Mr. Franklin is quite wrong in his conclusion that when I praised the English single gold standard as long having been "the envy of other nations," I abandoned "the device of clipping the coin," as Mr. Franklin calls the plan of seignorage. My observations were distinctly to the contrary effect, and that I fully held to what I had previously said, at home and abroad, as to the plan of a seignorage being in every way desirable, and that the United States had again, in the past year, re-affirmed the principle of making such a charge. It is alike called for to meet the expense of first coinage, and as a sustentation fund for keeping up the integrity of recoinages at the expense of the nation, according to calculations on international coinage which I have given at length to the Paris Commission of 1870.

4. Mr. Franklin makes a perhaps unconscious pun when he says that "questions of weight ought not to be treated with levity." I suppose that is why he makes such a ponderous inuendo against foreign nations, as teaching us a lesson that "we should eschew conventions with other people, who are apt to take *ex-parte* views of the length, depth, area, weight, and value of international standards." Probably Mr. Franklin still makes politico-economical capital of the poor ex-Papal government at its wit's end, having turned a few scudi by putting into circulation a larger number of silver-token francs than he was authorised to issue by treaty. This was purely an exceptional occurrence, and reacted on the heads of its contrivers, even spiritually, for I heard a *devote* old woman denounce the Pope as "*un grand voleur*" for what she called the light francs he had issued. But we must not treat these heavy matters with levity. We may, however, recollect that, after all, a good pair of scales, such as most bankers and changers keep, will act as a sovereign remedy against clipped coin under legal tender weight. And I may take heart of grace when I perceive that the present most efficient and able Deputy-Master of the Mint (Mr. Fremantle) not only thinks highly of the organisation and trustworthiness of the foreign mints as the result of his personal inspection, but expresses, in his report to Parliament just issued (*vide* page 23, Report, c. 103, 1871), just the same views upon the advantages and desirableness of international coinage as I have done in my less prominent position.

A few words, in conclusion, upon the Bill on the metric system, with which Mr. Franklin suddenly finds out we are "menaced" as if it were a surprise, instead of being a shell with a very long fusee. It is but the textual repetition of the Compulsory Bill, carried at its second reading, in 1863, by 110 to 75; in 1865, by 90 to 52; in 1868, by 217 to 65, *i.e.*, by a majority of 152. The number of years after which the penal clauses are to take effect is left blank. The Bill is to be read a second time on the 18th of the present month, and has on its back the endorsement of influential names, as men acquainted with the wants of commerce and agriculture, viz., Messrs. J. B. Smith, Sir Charles Adderley, Sir Thomas Bazley, Mr. Graves, Mr. Baines, Mr. Albert Pell, Mr. Muntz, and Mr. Dalglish. And this may be some guarantee to the Society of Arts, *pace* Mr. Franklin, that the Bill is not so communistic as his letter would have it inferred. Besides which, the measure has, on the present occasion, not only the support as before of the chambers of commerce, but also that of the agricultural chambers, the Farmers' Club, and of other influential sections of the community, administrative, educational, and scientific. Even if its parliamentary success be not secured in the present session by actually becoming law, it is simply a question of time. In the meanwhile, the rising generation of school children will be trained as friends of the movement, the new code of regulations of the Privy Council desiring that in all schools the children in standards 5 and 6 of arithmetic should know the principles of the metric system. The matter has, in point of fact, been debated so long that the public mind may be said to be ripe for the change, and if an Act were now passed to render the adoption of the system obligatory after three years from its date, there would soon be an end to the trouble of teachers having to expound, and scholars to comprehend, two distinct and discordant systems of weights and measures. Thus we should realise what De Morgan wrote, and what Sir William Brown quoted from him, in 1858, that a decimal system being adopted, one-half, or even four-fifths, of the time now occupied in teaching arithmetic would be saved, and left for the pursuit of other studies. The advantage is self-evident, plain to the humblest capacity, but yet Mr. Franklin, although the 13 years that have passed since 1858 have led to an immense extension of the metric system over the whole world, would have us plod on, perhaps decimalise our present inconvenient and discordant measures and weights, render confusion worse confounded, and wait till noon to find that the sun is up.—I am, &c.,

Fredk. Hendriks.

Palace-gardens-terrace, Kensington,
April 5th, 1871.

BENEFICENCE AND "PROFIT."

Sir,—In the discussion upon Dr. Stallard's paper "On the Economical Construction of Workmen's Dwellings, &c.," read before the Society on the 19th inst., a charge was brought against him, and most unreasonably, as it seemed to me, of "sneering" at the philanthropic element in such undertakings. The objector himself, going on to express no small contempt for any such thing as "profit," characteristically fell back upon that convenient abstraction, "the State," and further pointed out the deposits in the savings-banks as a fund which government ought to apply to such building purposes. I know nothing of the objector's opinions, and should be sorry to judge of them from a short and casual speech, but, to say the least, this kind of disparagement of work done for ordinary pecuniary profit, and the readiness to throw off such onerous duties on "the State" lie so close to very seductive and pernicious fallacies, that I shall, with your permission, endeavour to clear away some misapprehensions which embarrass this most important question.

In the first place, what meaning is there in the proposal that the State should lend the money of the depositors in the savings-banks to build houses for the working classes? The State, we know, has come under an obligation to pay to these depositors a certain stipulated interest. It now uses the money deposited with it in discharging other obligations for which it is equally responsible, whether for telegraph works or any other purpose. It is quite beside the mark to inquire here whether these obligations have been wisely entered into or not. They have been, as a matter of fact, accepted by the nation, and in thus setting one obligation against another, the government does not extend the sphere of its liabilities at all. It is, indeed, idle to talk of one special sum of money more than another, out of the aggregate paid into the public treasury, as being appropriated to any special purpose. The money is like milk in a pail, so many quarts may be for one person, and so many for another. Enough must be put in to meet the total quantity that has to be given out, but no one quart more than any other can be said to be set aside for any particular customer. So with the savings-banks deposits. It is never suggested that the depositors should take any personal charge of building these lodging-houses, directly or indirectly; it is never supposed that they should take any responsibility in the matter; they would, in fact, have nothing whatever to do with it in any conceivable way; and there is, therefore, no meaning in intruding a mere technicality of book-keeping transfers—all very proper and necessary in their right place—into the consideration of a totally different question.

This question is, whether "the State" should enter upon a totally new work, entailing new obligations altogether; whether in other words, it should undertake to become a house builder on an indefinitely large scale, and so, it seems to be supposed, save the "profit" which would otherwise go to the builder? Here we get hold of a most pernicious fallacy,—a fallacy which, more than any one other cause, has wrought, and is working, such direful evil in France. There is a sort of vague notion prevalent, mystifying men's conceptions of the inexorable "laws of nature," and of what is and what is not within the limits of practicability, that mere "capital" and irresponsible labour, in some sort of miraculous way, will of themselves produce dwellings, or any other organised product of industry that may be required. No one would be likely, perhaps, to put this fallacy in exact terms. Like many other fallacies, exercising a most pernicious effect on society, it disappears whenever a clear statement of its discordant and disconnected parts is once apprehended. But, nevertheless, the fact that a "mind" is required to ordinate "matter," that there must be an organising brain to regulate and give utility to the work of the hand, is a truth very frequently altogether ignored in the discussion of social questions. No doubt government would not in terms make a charge for "profit," but how would it have to set about the work suggested? It would have to get a staff of men competent to do the work of contractors and master-builders (unless, indeed, it gave out the work to contractors, who would directly get a profit), and some one or more of a yet higher capacity capable of discriminating between conflicting proposals, and coming to some decision upon their respective merits. These men must be under the control and discipline of government, and a service under such conditions is not likely to be gratuitous; and, if service is paid for at all, ill-paid service would probably be bad and expensive service. The work of builders, contractors, and supervisors must equally be done and equally be paid for in any case, only the remuneration is in the form of a salary instead of in that of a profit—the form first-named, be it noted, certainly carrying with it a less unqualified responsibility.

Some misconception may arise from the double sense in which the term profit is commonly used. Speaking of capital, and labour, and "profit" in the abstract, there is no doubt, indeed, that all excess of production over consumption is profit, and this profit goes to the increase of capital. In this sense, a man who gets high wages, and only requires to spend a part of them, may very easily secure a profit. But we do not mean anything like this when speaking generally of a dealer's profit. This arises from the difference between what he expends for the purchase of materials and the payment of wages on the one hand, and that which he receives for the finished production he has to sell on the other. This profit is what he has to spend, but it by no means follows that it may be more than enough to support his necessary personal expenses, though if it will not afford that much on the average, he of course must give up his business. Profit, in fact, in this context is merely the most convenient and appropriate mode of remunerating the work of those who undertake the control and risk of certain kinds of industrial enterprises. It is service which the mechanic—*qua* mechanic—cannot do, though there is no reason against, but every reason in favour of, the "working man" undertaking any or all of the higher branches of his calling for which he may be qualified, without losing his sympathy with those with whom he may have been previously associated, or his knowledge, gained by practical experience, of the relative value of their share of the common work performed. Whether "profits" are or are not too large as compared with wages is, of course, quite an open question, to be fairly considered on its merits; but certain it is that neither the necessity for nor the cost of this kind of head-work, will be saved by merely changing the mode of remunerating it.

The only sound reason for throwing such work as house-building on the State is the conviction that the government is better able to grapple with the difficulties of the subject than private individuals; surely a very strange and far-fetched conclusion. There is, however, a broad distinction between such work and that which comes within the scope of the proper legislative and administrative functions of a government. To this branch of the subject I will not now refer:—if such work is to be done at all, of course it must be done by the government. But is there any reason to suppose that the constructive part of the work could be done by a government department better than by private exertions, which can be so much more freely moulded and adapted to special circumstances and exceptional difficulties? The evil is indeed so great, the arrears of former shortcomings so heavy, that the utmost possible freedom of operation is desirable. Men cannot be thrown into a trance and put out of the way pending the completion of arrangements for permanently bettering their condition. The pressing need of daily support must be met, but it is not the less true that, simply to relieve distress temporarily, or even to provide permanently for a few taken here and there out of the crowd, is but treating a symptom of a disease, the deeply-planted roots of which are untouched. It is absurd to talk of a want of money; the country, as a whole, is rich to repletion. The alms already given are probably amply sufficient, if properly applied, to do all that money can do, nor can there be any doubt whatever that they would be increased manifold if the public conscience were convinced that further gifts were required to afford a lasting remedy for the evil. The nature of the difficulty is this:—Many of our fellow-creatures are left out of the circle of productive industry, they can find nothing to do, often are able to do pitiously little that is of any use to any other human being. They lie outside the regions in which the innumerable interchanges of services one with another to which civilisation gives rise are constantly going forward. The distribution of alms does not tend to lessen this anomaly, on the contrary, it supports and confirms *pro tanto* a radically faulty adjustment of industry. Where labour of any special kind is an excess—and unskilled labour is, and, till education is more widely diffused, must be, greatly in excess—wages will inevitably tend to the minimum necessary to support life, and when such means of support are supplemented by alms, will further tend to fall below that minimum. It is useless to blame the immediate employers—indeed, except in some cases, which, thank God, are too low for competition, their gains also are kept down to a minimum. It is those for whom the work is done, an indefinable, flcutuating, and irresponsible section of society, who pay too little for the service rendered or commodity purchased; the almsgiver and ratepayer making up the deficiency. The result is simply a state of aggravated disorder; the poorest class are not only not raised or permanently helped, but are artificially placed on the very brink of starvation, and, for the time being, must be saved from it by exceptional and abnormal means. Not the less in such cases as that of lodging-houses, is working to a profit a most necessary rule. It constitutes, in fact, the only criterion by which the real success of such undertakings can be estimated. If houses are made to pay, it is a proof that the inhabitants have been brought, so far, within the wholesome and comparatively safe circle of productive industry; they are self-supporting, and at the worst are not forcing down others to pauperism or starvation by a competition unfair, because carried on under conditions manifestly unequal.

But is beneficence to have no part in such works as these? By no means, though hardly, probably, in the particular mode which has been more specially under consideration. There are exceptional cases of overwhelming disaster, where free gifts bestowed with a liberal hand are as good for the receiver as for the giver. There are and ever will be, in the daily experiences of private life, cases where especially the "left hand should not know what the right hand doeth," or where the trouble falls most fittingly on the family or on the "neighbour." Beyond such cases as these, it may be said generally that, although extreme poverty is a difficulty which has constantly to be met, it is not the radical evil which has to be combatted. It is dis-order, in the widest and most emphatic sense of the word, that must be remedied. Money, judiciously used, may do something, for though a fair working profit must be the criterion of success, it most assuredly is not the inducement which urges philanthropists to enter upon such undertakings, and the course of a building society carried on in a spirit of beneficence may in some ways hasten the remedy of the evils under which the poor are suffering. There is, for example, as Dr. Stallard remarked, no reason why dwellings should not be built in anticipation of, and with the purpose of creating, a demand, which, simply through ignorance and apathy, may be slow to arise. A certain amount of business-like perspicacity and caution is no doubt a matter of prudence and duty, for nothing could be more injurious and short-sighted than to drive natural competition from the field. Or, again, no practical man ever completed a new work without finding out, by the time he got to the end of it, how it might have been better done. A man dependent for his living on his profits is not to be blamed for keeping the results of experience, gained at his own expense, for his own advantage. A philanthropic society need have no reserves of the kind. If a private builder takes advantage of its experiments, and will do honest work, supplying the demand which there may be on fair market terms, so much the better. The good work is virtually done. Practical beneficence has made the first step, which is proverbially so hard to achieve, and may thankfully turn its attention to new fields.

There is one more practical point which I would urge in connexion with building. If there be a real want for houses for a class well above poverty, which it cannot itself supply, but for which there is no reasonable doubt it could pay in the shape of remunerative rents, there are surely some strong reasons for entering upon such an undertaking rather than directly building for a pauperised class, who cannot pay at all. It is certainly somewhat hard entirely to reverse the old maxim, and to refuse "on principle," to help those who can do a great deal to help themselves, and beyond this lie two very practical considerations. 1. This better class certainly cannot occupy new houses without vacating old ones, so that all, down to the lowest, are likely indirectly to share in the benefit. 2. Such a better class of tenants will not only be self-supporting, but in all probability their houses, when tenanted, will become saleable, so that a great and permanent advantage would be afforded by a use of funds for a short time. Not only is the money replaced for future usefulness, but there is a double, though partial, advantage speedily and safely accomplished, and it may well be also that in some cases good gained by such easy steps may in the long run go on faster and better than that accomplished *per saltum*.—I am, &c., R. H.

EDUCATION OF THE BLIND.

Sir,—I fear that in the new scheme of education the provisions as to the blind will only extend to pauper children. Where can be the difficulty? Surely the blind ought not to be excluded from the schools; you may limit the number, but certainly not exclude them. From my experience, I do not think you can mix children with adults in education; it may be a serious evil to the one, and no benefit to the other. In the calculation that there are about thirty thousand blind persons in the United Kingdom, not more than 2,700 out of that number receive partial assistance. The healthiest education for a blind child is one that resembles as closely as possible the natural training of home. A child free from the association of seeing persons and the ordinary discipline of domestic life is in an unnatural position. The advantages obtained by education in our exile schools for the blind is counterbalanced by the disadvantages sustained by severing the blind from the seeing, and thereby weakening the domestic ties. Nearly all the blind who have distinguished themselves by being useful in life to their fellow-men have been educated by the seeing, and under the blessing of home and social influence. It is far better in training and educating the blind to direct than supersede their own exertions. The most serviceable companion for a blind boy is one who can approach his mind by every entrance open to him. The best schools for the blind, and which will produce the most beneficial results, are those that would give the blind boy the companionship of seeing children, sound, healthy, and possessing all the activity and vigour of youthful life. The collecting blind children in separate schools destroys the foundation of a true principle of training and educating them. They require sympathy, domestic and friendly intercourse; they pine for the association of seeing persons and for home and social joys.

One great principle which ought to be impressed upon the real friends of the blind is to adopt measures in their training and education that will enable them to become in every way self-dependent. There may be an impression abroad that the blind are unable to become useful and self-supporting members of society; their true friends deeply regret that anything so illiberal and so erroneous should be thought of for one moment. Give the blind the social rights and domestic privileges of the seeing common to us all, you will cheer and gladden many heavy hearts. There is much difference of opinion as to the best system for instruction by the embossed books. I have my own predilection in favour of Moon's, particularly for learners, yet there are others to the educated and intellectual that are more acceptable. The form of the raised letters is still much agitated which are the best. I have collected some information, and truly glad should I be that the blind may receive some advantage from what myself and others have done for them, by opening some way that they may have the benefit of the education now being extended to all but themselves.

I trust you will excuse my thus troubling you, but I know of no other channel to communicate my desire that something should be done for the blind in the way of education. I venture to hope that if you can in any way help in the matter you will kindly do so.—I am, &c.,

HENRY GREGORY.

Herne-hill, Dulwich, March 28th, 1871.

MEETINGS.

Friendly Society Association.—A morning and an evening meeting of the association will be held at the Society of Arts, May 11th, the Earl of Lichfield, president, in the chair, when papers will be read by Mr. Neison on "The Financial Condition of Friendly Societies;" by Mr. B. T. Williams, on "The State in Connection with the Friendly Society;" and by the Hon. and Rev. Samuel Best, on "The Deposit Principle." Other papers will be read, of which notice will be given. Discussions will be held on each paper.

GENERAL NOTES.

A College of Science for Yorkshire.—At the annual meeting of the Yorkshire Board of Education, held at Leeds, Lord F. Cavendish, M.P., advocated the necessity of establishing a college of science, to which both manufacturers and artisans could send their sons, to learn the laws which regulated the materials it would be their future business to deal with.

Owens College, Manchester.—Miss Brackenbury, of Manchester, has signified her intention to give £10,000 for the establishment of a medical school in connection with the College, being £5,000 for the erection of suitable buildings, and £5,000 by way of endowment for the support of the department. It is suggested that, as the father of Miss Brackenbury was in the medical profession, it would be a graceful recognition for the governors to endow a Brackenbury professor.

A Public Picture Gallery Fund for Birmingham.—A manufacturer of Birmingham, who wishes to be anonymous, desires to appropriate £3.000 towards the maintenance of a public picture-gallery in Birmingham. He hopes that the fund thus commenced may form the nucleus of a much larger fund, which may be the means of providing a free public picture-gallery for Birmingham, not unworthy of the town. The money will be invested in the name of an association, so soon as it shall be incorporated, under the Companies Act; but he desires to leave to the unfettered and absolute discretion of the association the mode of prosecuting the object in view, namely, the promotion, diffusion, and development of a knowledge and love of the fine arts of painting, drawing, etching, engraving, and sculpture, in Birmingham, but not including art-manufactures.

Manchester Society of Architects.—This society, desirous of encouraging architectural pupils in the study of their profession, has recently offered premiums of the value of £5, to be competed for by articled pupils in the offices of Manchester architects. The subject of the drawings to be submitted were set forth in the circular inviting the competition; and in response eleven sets were sent in, many of which were of considerable merit. The Society has awarded the first premium, value £4, to Mr. A. Mattinson, for his design for the side of a dining-room, and a view of Cheadle Church; and the second, of £1, to Mr. B. S. Dean, for a perspective view of a mansion.

Colossal Gilt Images.—It is the practice with the Chinese and Hindoos to gild the images of their gods, sometimes of large size. At present, in the Vatican, there is a colossal gilt statue of Hercules, lately dug up in Rome, but it is very much tarnished. There was also a very large bronze statue of Alexander existing in Rome at the time of Nero, in respect to which, as given in Professor Westmacott's excellent Handbook of Sculpture, a curious anecdote is recorded. "The emperor had it gilt, but found its beauty as a work of art so impaired by this treatment, that he had all the gold scraped off it, and the statue, Pliny says, was preferred in its original state, notwithstanding the marks left by the scraping," which circumstance, the professor adds, in another place, "speaks favourably for the taste of the emperor, who could forego a fancy for the sake of preserving the effect of the sculpture."

Study of German in France.—While nearly all the rest of the world of France is bent upon shutting out Germany and everything German from its sight and knowledge, M. Jules Simon, the Minister of Public Instruction, has exhibited a very different and far more enlightened spirit. He has addressed a circular to the rectors of the University, recommending them, as an imperious necessity, the study of the German language in all the *lycées* of the country, setting forth the argument that if rising generations desire to stem the current of German invasion they must learn to understand German, and thus to comprehend the writings, the acts, and the progress of the German race. This contrasts favourably with the conduct of France in general, who, in trying to shut out Germany from sight, are repeating the fabled act of the foolish bird which, when its head is buried in sand, imagines that its body is hidden from its enemies.

Land Tenure.—An association has been formed for the purpose of promoting reform in land tenure. A programme has been issued, with an explanatory address by Mr. John Stuart Mill. The objects in view, as delineated by the programme, are:—1. To remove all legal and fiscal impediments to the transfer of land. 2. To secure the abolition of the law of primogeniture. 3. To restrict within the narrowest limits the power of tying-up land. 4. To claim for the State all future increase of rent due to increase of population and wealth, allowing, however, owners to have the option of selling to the State, at the market value, at the time when this principle may be adopted by the Legislature. 5. Co-operative agriculture to be developed, by the State purchasing estates, and letting them to co-operative associations. 6. Small cultivators to be encouraged on a similar plan. 7. Crown lands, lands belonging to charitable or other endowments, or to public bodies, to be made available for similar purposes, and no such land to be sold to private individuals. 8. All waste lands to be retained for national uses. 9. The wilder and less profitable portions to be retained in their present picturesque state. 10. To obtain power for the State to take possession (with a view to the preservation) of all natural objects or artificial constructions which are of public interest, due compensation being made to the owners.

Wood Carpet.—The *Scientific American* describes the new wood carpeting which is coming into extensive use in America, as follows:—The fabric is made of slats or more ornamental shapes, glued or cemented upon a cloth backing. The slats or strips of wood are of different colours, and are arranged to produce all the effects of tesselated floors, mosaic work, &c., and being about ¼ in. in thickness, they will wear many years. They are finished in oil, and fit together so tightly that the joints are as perfect as those in inlaid work. The surface thus produced can therefore be scrubbed, washed, and oiled. when needed, precisely like other floors made of ornamental woods, which floors they resemble in all respects when laid.

Coffee-Planting in Ceylon.—Perhaps there is no more remarkable instance of the rapid progress of a staple industry in the colonies than the present enormous production of coffee in the island of Ceylon. Although in some of the Kandian villages there are still coffee-trees which must have been planted during the last century, yet it was only about the year 1823 that coffee plantations were attempted, and not till 1845 that it was developed to any extent. About 140,000 cwt. of coffee was the average export from Ceylon from 1841 to 1846, but in 1865 the shipments had risen to 884,000 cwt., and in the last three years they have exceeded 1,000,000 cwt. In 1849, the quantity of Ceylon coffee shipped was 337,526 cwt., valued at £456,663, of which 210,187 cwt. was plantation coffee, and 127,339 cwt. coffee grown by natives. In 1869, the total export was 1,004,508 cwt., valued at £2,593,996, of which 835,686 cwt. was plantation coffee, and 168,882 native. The average price of plantation coffee in 1849 was, for plantation coffee, 32s. 7½d. per cwt., and for native, 17s. 10d. In 1869, the average price had risen to £2 14s. for plantation, and £2 for native. In 1864, there were 802 coffee establishments in the island; there now 1,017, of which 914 are opened up and worked. The total extent of land in private hands in the 34 coffee districts of the island, is 380,883 acres, of which 176,467 are planted in coffee. Over production need not be dreaded, for at the rate at which the population is increasing, there is ample room not only for the planters of Ceylon, but also for those of India and the Eastern Archipelago.

Gold Mining in Victoria.—On the 31st December last the total number of miners employed in Victoria was 59,247, of whom 44,168 were Europeans, and 15,079 Chinese. The total number of Europeans engaged in alluvial mining was 28,281, and of Chinese 15,015, whilst 15,887 Europeans and 64 Chinese were employed in quartz mining. The number of steam engines employed in winding, pumping, &c., in connection with alluvial mining was 403, of an aggregate horse-power of 9,915. There was also employed in alluvial mining 351 steam puddling machines, 38 buddles, 1,567 horse-puddling machines, 258 whims, 276 whips or pulleys, 19,161 sluices, toms, and sluice-boxes, 12 hydraulic hoses, 867 pumps, 323 water wheels, 269 quicksilver and compound cradles, 608 stamp heads (for crushing cement), and 20 boring machines. There were 711 steam-engines employed in winding, pumping, crushing, &c., in connection with quartz mining, of an aggregate horse-power of 13,572, and that there were also employed in quartz mining 70 crushing machines driven by other power than steam, 6,522 stamp heads for crushing quartz or other vein stuff, 32 buddles, 3 winding, washing, pumping, or other machines moved by water power, 627 whims, 581 whips or pulleys, and 10 boring machines used in blasting. The approximate value of mining plant was £2,128,896. The number of square miles of auriferous ground actually worked upon was 938½, while the number of distinct quartz reefs actually proved to be auriferous was 3,034. The total quantity of gold obtained, as near as could be ascertained from the reports of gold buyers and others, during the quarter, was 371,187 oz. 16 dwt., of which 196,705 oz. 3 dwt. was the produce of alluvial, and 174,480 oz. 13 dwt. of quartz mining. The mining population were settled in the seven districts as follows:—Ballarat, 14,375; Beechworth, 9,184; Sandhurst, 8,994; Maryborough, 12,196; Castlemaine, 8,795; Ararat, 2,708; Gipps Land, 2,995; total, 59,247; and the value of the mining plant used in the various districts was estimated to be—In Ballarat, £565,398; Beechworth, £303,152; Sandhurst, £435,645; Maryborough, £294,305; Castlemaine, £294,305; Ararat, £108,818; Gipps Land, £145,320.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

May 3.—"On the Production of Artificial Cold." By Professor John Gamgee.

May 10.—On "The Application of Steam to Canals." By Geo. Edward Harding, Esq., C.E.

MEETINGS FOR THE ENSUING WEEK.

Mon. .. **SOCIETY OF ARTS, 8.** Cantor Lectures. Dr. T. Spencer Cobbold, F.R.S., "On our Food-producing Ruminants, and the Parasites which reside in them."
Royal United Service Institute, 8½. Messieurs Martini and Hotze, "On the Organization of the Swiss Army."
Society of Engineers, 7½. Discussion on Mr. Baldwin Latham's paper, "The Ventilation of Sewers."
Royal Institution, 2. Monthly Meeting.
Anthropological, 8.
Entomological, 7.
British Architects, 8. Annual Meeting.
Medical, 8. Annual Oration.
Asiatic, 3.
Victoria Institute, 8. Rev. J. H. Titcomb, "On Ethnic Testimonies to the Pentateuch."
Farmers' Club, 5½. Mr. J. J. Mechi, "How to Hire, and how to Let a Farm."
London Institution, 4.

Tues. ...Royal Institution, 3. Mr. W. Pengelley, F.R.S., F.G.S., "On the Geology of Devonshire, especially of the New Red Sandstone System."
Civil Engineers, 8. Mr. Bernhard Samuelson, M.P., M. Inst. C.E., "Description of Two Blast Furnaces erected in 1870, at Newport, near Middlesborough."
Pathological, 8.
Zoological, 9.

Wed. ...**SOCIETY OF ARTS, 8.** Professor John Gamgee, "On the Production of Artificial Cold."
Microscopical, 8. 1. Dr. Maddox, "On the Structure of Lepidopterous Scales bearing on the structure of Lepidocyrtus curvicollis." 2. Mr. B. T. Lowne, "On the foot of Dityscus marginalis."
Royal Society of Literature, 8½.
Obstetrical, 8.

Thurs...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. Mr. R. Meldola, "On the Phenomena of Protective Mimicry, as illustrated by the Lepidoptera of the British Islands."
Chemical, 8. Dr. Voelcker, F.R.S., "On the Productive Powers of Soils in relation to the Loss of Plant Food by Drainage."
Royal Society Club, 6.
Artists and Amateurs, 8.
Royal Institution, 3. Professor Tyndall, LL.D., F.R.S., "On Sound."

Fri.......**SOCIETY OF ARTS, 8.** India Conference. Lieut.-Col. Haly, "On the Conservation of Indian Fisheries."
Geologists' Association, 8.
Royal Institution, 9. Mr. W. R. S. Ralston, "On Russian Folk-Lore."
Archæological Institute, 4.
Royal United Service Institution, 3. Lieut.-Colonel C. C. Chesney, R.E., "Recent Modifications in the Art of War."
Architectural Association, 7½. Mr. E. C. Lee, "Canterbury."

Sat ......Royal Institution, 3. Mr. Joseph Norman Lockyer, F.R.S., "On the Instruments used in Modern Astronomy."
Royal School of Mines, 8. Dr. Spencer Cobbold, F.R.S., "Geology." (Swiney Course.)

Journal of the Society of Arts.

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FRIDAY, MAY 5, 1871.

PROCEEDINGS OF THE SOCIETY.

TWENTY-FIRST ORDINARY MEETING.

Wednesday, May 3rd, 1871; C. W. SIEMENS, Esq., D.C.L., F.R.S., in the chair,

The following candidates were proposed for election as members of the Society:—

Boase, Francis, Mayor of Penzance.
Bridgeman, Greswolde D. Orlando, Tudor-lodge, New-road, Hammersmith, W.
Challis, George Ward, 6, Winterslow-place, Vassall-road, Brixton, S.W.
Moyle, Rev. Vyvyan H., M.A., Normanby-house, Middlesborough, and St. Stephen's and Clergy and Laity Clubs, London.
Salter, Jonathan, 211, Albany-street, Regent's-park, N.W.

The following candidates were balloted for and duly elected members of the Society:—

Clayton, Frederick, M.D., Millbrook-house, Navan, Co. Meath.
Ellerton, John Lodge, 6, Connaught-place, Hyde-park, W.
Fletcher, Banister, 24, Bedford-square, W.C.
Horwitz, Albert, Mus. D., 7, Victoria-road, Holloway, N.
Rae, Robert, 18, Fitzwilliam-road, Clapham, S.W.
Ritchie, Thomas Boldwin, 16, Gresham-street, E.C.
Smith, Frederick William, Sutton-lodge, Hackney.
Taylor, Capt. Robert Francis, 30, Cave's-terrace, Shepherd's-bush, W.
Wade, John Edward, 8, South-parade, Leeds.

The Paper read was—

ON THE ARTIFICIAL PRODUCTION OF COLD.

By Professor John Gamgee.

The methods whereby heat may be economically abstracted from any given agent, the maintenance of the reduced temperature obtained, and the combination of various antiseptic processes with the utilisation of cold in the preservation of meat and other organic substances, have occupied my attention for the past two years.

Prior to my visit to America, in 1868, I was under the impression that it was quite possible to preserve fresh meat in bulk in the warmest climates without the intervention of cold. A prolonged and very mixed experience in Chicago and Texas, where remarkable successes were alternated by signal failures, taught me under what conditions I could not fail to succeed, so far as the preservation of meat was concerned. We require:—1. Air-tight, non-conducting chambers of adequate capacity, the temperature of which is perfectly under control. 2. Ample facilities for rapidly slaughtering animals, which can be at once passed into the cooling chambers and quartered, or divided into more convenient portions for preservation and transportation. 3. Exposure of the meat for a certain number of days to the action of antiseptic gases. 4. Facilities for moderate desiccation by cold currents of air, the water abstracted from the meat being absorbed by a deliquescent salt or condensed in a refrigerator.

Since it has always been my object to preserve meat in a condition fit for the butcher's stall, the preservation had to be conducted in a very careful manner, to avoid an adventitious taste or excessive drying. This necessitates the adoption of special means for the transportation of meat to or from the Antipodes to this country, whereas for the purpose of ordinary Atlantic voyages all that is required is to avoid close packages and favour a slight continual desiccation.

It is my object this evening to lay before you means devised during the past year, which are calculated to complete the task I imposed on myself in the days of the cattle-plague. That we shall soon see the end of the ocean transportation of fat animals destined for slaughter I am satisfied, and, but for the war, we should have had a large importation of dead meat from Eastern Europe during the past winter. To ensure a steady trade all the year round, and especially the trade with countries beyond the line, we must have facilities for maintaining all the characteristics of fresh meat, and the principal of the means to be employed are gaseous or atmospheric currents, at about 40° or 45° Fahr.

Much has been done in the way of devising apparatus for freezing meat, and transporting it in refrigerating railway trucks or ships. It has been with a view to this end that many improvements in ice-making machines have been suggested; and whereas I am satisfied that to freeze meat, and attempt its transportation in a frozen state is a mistake, and commercially impracticable, I am sure that there is a vast and inexhaustible field for the exercise of man's skill and ingenuity, in attempts at moderating the heat of summer here, or the annual high temperature of tropical regions, with a view to check putrefaction in edible substances.

The first freezing-machine I examined with any care was Carré's, in successful operation manufacturing ice for New Orleans. A demand of 40,000 dollars for the right of using a Carré machine in a single Texan province induced me to return home promptly, and study the whole question of the artificial production of cold. On my way back, I had an opportunity of seeing Low's carbonic acid machine, and a ship fitted for the transportation of frozen beef carcases from Texas. On my return to England, I investigated Kirk's air and Siebe's ether machines, and from the comparatively small amount of power required, and the excellent results obtained in Messrs Truman and Hanbury's brewery, I used an ether machine in the course of an extensive series of experiments. In Paris, I have seen Carré's machines, the old ether machines of the Compagnie des Glacières, and Tellier's apparatus for using ammonia or methylic ether We have recently seen and heard much of Windhausen's and Mignot's air-machines.

It is quite impossible for me to enter into the peculiar features and respective merits of each of these machines. I have seen no reason, however, to modify my opinion formed in 1869, that well-constructed air-machines present great advantages where water-power is at hand; that carbonic acid is not a suitable agent to use in ice-making, from the pressure required in working with it; and ammonia possesses properties which cannot fail to restrict its use permanently for this purpose. The manufacturers of air-machines have attempted to prove that volatile liquids were all objectionable, and speak of making ice without chemicals, as if their machines made purer ice than an ether machine. Sulphuric ether is undoubtedly one of the most available liquids ever suggested for the production of cold by volatilisation *in vacuo*; and it has been mainly my aim so to construct refrigerators and condensers as to enable us to do more with ether and liquids allied to it than can be accomplished readily with the air-machine.

I need not enlarge here on the well-known fact that economy in the artificial production of cold depends on economy of fuel. The smaller the power required to drive the machine, the cheaper the ice, or the definite degree of cold produced. The improvement of the steam-engine implies the cheapening of the artificial production of cold; and, given the best motive power, we require the most ready means of transferring the heat of the medium to be cooled to the agent turned into gas or vapour. One pound of anthracite coal yields in burning 14,000 units of heat; and in reducing one pound of water from 72° Fahr. to the condition of ice, we must abstract from it 180 heat units. This is the 80th part of the 14,000 units, so that the heat produced by the combustion of one ton of anthracite coal is equivalent to the congelation of 80 tons of water at 72° Fahr. In practice, it is found that with one ton of coal not more than ten tons of ice can be produced, and this is mainly due to the well-known fact that the steam-engine produces only from one-tenth to one-seventh of the amount of power which would be equivalent to the number of heat units consumed. In order to obtain the largest amount of cold from the consumption of the least amount of fuel, I have searched for the volatile liquids suited to different climates, viz., condensed by a mere flow of water, at the temperature in which this is found in warm latitudes, without using pressure for such condensation; and, moreover, I have searched for liquids with the largest amount of latent heat. The cooling on evaporation does not depend on the volatility of a liquid so much as on the amount of heat abstracted by it in the process of volatilisation. Thus, the light oils off petroleum are very volatile, but their latent heat is low.

If the boiling point of water were low, the latent heat of steam being 536, water would be the best medium to use; and, in fact, we are well acquainted with the production of cold by draughts of air over moistened cloths or the soil, and it is quite easy to freeze water in an apparatus calculated to draw off and condense rapidly the watery vapour. One of the earliest patents for the production of ice artificially refers to the use of the air-pump in evaporating water, and the absorption of the vapour by sulphuric acid. Carré has recently popularised this plan, and, in accordance with it, constructs machines for freezing water in carafes.

The advantages presented by sulphuric ether are, that it boils at 35° C. (95° F.), and the latent heat of its vapour is as high as 91·11. Sometimes it is found difficult to work an ether machine in hot countries, inasmuch as the water is at too high a temperature to condense the ether vapour. A simple expedient suggested by me in the past has been, to start the ether machine by making a saline freezing solution for the condenser to start with, and then utilising part of the cold produced by the refrigerator, in order to work the machine satisfactorily. It is, however, better to be armed with a number of liquids of different boiling points, to suit varying circumstances, and it is not difficult to select one or two with which the more volatile ethers are miscible, and which will elevate the boiling point to the precise degree required.

Thus, methylic alcohol, boiling at 65° C. (136° F.) with a latent heat of vapour of 263·86, is one of the most available agents to be used singly under certain circumstances, or in combination with liquids of a lower boiling point. Acetone is also an agent of the most valuable description for such a purpose; and, in fact, crude wood naphtha, which contains both of these, and is exceedingly cheap, may hereafter be found to play a very important part in working in hot countries.

There are liquids which undoubtedly present advantages considerably over those possessed by sulphuric ether. Thus, the formiate of methyl boils at 36° C. (95° F.), and the latent heat of its vapour is 117·10. The difference in favour of the formiate over sulphuric ether amounts to 26 heat units, or, in other words, the formiate is nearly one-fourth better than common ether for refrigerating purposes. Should the low boiling-point of the formiate of methyl and sulphuric ether militate against their use at times, a substitute is found in the acetate of methyl, which boils at 53°, and has the high latent heat of 110·20 (127° F.), viz., nearly 20 higher than the common ether. Acetate of methyl is infinitely superior to common ether in tropical regions.

Another agent may be used as an ether substitute, viz., bisulphide of carbon, which boils at 47·9 (118° F.), and the latent heat of which, in the state of vapour, is 86·67. On the whole, it must strike every one that the methyl compounds are exceedingly available.

With the new compounds mentioned, a vast field is opened for experiment with mixtures and combinations, and the manufacturers of ether machines may distance all competitors in their operations.

I have aimed at the construction of a machine calculated to ensure the most prompt and complete transference of the heat from the air, gas, or liquid to be cooled to the volatile medium, and in doing so have planned compound tubular refrigerators and condensers, which can be easily put together or taken to pieces, and the expense in the manufacture of which could never be excessive. The main point is the insertion of one tube within a larger tube, the liquid being volatilised in the annular space between the two tubes, whereas the medium to be cooled would be within the inner tube and outside the outer one. This form of refrigerator affords very ample conducting surface within a small space, and presents the great advantage of enabling us, if necessary, to cool two agents at a time, such as air or gas passed through the central tubes, and water or brine outside the larger ones.

I have often thought that the piston-pumps in use might advantageously be superseded by well-made rotary pumps, and Messrs. Appleby are now affording me opportunities for the complete trial of Behren's pump in connection with one of my machines.

There are many plans in practice for the utilisation of of cold; and of late years the brewers have not only given an impetus to the manufacture of ice-making machines, but to many improvements in the construction of attemperators or coolers, which are used to reduce the temperature of the worts. Messrs. Morton, Pontifex, Ashby, Lawrence, Baudelot, Stirll, Heath, Riley, Dix, Gregory and Haynes, and others, are competitors for honours in this important industry, and the variety of refrigerators patented and made is so great that it seems impossible to devise anything newer or better than has already been adopted.

In my meat-preserving process, I have had to cool gas coming from a charcoal furnace, in addition to cooling the meat, and I have been much troubled by the advice of engineers, which, in deference to their professional knowledge, I have followed to my cost. The plan recommended to me first was to pump over a metal roof a thin layer of cold brine, coming from the refrigerator of an ether machine. The chambers were made of concrete and wood. With only the lower surface of a thin layer of brine on an iron roof, it was impossible to obtain any marked lowering of the temperature of the chamber. Rooms have at times been provided with pipes, on the same system as that adopted for heating by steam, but the transmission of heat from the surface of steam pipes is a rapid process in virtue of the expansion and prompt circulation of the heated air; whereas, with pipes in which salt water is flowing at freezing point, the cold air adheres to the metal, circulation is checked, and it is extremely difficult to bring down the general temperature of the room.

Preserving chambers have been made in America, and have been in constant use, with iron roofs, and an ice store over the roof. The descent of cold air brings the temperature of the chamber down, and with the aid of chloride of calcium to dry the cold air, and sometimes the direct introduction of a mixture of ice and salt in the rooms, I have seen salmon frozen quite solid. In meat packeries, cellars of great extent, with iron roofs which form the floor of a huge ice house, exist, and immense stores of bacon may be seen there during the entire summer.

In some countries it may be found most profitable for us to use natural ice; but considering the expense of storage, and the fact that very low temperatures are never desirable in meat preservation, the use of freezing machines must become very general, even where ice is no rarity.

With the aid of an air-machine, which sets free a large volume of expanding air at every stroke of the piston, it is a simple matter to cool chambers of any size, and it is not difficult to cool any number of bullocks daily by this process in the hottest countries. But beyond the first operation of bringing meat down from blood heat to 40° or 50° Fahr., the direct currents of cold air cannot be utilised. When chambers are charged with meat in the process of being preserved, they contain the gases produced by the combustion of charcoal, and these gases can readily be withdrawn by a blower, and passed round into the chamber again through the tubes of a refrigerator. A low temperature during the whole time the meat is in the chamber is not necessary, but the meat retains a fresher and more marketable aspect if not kept long in a warm medium; and for this reason I have the metal box of my refrigerator containing a definite amount of cold brine, amounting to 20 gallons for every 1,000 pounds of meat preserved, fixed beneath the roof of the chamber. Whenever we require it, the gases may be blown round and round through the pipes traversing my refrigator, and in this way the desired temperature may at all times be ensured.

It is this perfect control over the condition of a perfectly closed chamber which is important in meat preservation, and with a well-constructed machine, and probably a rotary engine, it is quite an easy matter to maintain the hold of a ship packed with meat at a temperature slightly above freezing point, so as to ensure that meat, very mildly preserved and fit for any table, should be delivered, with all its freshness and plumpness, from South America and Australia.

Such experiments demand much capital and favourable opportunities, and until the two combine we must rest satisfied with operations nearer home; but our condition as to food supplies is getting more urgent daily, and the Australian colonists are more and more in earnest as to the disposal of their stock. It shall not be from want of persistent effort and careful study of the whole subject that they shall fail, so far as I am concerned. The lesson I have learned in the past is, not to proceed by fits and starts, and with imperfect appliances, and for this reason I have taken advantage of complete suspension of my work abroad during the war, to perfect arrangements for the transportation of fresh meat over long distances.

The production of cold is one thing, and its conservation quite another. The enterprising company formed to supply the Paris cafés with *carafes frappées*—carafes in which water is frozen—never paid until means were adopted for economising effectually the cold produced. Ice-making machines are of special value in hot countries, because the cold is produced when and where it is required, and the right temperature can be obtained without useless expenditure. Brewers, for example, like meat preservers, do not need ice; they need their liquor at a temperature considerably above that of ice. They do not aim at the conservation of cold, inasmuch as they use their water as fast as it is pumped through the refrigerator.

But for many purposes the construction of non-conducting chambers is of the greatest importance. In dealing with this subject, the remarks I have to make refer mainly to meat-curing establishments; but there are many purposes for which cold rooms can be used. In chemical and manufacturing processes the possibility of obtaining a regular and definite temperature all the year round, and arresting the summer heat, is a great desideratum. I know a large glue factory in America, one of the largest in the world, where, whenever the glue in summer begins to turn, it is transferred promptly, but at great cost and inconvenience, into chambers connected with ice houses. The main point in constructing a good cooling room is its complete isolation. An underground cellar is usually favourable for producing cold which is artificially generated within it.

It is well known that the temperature six feet below the surface of the earth in any country is the same as the mean annual temperature above ground. In some parts of the world, as in Western America, the thermometric range is enormous; and whereas in winter the thermometer is far below freezing-point, in summer the heat is unbearable.* It is a great advantage under such circumstances to know exactly the work to be done, winter and summer, without deviation, and therefore underground chambers are most convenient. The depth should not be more than a few feet from the surface, and it is best to have a somewhat circuitous entrance by an underground gallery, guarded at both ends with well-fitting double doors.

A good non-conducting room must be dry, and may be built of brick, stone, or wood. The most perfect non-conducting chamber I can suggest must be built of stone or brick, with an inner surface of compressed coal-bricks, and within this, for cleanliness and even more perfect isolation, wooden boards.

With simple wood and concrete, I have found it very difficult in summer to reduce the temperature economically, and especially with the imperfect metal roof arrangements before mentioned. Thus, with brine at 20° Fahr., I could not, with several hours' cooling, bring the temperature of a room twelve feet long by seven feet high and three feet wide, down to within 14° of the temperature of the brine, and all this was due to the imperfect utilisation and retention of the cold.

Wood, being a good non-conductor, can of course be used with great advantage in building chambers, whether over or under ground, but it is difficult in hot countries to build heat-proof houses of wood. The walls have to be double, and the interspaces filled in with straw, sawdust, charcoal, or other light and porous non-conductor, and I have used cheap kinds of felt; but wet interferes much with the result, and in preserving meat dampness is unavoidable. Skins, wool, and hair, have been employed in ships intended to carry frozen meat in the hold, the non-conducting material being placed between well-made wooden walls, and the inner planking being well corked. The barks of certain trees, some reeds, and cork, or even cork-dust, are lighter and better than any felt or animal product that I have ever seen used, and for most purposes I should recommend reliance on wood and cork when lightness was required, and stone building inadmissible.

The great point with a cooling-chamber is to keep it closed, and to avoid the frequent exit and entrance of persons. It should have no windows, and, in fact, should be kept isolated as completely as possible from the surrounding atmosphere.

In cooling meat in Texas, I have found on an average that I required nearly two hundred pounds of ice for each bullock, or about 300 lbs. for 1,000 lbs. of meat. In preserving, therefore, 100 bullocks daily—and this is by no means a large quantity—we should require 15 tons of ice, or over 50,000 tons annually; and when the enormous waste and labour attendant on the transportation and storing of ice for this purpose is considered, it must be apparent to all how important it is to have machines producing the exact amount of cold needed, and efficient means for maintaining the temperature produced.

For most purposes it is dry cold and not wet cold that is needed, and I cannot omit to refer to the advantages presented by desiccation at a low temperature. Drawing off the moisture of organic substances is one of the most common and satisfactory means of preserving them, but the materials are usually dried by heat. A ham that is packed for the Indian market is reduced several pounds in weight in the smoke-house, and bacon-factors have to resort to drying under circumstances which entail great loss and waste. Sometimes, an apparently insignificant observation leads to important and unforeseen results; and the first time it occurred to me to dry tongues, hams, and bacon, or preserved fresh meat, by currents of cold, dry air, was in the winter of 1868 and 1869, when I was residing in Brooklyn. On a clear and bitterly cold day, I noticed some handkerchiefs hung out to dry. I anticipated their speedy consolidation by the freezing of the water with which they were charged, but, to my astonishment, they dried as fast as on a warm summer's day, and instead of being hard to the feel, were quite limp and soft, as if dried in the sun. The explanation was obvious. The frozen surfaces all round condensed the moisture from the atmosphere; currents of intensely cold, dry air favoured so rapid an evaporation from the wet handkerchiefs as to prevent the formation of ice; and on the same principle, materials injured by dry, hot air may be effectually desiccated by cold currents. Thus, a bacon curer who prides himself on mild-cured bacon, with a cellar maintained at 40° or 45° Fahr. in summer, may readily dry, and even smoke, by passing air and smoke through the tubes of a refrigerator in which all the water is condensed and drained off. On the air being driven round and round, any degree of dryness may be secured without danger of the bacon turning. The preservation of vegetables by such a process has been recently attempted with good results, as all readers of the Society's *Journal* know. (*Journal*, Feb. 1, 1870.)

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* For instance, at Dubuque, Iowa, with a mean temperature for January of 20·8° Fahr., the mean temperature for July is 76·5°, giving a range of 55·7°. The mean average temperature is 48° Fahr.

To many in this country, the production of cold may seem a matter of trifling importance. Over a wide portion of the globe, however, it is one of the most precious expedients for utilising products of great economical value, and the health and comfort of the people call for supplies of cold air and water when they can only be obtained by artificial means. In the treatment of many diseases, cold is a very precious remedy, and I could readily enlarge on means of utilising it which would induce you to believe that the manufacture of cheap and effective machines for the reduction of temperatures is, in some latitudes, of vital importance to man's well-being. This subject has, however, been so often dealt with, that I have only to express a hope that we may ere long have on record data relating to the production and utilisation of cold as exact as those bearing on the production of steam.

At the conclusion of the paper,

Professor Gamgee drew attention to a specimen of compressed coal, which he thought would be admirable for building a non-conducting chamber; indeed, it had been used in Paris by the *Compagnie des glacières* for that purpose.

DISCUSSION.

Mr. C. S. Read, M.P., said he did not understand, in the preservation of meat, how it was kept sufficiently cool to stand a voyage from South America after it had been frozen.

Professor Gamgee said he did not wish it to be supposed that he had been describing a process for preserving meat; for, in his opinion, the using of cold, and cold alone, was impracticable for such a purpose. The meat must be preserved in such a way that when it was removed from the cold medium it would keep. He had preserved bullocks, sheep, &c., in Western America, and sent them across the continent to New York, whence they were shipped to Liverpool, and they had arrived in pretty good condition; but from other parts, the climate was such, that meat prepared in the way he adopted would spoil, unless it were kept in a cool temperature. He had had meat go from here to Melbourne in perfectly good order, but from attempting to do too much, some of it had got spoilt. He had known vessels take out meat regularly from Falmouth to the Brazils and South America, and it had been eaten on the voyage, and sometimes coming back. In that case, it was kept in the open air, and undergoing a certain amount of drying. Meat exposed in such a way would get darkish on the surface, and the problem to be solved was, if you once had good meat, which could not always be got in South America or Australia, how to keep the carcase, with a fresh appearance, right through the tropics for the space of a three months' voyage. He held that there was no engineering problem more easy than to render the hold of a ship a good non-conductor, and if that were done, there would be no difficulty in preserving the meat. For this purpose a temperature of from 30 to 40° was required, and by that means the meat would arrive here in such a condition, that even East Londoners, who were the most difficult to please of all, would not be aware that they were not buying recently killed food. He thought that owing to the great expense of railway carriage from Russia, it would probably be found desirable, if such a method could be adopted, to bring meat from Odessa round by way of Gibraltar to England. The same held good with other commodities. For instance, rice would turn brown in coming from the East Indies. The first thing necessary, therefore, was, by means of cork, wool, or some other substance, to make the hold a good non-conducting chamber; and in the next place to have a machine, which would be working a short time, say an hour or two a day, and driven either by a small steam engine, by water, by a sail, or any other available mode, to reduce the temperature, and keep it at a certain point throughout the voyage. There was no difficulty in doing it, but in order to do it commercially, you required a machine which would do it with the least amount of power and fuel. Attempts had been made with Tellier's machine to freeze meat, and so keep it for a long voyage, but he believed the attendant was rather too fond of whiskey, and the machine not being kept at work, the meat turned bad, and had to be thrown overboard. A system was required, therefore, which would not be liable to such accidents; and the meat ought to be so preserved that if the temperature was rather higher than was expected for two or three weeks, it would not be injured, although it might be rendered a little darker in colour. The mean temperature required in the hold, to prevent bad consequences, would be from about 35° to 40° Fahr. His process of preserving meat was this, the animal was killed with carbonic oxide gas, and then suspended in a chamber of air, which was completely burnt. At the same time, boxes charged with charcoal, which was said to absorb a large quantity of sulphurous acid, were placed in the chambers, and the meat was left exposed to this sulphurous acid and carbonic oxide for a certain length of time. Meat was so well cured in this way that he had cured sheep in November, 1868, and eaten portions of the same in September, 1869.

Mr. Espasse asked if the meat was salted.

Professor Gamgee said it was not, it was perfectly fresh. To show that this was the case, he might mention that he sent some to St. Petersburg, which was lost on the way, but it ultimately reached its destination, and was cooked and eaten as ordinary fresh meat before it was known what had become of it, although it had been three months on the journey.

Mr. W. Hope, V.C., asked if bisulphide of carbon could be considered a satisfactory liquid to use in the hold of a ship. He fancied its peculiar odour would be a great objection.

Professor Gamgee said the volatile liquid employed ought not to be smelt. At the same time, there were great objections to bisulphide, and he did not at all recommend it. Perhaps Mr. King would mention the results of the ether machines in use under his direction, and what quantity of ether was lost in the process.

Mr. King (Truman and Hanbury) said his experience only went to refrigerating wort. He had two of Siebe's machines at work for two or three years. It was found that if they were careful to keep the stuffing-boxes tight very little ether indeed was lost. During the last season, it cost them for producing results equal to 3,734 tons of ice, £20 for ether, £484 for coal, and £63 10s. for wages; and, allowing 12 per cent., which was a very high estimate, for interest and wear and tear, £500, making altogether £1,067 14s. 6d., or about 6s. a ton. He must say, however, that if they had used the machine for actually producing ice, they would only have produced about 650 tons. This showed the economy of applying the refrigerator directly. The cost of coal per ton was about 20s.

Mr. Reece said the paper was a most interesting one, but it was, in some respects, inaccurate, in particular with regard to the work which various liquids were capable of doing in a machine; and it was quite a mistake to suppose the bisulphide could be used at all in opposition to ether. The tension of the vapour of various liquids differed at their boiling-points, and ether was the only one really applicable to ice-making, so that neither wood spirit, alcohol, nor acetone could be used in competition with it. For example, wood spirit vapour at 65°C. would have a tension of vapour nearly double that of ether boiling at 36°. The same weight of a cubic foot of any liquid evaporated by an air-pump, and thrown into a condenser, would repeat the same number of heat-units abstracted (whatever liquid were used) per cubic foot of vapour. That was Dalton's law of tension of vapours, which had been most satisfactorily demonstrated, and it would be an equal fallacy to suppose that a combination of any of these liquids could be used, for it was an equally well-known law that the tension of the vapour of a mixture of two liquids was a medium between the two. All the different liquids which had been mentioned had been patented at various times by French, German, or English inventors; but, for the reason he had given, ether only had ever been found practically useful, viz., that the tension of ether was so much higher, whilst its boiling-point was so low. Further, it had a lower capacity for abstracting heat at a low temperature. Mr. King's observations with reference to machines of this class was quite accurate, that by using them directly you might produce results equal to 3,740 tons of ice, whilst, at the same time, only 1,500 tons of ice could be produced practically. But there was one consideration to be borne in mind—the lower you wanted to reduce the temperature the more costly was the action of the machine. The tension of ether vapour at 40° Fahr. was ·282 of the atmosphere, but if it were used for ice-making at 14°, the tension was only ·147; and, of course, it was a simple question of proportion as to the power required, and in the latter case there was a waste equal to 50 per cent. It had been calculated that a ship of 1,000 tons going from New York to Bombay lost three tons of ice per day, and that afforded a means of calculating exactly the amount of coal required on such a voyage to make up the deficiency. With an ether machine to do that for 100 days, it would require about 150 tons of coal; and when the stowage both of the coal and the machinery was taken into account, it was evident that such an operation would not be practicable commercially; therefore it appeared to him that the solution of the problem must be looked for in some other direction. He was decidedly of opinion that the ether machine as manufactured by Siebe could not be improved upon. New mechanical methods might be discovered, but until the steam-engine was improved, and he did not think it was very easy, these machines could not be beaten. He did not see that Professor Gamgee's method would add to the rapidity of evaporation in the slightest degree. The particular arrangement of surfaces was a mere detail of construction. You could not maintain a vacuum without a certain expenditure of fuel; that was the real point of question. He was quite positive, therefore, that with none of these machines could fresh meat ever be brought to this country from long distances.

Admiral Ommanney inquired whether the machine described by Professor Gamgee would require a special furnace, or whether it could be worked in connection with the ship's steam-engine.

Professor Gamgee said it did not require a separate engine.

Mr. Fordred said it had been remarked before in the room that the whole question was resolved into this—How many tons of ice could be produced by one ton of coal? It was generally said that the ether machine would produce three tons of ice per ton of fuel, and Mr. Tellier claimed to produce ten. He should like to know if Professor Gamgee had estimated the productive power of his machine in that way.

Mr. Hancock said he could not quite agree with all the remarks of Mr. Reece, as to there being no advantage in the machine proposed by Professor Gamgee, because although it was perfectly true, as a physical fact, that by the introduction of the pressure on the volume of volatile liquid you obtained a definite amount of reduction of temperature, that was not precisely the question in point. It was this, that by drawing that volume of cold evaporated at a lower temperature through a small space in close contact with the conducting medium, the whole of the cold (to use an incorrect term) was absorbed from the reduced volume of evaporated liquid. For instance, if the volume of air in the room were reduced, and drawn by an air-pump through a large tube, only the external surface being in contact with the copper tube, it would be only that portion in contact with the copper which would part with its cold; but if, instead of that, some ten thousand small tubes were employed, an incomparably much greater effect would be produced. In the former case all the cold that would be developed by the reduced temperature in the centre of the large tube was practically lost. Having seen the refrigerating machines in use at Messrs. Truman and Hanbury's, he agreed with Mr. Reece that an ether machine was the most valuable one in use for such a process; but he could not agree with him that in a warm climate, where ether boiled at a much lower temperature, it would be the only available liquid. Under such circumstances it would be necessary to take Professor Gamgee's hint, and to use either a liquid having a higher boiling point, or a mixture of liquids. With regard to using bi-sulphate of carbon, he should be extremely sorry to try it, for having made some experiments with it in connection with the vulcanization of india rubber, he had made himself ill for some weeks. The production of cold, as he might call it, was much the same, only in the inverse proportion, as in dealing with the pressure of steam. If you wanted to raise steam to a temperature of one or two degrees, the effective force of the steam would be immensely inferior to the force of the same steam raised to a much higher temperature and then allowed to expand. The suggestion thrown out at the close for using condensed fuel for building ice-houses was, he thought, a very valuable one, for it was well known that ordinary bricks were exceedingly porous, and allowed the percolation of moisture and vapour through them, which, of course, would tend to waste the ice within. He believed the Chairman had had great experience with submarine telegraphy, and was aware how exceedingly desirable it was, in laying a cable in a long voyage, to keep its temperature, especially if it were covered with gutta-percha, as low as possible, so as not to disturb the testing of the cable during its transit. He believed that an ether machine had been used most successfully for this purpose in the hold of a ship in laying the Red Sea cable.

The Secretary said he thought Mr. Reece had been rather too modest in omitting all mention of his own ammonia machine, which he thought the meeting would be interested in hearing some particulars of.

Mr. Reece said, the paper being on the nature of machines working *in vacuo*, he had not ventured to introduce other methods of dealing with the problem. If it were required to cool 1,000 gallons of water 25° by an air machine, it would take 200 cwt. of coal per 24 hours; to do the same thing with an ether machine would require 36 cwt.; whilst by the ammonia machine of his own construction it would require 10 cwt. This was no mere theory, because a machine could be seen in operation, and the quantity of fuel measured. To put it in another way, to cool 1,000 gallons of water through 25° by an air-machine 156 horse-power indicated was necessary; to do the same thing with an ether machine required 26 horse-power indicated; whilst with the ammonia machine no power at all was necessary, the cold being produced by the direct action of heat, consequently there was no wear and tear of expensive machinery, and in the hold of a ship, or elsewhere, much less room would be required. He had with him the exact calculation with regard to the ether machines at Messrs. Truman, Hanbury, and Co's., showing what it ought to do in making ice and in cooling water. It was theoretically capable of evaporating 1,886 lbs. of ether per hour, but there was an expenditure equal to 14 per cent. required to cool the machine itself down from the temperature of water passing into the condenser, and if it were required to be brought down to 14°, and to be used for ice-making, 23 per cent. was wasted in the same way. The large machine, with the 20 in. cylinder, would absolutely evaporate 1,698 lbs. of ether per hour, but deducting the 14 per cent. it was reduced to 1,426 lbs., which was equivalent to cooling about 1,700 gallons of water through 15°. If used for ice making, the same machine would only evaporate 681 lbs. This was due to the law of the tension of vapours, which he had before referred to, and was capable of as exact calculation as any sum in arithmetic. To come to the practical application of the matter, a ship bringing 1,000 tons of meat from Australia could be kept sufficiently cool with a good ammonia machine by the expenditure of about 25 tons of coal, whilst the machine itself would not occupy more space than the boiler of an ether machine. In any climate where the normal temperature of the air was over 100°, there was no liquid which could be practically used for ice-making. A cubic foot of ether at 14° weighed half an ounce, and at 40° it weighed nine-tenths of an ounce, and it had, therefore, great evaporating power, but liquids with different tensions and higher boiling points would scarcely evaporate at all.

Professor Gamgee said he was very glad to have an opportunity of seeing Mr. Reece for the first time, for unfortunately he had missed him whenever he had called for the purpose of seeing his machine. He should be very happy to cross swords with him when he had better particulars. He differed from him on many important points, which he would not then go into. He had used the bi-sulphate of carbon successfully, although he quite agreed it was not the proper liquid to use. Still it had been used practically where the ether machine could not be started by itself, but with the bi-sulphate of carbon it could be set going, and then the working continued with ether. His great point, however, was this, that by having a liquid to a higher boiling point with which ether was perfectly mixible, it might be possible to produce results which could not be obtained by ether alone. It had, in fact, been done by mixing ether with methylated alcohol. The ether evaporated from the alcohol, which was found of great use in aiding its volatilisation. As far as his experiments went, they went to show, and he believed further investigations would prove, that they could do the work required with one-tenth the power now used by a Siebe machine. All he wanted was the best machine for the purpose. One great defect in Siebe's was, that the whole of the outer surface of the cylinder was lost as a cooling surface. In conclusion, he would only say, that an exhaustive series of experiments were being carried on, and he would promise that whichever way they might turn out the results should be published in the *Journal of the Society of Arts*.

Mr. Fordred said Professor Gamgee had not stated how many tons of ice he could produce per ton of coal. The other machine gave three tons; Mr. Reece claimed 25, and the theoretical quantity was 80 tons. That was where the whole problem rested.

Mr. Reece said, with regard to the theoretical quantity being 80 tons, that was arrived at by measuring the heat when coal was burnt in oxygen, and not in air. When consumed under a steam-boiler, the practical theoretical quantity would be about 50 tons. One of his machines would produce an effect equal to the smelting of 40 tons of ice, and if made on a large scale, he had no doubt of producing the theoretical quantity.

The Chairman, in proposing a vote of thanks to Professor Gamgee, said there was no doubt that the machine described was theoretically the same as the ether machine; it was simply a question of the details of construction; but sometimes these matters were of great practical importance in the result. Mr. Reece's machine, on the other hand, was of an essentially different character, He did not use mechanical force, but produced the refrigerating action by the evaporation of water and ammonia, and of reabsorption of the ammonia by water. That, no doubt, was a different conception of the same problem, but finally it came to the same theoretical result, although the ammonia machine avoided the losses connected with the steam-engine, which were very considerable. It had been correctly stated that a ton of fuel ought to produce something like 80 tons of ice, but considering that a considerable quantity of heat must always be wasted, from 40 to 50 tons was about the practical limit. He could not agree with Mr. Hancock, that in hot climates the liquid to be employed must be different, because the question of the liquid to be chosen did not depend on the external temperature, but upon that which you wanted to produce. In the case of Mr. Gamgee's machine, the amount of compression that had to be performed by the pump would be much less if the water were at 60°, than if it were at 80° or 90°. If you wanted to go to the freezing-point, or below it, you must select a liquid that would boil at a point considerably above the freezing-point of water, under the reduced pressure maintained by the air-pump. He should have liked the air-machines to have been more discussed, as they were well worth attention. There was a well-known method of producing a low temperature by compressing atmospheric air, cooling it, and then allowing it to expand; and some years ago his attention was directed to a machine of that description invented in America, which he found laboured under a most egregious error in its conception. The air was compressed by a very excellent machine, and was cooled by a well-arranged system of tubes, but it was then allowed to expand through a throttle-valve, under the idea that depression of temperature would thus take place. But this was an entire misconception of the facts. Heat was nothing but force, and the reason why air in expansion became lowered in temperature was simply because it developed force in so doing, and if no force were developed in its expansion, no depression could take place. Therefore, if air were compressed to a hundred pounds to the square inch, and then were expanded through a small orifice, there would be precisely the same temperature in the expanded air as there was before, but if the same air were expanded between the same limits in an expansive engine, a proportionate loss of heat would take place, and the machine would give back a considerable amount of the power expended in compressing the air. Where the problem was simply to cool the air, this kind of machine was, therefore, well worthy of attention. Professor Gamgee had complained of being misled by engineers, and he feared he was not yet quite out of the hands of the Philistines, for the rotary-pump he referred to would not, he thought, be equal to an ordinary honest cylinder and piston. However, as it was not particularly described, he would not condemn it altogether.

The vote of thanks was carried unanimously.

ANNOUNCEMENTS BY THE COUNCIL.

CONVERSAZIONE.

The annual conversazione of the members will be held on Thursday, June 1st, at the South Kensington Museum. Cards of invitation will be issued in due course.

CANTOR LECTURES.

The third lecture of the course on "Our Food-producing Ruminants, and on the Parasites which reside in them," was delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., on Monday, the 1st inst. These lectures will be continued as follows:—

Lecture IV.—Monday, May 8th.

The Cervine, Antilopine, and Cameline Ruminants, with some account of their Parasites.

Lecture V.—Monday, May 15th.

The general question of the Parasitism of Ruminants in relation to Sewage and Public Health.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

INDIA COMMITTEE.

A Conference will take place this evening, May 5th, on "The Conservation of Indian Fisheries." The opening paper will be read by Lieut.-Col. Haly.

THE LIBRARY.

The following works have been presented to the Library:—

On the Influence of the Differential Duties upon the Progress of Modern Improvements in Sugar Manufacture. Presented by the author, Ferdinand Kohn.

A Catalogue of Anglo-Saxon and other Antiquities discovered at Faversham, Kent. Compiled by C. R. Smith, F.S.A., Hon. M.R.S.L., &c.

Patent Law and Practice. By a Practitioner. Presented by the author.

Heavy Rifled Ordnance, Cast and Wrought Iron. By Bashley Britten. Presented by the author.

Transactions of the National Congress on Penitentiary and Reformatory Discipline, held at Cincinnati. Edited by E. C. Wines, M.D. Presented by the editor.

George W. Childs; a biographical sketch. By James Parton. Presented by the author.

Abstract of the Annual Report of the Society for the Suppression of Vice. Presented by the Society.

Half-Yearly Report and Minutes of the Yokohama General Chamber of Commerce.

Rules and Regulations Relating to School Board Elections. By Thomas Preston. Presented by the writer.

Annual Report of the Royal National Life Boat Institution for 1871. Presented by the Institution.

Elementary or National Education. By J. Parkin, M.D., F.R.C.S.

Khânâ; a Hand-book to the Resources of India. By Colonel G. T. Haly. Presented by the author.

Quarterly Weather Report of the Meteorological Society. Presented by the Society.

Specimen Copies of Drawing Books. By Vere Foster.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The International Exhibition of 1871 was opened on Monday, the 1st of May, at twelve o'clock, on behalf of the Queen, by his Royal Highness the Prince of Wales.

His Royal Highness the Prince of Wales was accompanied by their Royal Highnesses the Count and Countess of Flanders, the Prince Christian of Schleswig Holstein, and his Highness Prince John of Glücksburg, and attended by the Great Officers, and by Her Majesty's Household in Waiting.

A captain's escort of the Household Cavalry accompanied the procession, and a guard of honour mounted at the Queen's entrance to the Royal Albert Hall, where his Royal Highness the Prince of Wales, and the Royal personages accompanying him, were received by her Majesty's Commissioners for the Exhibition of 1851, and conducted in procession through the corridors to the conservatory in the Horticultural-gardens, where a dais was prepared for their reception.

His Royal Highness the Duke of Cambridge, and the other members of the Royal Family who had accepted invitations to be present, were received at the Queen's entrance of the Albert Hall, and conducted to the Conservatory.

The 148th Psalm was sung, after which the following presentations were made to his Royal Highness the Prince of Wales:—

By his Royal Highness the Duke of Cambridge, K.G.—The Inspector-General of Fortifications, the Deputy Adjutant-General of the Royal Engineers, and the officers of the Royal Engineers, &c., assisting in the Exhibition.

By his Royal Highness the Prince Christian of Schleswig-Holstein, K.G.—The Officers of the Exhibition Staff and Members of Committees engaged in the Fine Arts Division.

By his Serene Highness the Prince of Teck, G.C.B.—The Officers of the Exhibition Staff and Members of Committees engaged in the Industrial Division.

By the Earl Granville, K.G., Secretary of State for Foreign Affairs—The Foreign Commissioners of the Exhibition, accredited through the Foreign-office.

By Lord Henry Gordon Lennox, M.P., Chairman of the

Council of the Society of Arts—The Council of the Society of Arts.

By the Bishop of Winchester—The Council of the Royal Horticultural Society.

By Lord Houghton—The Official Reporters for the Exhibition.

By the Right Hon. H. A. Bruce, Secretary of State for the Home Department—The High Sheriffs of Counties of the United Kingdom who had accepted the invitation of the Commissioners; the Lord Mayor, Sheriffs, and Recorder of the City of London; and the Municipal Authorities of the United Kingdom who had accepted the invitation of her Majesty's Commissioners.

By the Right Honourable Sir John Pakington, Bart., B.—The Musical Committee for the Exhibition.

By the Right Honourable Chichester Fortescue, President of the Board of Trade—The Chairmen of the Chambers of Commerce who had accepted the invitation of the Commissioners.

By the Right Honourable the Lord Mayor of London—The City Companies.

Lieutenant-Colonel Scott, the Secretary to her Majesty's Commissioners, then handed their report to Mr. Bruce, the Home Secretary, who presented it to the Prince of Wales, by whom it was received on the part of her Majesty. The report was as follows:—

"May it Please your Majesty,—We, your Majesty's Commissioners for the Exhibition of 1851, incorporated by your Royal Charter to dispose of the surplus arising from that Exhibition, in the promotion of objects tending to increase the means of industrial education and extend the influence of science and art upon productive industry, now humbly report to your Majesty that, in discharge of the trust committed to us, we have resolved to establish a series of Annual International Exhibitions of the Fine Arts and of Industry, the first of which is opened this day. During the twenty years which have elapsed since the Great Exhibition of 1851, various exhibitions have taken place in this and other countries, and your Commissioners have not failed to take advantage of the information which the different organisations of such Exhibitions have afforded, in determining the principles on which the present series should be based, in order, as far as possible, to increase their practical utility.

"Your Commissioners observed that the tendency of such Exhibitions has been to encourage undue increase in their size, to admit objects in no way distinguishable for any peculiar merit beyond those to be obtained in the ordinary way of trade, and to throw upon exhibitors who were influenced by considerations apart from the actual sale which might be made in the Exhibition itself, a heavier tax than they were inclined to bear. It had also forced itself upon the attention of your Commissioners that the method of pronouncing definite opinions on the merits of this or that production by means of juries led to inconveniences. The estimation of the merits of the goods of each country were often determined very much in the proportion of the number of the jurors it was allowed to name. It was impossible to find jurors with sufficient technical knowledge of all the subdivisions necessarily grouped under one heading to pronounce comprehensive and correct judgments on the comparative excellence of the objects exhibited. And amid the enormous mass of objects which such exhibitions brought together, many oversights occurred which did injustice to individuals.

"In settling the principles for placing the objects in the Exhibition of 1851, it was the strong wish of the Prince Consort that the arrangement should be by classes, and not by nationalities—a wish which it was impossible to realise in such a novel and vast undertaking—but your Commissioners feel satisfaction in having in the present year, in great measure, carried out the wishes of the great founder of International Exhibitions; and in future years they intend to carry the principle into effect, without exception. By this means greater scope will be given to the public for the actual comparison of the works of different countries, and the education and practical value of such displays will be much increased. Guided by these ideas, your Commissioners arrived at the following conclusions, and have endeavoured to give effect to them in the present Exhibition:—To confine the Exhibition of each year to two or three industries only, but to admit every year works of fine art, scientific invention, and horticulture; to admit such objects only as might be selected as worthy of exhibition by a competent committee of selection; to group these objects by classes and not by nationalities. In the case of fine arts, certain slight modifications of the rule, have, for this year only, as already intimated, been admitted; to save to exhibitors, so far as possible, the cost and trouble of exhibiting, by providing for them glass cases, stands, steam power, and other appliances for the proper exhibition of their objects; and also by employing agents who will answer inquiries respecting the objects, and generally watch over the interests of the exhibitors.

"With the view of increasing the educational value of the Exhibition, your Commissioners have also made arrangements for issuing, within a few weeks of the opening of the Exhibition, reports on the various classes of objects. In these reports an attempt will be made to inculcate such principles as will enable the public to arrive at a standard of judgment, and form its own opinions upon them. In discarding the jury system, your Commissioners also abandon that of giving prizes, which had proved a source of dissatisfaction, and sometimes of abuse. The admission to the Exhibition itself, in the opinion of your Commissioners, should be viewed as conferring a distinction worthy of competition. Your Commissioners desire to bring to your Majesty's notice the patience and conscientiousness with which the ladies and gentlemen, eminent in the spheres of art, science, and industry, who were invited by your Commissioners to act as committees of selection, have carried out their arduous and responsible duties.

"In the design of the Royal Albert Hall, erected to the memory of the Prince Consort, considerable provision had been made for the exhibition of objects in and around the main chamber of the structure. Your Commissioners have therefore taken advantage of the space thus afforded for this year's Exhibition, whilst for the main portions of the Exhibitions they have erected on each side of the Royal Horticultural Society's Gardens spacious and well-lighted galleries, which communicate with the hall and with each other. To the erection of these galleries they have devoted the sum of £75,000 out of the surplus left in their trust. They have devoted a further sum of £25,000 in providing fittings, furniture, and cases for the Exhibition galleries, for certain necessary work in the adjacent buildings, to enable them to be used as a part of the exhibition space, and to meet the preliminary expenses attending the undertaking. The total cost, therefore, of opening this, the first of the series of Exhibitions, including the permanent structures, which will be available for the whole series, will be £100,000.

"The representation of all branches of the fine arts, of scientific inventions, and of horticulture takes place this year as it will do in subsequent years, and your Commissioners have selected woollen and worsted, pottery, and educational appliances, as the manufactures and industries for the Exhibition opened this day. Your Commissioners have also decided that, during the Exhibition, representations of music, as a branch of the fine arts, shall take place in the Royal Albert Hall, with a view to the improvement of the taste for music, which has not hitherto met with that attention in England as an elevating and educational instrument which has been bestowed upon it in other civilised countries. The four nationalities of England, France, Germany, and Italy, will be specially represented by musical compositions on this day.

"With this report, we lay before your Majesty the catalogue of the Exhibition of the present year, enumerating upwards of 8,000 objects or groups of objects, and we humbly trust that our work this year will receive your Majesty's gracious favour and approval.

"It was long since announced to the world that this Exhibition would open on the 1st May, for it appeared to us that the present series of Exhibitions could not be opened more appropriately than on the anniversary of the day on which the first Great International Exhibition of which they are the natural sequel, was thrown open to the admiration of the world, and we trust that, by the blessing of God, the work on which we are engaged will not only promote the welfare of your Majesty's subjects, but will assist in promoting friendship, and brotherhood, and happiness of all the nations of the earth."

His Royal Highness then, in the Queen's name, proclaimed the opening of the Exhibition, first in the Conservatory and then from the balcony looking into the Horticultural Gardens, and a flourish of trumpets and a salute from a battery of the Royal Artillery stationed in the park announced the fact to the public. The procession was again formed, and his Royal Highness the Prince of Wales, with the other Royal personages, was conducted through the fine arts galleries. The order of procession was as follows:—

Heralds and State Trumpeters.
Contractor for the Building.
The Fine Arts Staff and Committee for the Exhibition.
The Industrial Staff and Committees of the Exhibition.
The Military Staff of the Exhibition.
The Foreign Acting Commissioners.
The Council of the Royal Horticultural Society.
The Council of the Society of Arts.
Official Reporters.
The Chairmen of the Chambers of Commerce.
The Mayors of the United Kingdom.
The City Companies.
The Lord Mayor of London, &c.
The High Sheriffs.
The General Purposes Committee for the Exhibition.
Her Majesty's Commissioners for the Exhibition.
His Royal Highness the Prince of Wales.
The Royal Personages, Maharajah, &c.
The Court.

The procession having returned to the Conservatory, the Prince of Wales took his departure in the same manner in which he had arrived.

After an interval of an hour, a Grand Concert of International Music was held in the Albert Hall, under the direction of Sir Michael Costa. The programme was as follows:—

Overture, "Der Freischutz."
Chorale, representing Italian music, composed and conducted by Chevalier Pinsuti.
Gallia, representing France and French music, composed and conducted by M. Ch. Gounod.
Grand March, representing German music, by Dr. F. Hiller.
Dramatic Cantata, composed and conducted by Mr. A. Sullivan.
Overture, "Semiramide."
"God Save the Queen."

Belgium.—The Count of Flanders, the president of the Belgian Commission for the International Exhibition of 1871, in order to complete the choice representation of Belgian art, personally brought over five pictures by the "Brothers Stevens," paintings which will be especially appreciated in England.

EXHIBITIONS.

THE MILAN EXHIBITION.

The programme of the exhibition to be held in Milan during the course of the present year, has just been published by the Italian Industrial Association. This association proposes holding periodical exhibitions in the building which has recently been erected in the Public Gardens, the first of which is to be opened on the 1st of September, and will comprise "Construction and the Common Arts." It will consist of the following classes:—

Class 1.—*Materials and Processes used for Construction.* —Raw materials, natural and artificial stone, marble, stucco, limes, cements, asphalte, models of furnaces and kilns, models and machines for the preparation of materials and construction, prepared timber, flooring (parquets), metals used for construction, cast-iron.

Class 2.—*Apparatus and Processes for Heating and Lighting.*—Fire clays (raw and manufactured), stoves for warming and for industrial purposes, steam-boilers, models and drawings of furnaces and ovens, economic cooking apparatus, apparatus used for the manufacture of gas and for its use for heating and lighting, lamps and fittings for lighting.

Class 3.—*Ceramic Arts.*—Raw materials, terra-cotta, earthenware, pottery, majolica, porcelain, glass, crystal, mirror and beads.

Class 4.—*Furniture and Decoration.*—Cheap and fancy furniture, iron bedsteads and furniture, paper-hangings and upholstery, carpets and mats, utensils and implements for domestic use, domestic telegraphs and bell-hanging, fireproof safes, locks, door-furniture, cornices, inlaid work, carving, painting and varnishing.

Class 5.—*Jewellery, Hardware, Arms, Philosophical Instruments.*—Articles in metals and alloys, clocks and watches, cutlery, arms, apparatus used for shooting and fishing, electro-plating and gilding, and plating by other processes, weights and measures, apparatus for determining the tenacity and resistance of various substances, optical, acoustic, and meteorological instruments, telegraphic and electrical apparatus, engineering and mathematical instruments, surgical instruments.

Class 6.—*Woven Fabrics, Leather Work, and Lace.*—Clothing, furs, waterproofs, sewing machines, saddlery and carriage work, japanned leather, toys, artificial flowers, the art of taxidermy.

Class 7.—*Apparatus and Processes used for Various Arts.*—Washing and process of bleaching, apparatus and various substances used, soaps and perfumery, various processes for disinfection, various uses of wax, stearine oils, and fatty matters, substances and apparatus used for the preparation of food, substances and apparatus used in the pharmaceutical arts.

Class 8.—*The Art of Printing.*—Printing, types, printing inks, lithography, electro-printing, wood-engraving, stereotyping, books and bookbinding.

OYSTER-CULTURE.

The inquiry into the merits of oyster-culture in the United Kingdom and France has resulted in an elaborate report, containing an account of the visit of the commission to the principal places marked out for observation. The importance of these descriptions will be better understood when we consider that the consumption of oysters in England is said to reach in value over four millions sterling, with a largely increasing demand, at even the present high prices. The introduction of improved methods of cultivation into Ireland was the especial object in view, since but little progress has hitherto followed upon recent legislation.

Out of nearly ninety licenses granted for oyster planting, which embrace an area of about 15,000 acres, scarcely half-a-dozen have been successful, and this is the more surprising as Ireland is admittedly well calculated for the prosecution of oyster-culture. The favourable temperature of the sea, the large inlets and bays on the western coast, containing banks where oysters are already found in great numbers, the habits and tastes of the coast population, all show that this most valuable industry might be prosecuted with success. The remarks of the commissioners are illustrated by numerous microscopical drawings of the spat in its various stages, by coloured plans of the government establishments at the Bay of Arcachon, near Bordeaux, at L'Ahilon, and the Isle of Rhé, with the pits at Marennes and La Tremblade, the hurdles, fascines, &c., at Hayland Island, Hampshire, and a map, showing the distribution of temperature over Ireland, and on the surface of the surounding sea.

We are reminded, by reference to early English history, how, at the time of the invasion of our islands by the Romans, those warriors had not landed long upon our shores before they became acquainted with our oyster beds, and British oysters soon formed an article of extensive export to Rome. At this period, oyster-culture was conducted by the Romans in the Lake Avernius, on precisely the same principle as that recently introduced into England. The present diminution in the supply appears to have commenced some ten or twelve years ago. Since that period, a greatly increased demand has resulted from the greater facilities of transport to places where previously fresh oysters had seldom reached. Another circumstance has also added considerably to the demand, viz., their more frequent use, owing to the fashion prevalent among the wealthier classes of consuming them at almost every meal. This materially enhances the price, and has led to a vast increase in dredging. In 1855, the price of natives was 41s. per bushel, and in 1870 it was £10 2s. A similar rise has taken place in seconds; while commons, in 1855, were 3s. 10d. per bushel, and in 1870 from 10s. to 18s. Considerable difference of opinion exists as to the cause of this decrease, some authorities contending that it is altogether due to over-dredging, others to failure in the natural production of spat.

Owing to the scarcity which had arisen, considerable efforts were made in France and England, especially the former, to promote the production of oysters by artificial means. The earlier steps for that object were taken in France by measures adopted for the preservation and restocking of the public oyster grounds by an artificial system of cultivation, and regulations made by government with respect to this branch of the fisheries. The chief sources of supply are the deep sea natural beds in international waters—the fishing of which is regulated by a convention—extending, with more or less perfect continuity, from Nordenaye, on the Hanoverian coast, to Brest. The beds which give their names to the best varieties, are those of St. Valery, Fécamp, Cape Le Héve, and Calvados; the remainder, which exist more in mid-channel, being comprised under the general name of "Channellers."

Although the cultivation is much less remunerative than it was formerly in France, still, even in its depressed condition, it pays better than any other industry pursued by the same class for the labour and capital expended upon it, and possesses the advantage of interfering but little with other occupations, as the attention required to be bestowed on oysters could be given at times when those following agriculture would be at leisure. The most encouraging instances of successful cultivation are to be found at L'Orient and Auray. At the former, the principal proprietor shows by his returns that, during the past six years, his operations have, making every allowance for indifferent years, been remunerative. At Auray, cultivation is carried on in the rivers La Trinité, Bono, and La Crach. Each of these possesses oysters naturally, besides which others were placed near the collectors, which consist of stones and tiles. The result has been most successful in the eighty parks, as many as 300 oysters having been found on one tile; and the instance of M. Le Rouse is a good illustration of the success which has attended the cultivation of these rivers. His park in La Trinité, at Carnac, contains 900 square metres. The first year of his operations, 1866-7, he sold 300,000 oysters; the succeeding year was not so good, but he was able to pay off all his outlay out of profits. He is extending his operations, and expects to profit at the rate of 20,000 francs a year. On the same river there are five other large proprietors; and seventy poorer peasants, who have received assistance from the government, have also commenced operations. All the rivers have a bottom of clay, similar to that of the Essex rivers and other localities where oysters are most productive.

With respect to the natural oyster banks, most of them became so denuded of oysters down to 1850, as to be hardly worth fishing, and some, formerly of great importance, such as those of Cancale, Granville, &c., have been all but destroyed. The most important authorities on the subject combine in attributing the exhaustion mainly to over-dredging. The diminution in oyster production which has taken place in England has not been so great, still it has been very considerable. Great natural beds exist, or have existed, in the estuaries of the Thames, Medway, Blackwater, the rivers of Essex and Suffolk, in the Solent, in Langston and Chichester harbours, Milford, Tenby, and other places. The Royal Commission, in their report on the sea fisheries of the United Kingdom, state—"That the supply of oysters has very greatly fallen off during the last three or four years," and this statement needs no further confirmation. The same causes as exist in France may be assigned for it.

Several attempts at artificial culture have been made, the most important from its magnitude, as well as the great success which attended its earlier operations, being that of Hayling Island, on the Hampshire coast. It is on the enclosure system, and comprises an area of eighty to ninety acres available for breeding ponds, of which there are five of various sizes, from four to twenty-eight acres. The Herne Bay Company's ponds were established with a view of assisting in the stocking of the extensive layings of the company in the estuary of the Thames. Further down the bay, there has been a small experimental undertaking at Reculvers. The Brading Company, in the Isle of Wight, have ponds of about three acres in extent. Besides these, there are ponds at Lymington and at Nacton-on-the-Orwell. The Medina Oyster Fisheries Company, at Cowes and Newtown, in the Isle of Wight, was also established to work two fisheries at the above places. Nearly all these ponds are similar, the chief difference being in size and in the kind of collectors used, some consisting of tiles, others of twigs, or fascines, slates, stones, and shells attached by tar or cement to boards, the depth of water varying from two to ten feet. If experiments in this country are not successful, in the opinion of the commissioners, it is because the natural conditions are unsuitable, or because the oysterculturist lacks the skill and experience to carry his work to a satisfactory conclusion, for skill and experience are quite as requisite, if not more so, in the aquaculturist as in the agriculturist.

The best places for the purpose are harbours, quiet bays, and estuaries of rivers. Exposed sea coast, though not the most desirable ground, may still be utilised where rocks or large stones abound, to which oysters can attach themselves, and from which they obtain a certain amount of shelter. With the object of obtaining every possible fact in connection with natural banks as well as artificial layings, especially in Ireland, by the co-operation of the Admiralty, the temperature of the sea was ascertained simultaneously at 32 points around the coast of the United Kingdom. For the object also of determining the soils most favourable to production, specimens of earth were obtained, forming the bottoms of various fisheries in France, England, and Ireland, and, with respect to the latter country, specimens from localities where cultivation had not proved successful, in order to ascertain how far the nature of the ground might have influenced failure. The earth known as London clay appears to be peculiarly adapted, and both in respect to the condition of soil and temperature Ireland appears to be capable of a far greater amount of oyster production than is yielded at present.

Although the Commission do not concur in the opinion put forward by some as to the extraordinary profits to be made from oyster-cultivation, yet, if judiciously undertaken, and prudently and perseveringly carried out, they believe that it is profitable, and that there is very much to encourage enterprises of the kind. When it is recollected that of the numeric quantity consumed in England, not much more than fifty thousand pounds worth are produced on the Irish coast, and that ten times that amount would find a ready market, at good prices, in England and France, comparatively insignificant as the subject may appear, yet the successful promotion of the oyster fisheries in Ireland would be likely to be productive of very important advantages to the coast population. Besides affording remunerative occupation, not likely to interfere with other employment, it might also be the means in many instances of enabling them to procure appliances for pursuing sea-fishing, and thus tend to promote that important but neglected and decaying industry.

EDUCATIONAL NOTES.

London School Board.—The most practical resolution yet passed by this Board was agreed to at the meeting on Wednesday last. It was proposed by Lord Sandon, and was to the effect that "the Board, without waiting for the completion of the inquiries into the efficiency of the existing schools, and into the social and religious condition of the whole of the metropolis, do undertake forthwith to provide a limited number of schools in localities where the deficiency is already ascertained to be great, and where there is no doubt that large provision for public elementary education must hereafter be made by the Board." The second paragraph requests the Statistical Inquiries Committee to recommend to the Board ten or more districts which appear to be suitable for such immediate action. The Board has thus bound itself to set about the establishment of schools without delay, presuming, of course, that the proper requisition is obtained from the Education Department.

Emanuel Hospital and the Endowed Schools Commission.—It is to be regretted that some journals from whom a more liberal tone might have been expected have, to some extent, endorsed the attacks made by the Corporation and by Lord Salisbury upon the Commissioners' scheme, explained in last week's *Journal.* A remarkable article on the other side appears in the *Spectator;* and as this case may be regarded as a typical one, and as showing how the Commissioners, if they succeed in carrying out their plan, will probably treat all similar institutions, the question becomes one of especial interest. The article referred to, after describing the scheme in detail, speaks of it as contemplating "an organised system of advanced instruction for Westminster, adapted for upwards of 1,300 children, of whom some are to be boarded, and more than one-fourth educated gratuitously on the foundation; while the rest would share with them, at a moderate cost, the advantages of good buildings, qualified teachers, the supervision of a responsible public body, and an improved modern education. The price to be paid by the public for this acquisition is the sacrifice of six little establishments, which collectively give a charity school education to 247 children, at a cost of £7,000 a-year." In answer to the accusation that this plan is one for "plundering the poor," the writer maintains that the present scholars in Emanuel Hospital are not "the poor," but are persons, for the most part, in the humbler walks of comfortable middle life, who have been fortunate enough to gain access to the Corporation, and to urge some claims on its favour. He urges that, "to the child, admission to the school is no boon, but a clear loss. He receives a less efficient and useful education than in an ordinary elementary school, is compelled to wear a ridiculous dress, to spend several years in a little monastic community, where the free, healthy play and intellectual life of a large, open boarding-school is unknown," and where no provision is made for helping him forward to higher instruction. The writer then puts forward the argument used by Lord Lyttelton, quoted last week, as to the proper use of such endowments being to furnish "means whereby those of the children in primary schools, who evince special promise, may be encouraged to prolong their education, and be aided to obtain it in higher schools." So far from this being, as has been asserted, "the transference of the heritage of the poor to the middle classes," it would be more accurate to describe it as "the transference of the endowments from primary to secondary education, in the interests of the whole community, and especially in those of the poor." In short, the objects aimed at by the Commission may thus be summed up:—"An organised system of secondary instruction for the whole country; graded schools for boys and girls, subject to public supervision, adapted to modern needs, and accessible to all classes at moderate fees; free places reserved in every school for meritorious scholars from the school below it; prizes and exhibitions to encourage further progress, so that no child in England shall be debarred by want of means from obtaining any instruction which his abilities entitle him to receive."

Science Teaching in the North.—The scheme to found in Newcastle-on-Tyne, in connexion with the University of Durham, a college for the teaching of physical science, especially as applied to engineering, mining, manufactures, and agriculture, is meeting with a large amount of popular support. The promoters thought that they might make a start with £5,000—they have received promises to the extent of £16,000, and they hope to raise a capital fund of £30,000. A fine public building is being erected in Westgate-street, Newcastle, by the coal trade, and it is intended to have the college in it.

Building Grants for Schools.—It will be remembered that the Elementary Education Act provided that no building grants should be made from the Parliamentary vote, except on applications received before the close of the year 1870. In the year 1869, 192 such grants were awarded; in 1870, the applications reached the enormous number of 3,230. Of these, 3,111 were received after the 1st of August; the Act passed early in that month. No less than 2,852, or nearly nine-tenths of the applications, were for the building of Church of England schools.

Payment of Fees in Denominational Schools.—It appears that more than 4,000 applications have been received by the Manchester School Board, since the passing of the bye-laws confirming the principle of paying, in denominational schools, the fees of children whose parents are unable to do so. Of these applications, about 1,500 have been approved, and this would cost upwards of £17 per week to the School Board fund; but the bye-law cannot be acted upon until it is sanctioned by the Education Department; and, from the reports of what occurred recently between the Liverpool deputation and the Vice-President of the Committee of Council, the approval of the Department appears somewhat uncertain.

Music in Sunday Schools.—It appears, from recent meetings of some of the Sunday-school unions, that it is proposed to devote a certain portion of the school hours on Sundays to instruction in sacred music.

CORRESPONDENCE.

HOMES FOR THE PEOPLE.

Sir,—With respect to workmen's dwellings, there should be independence. Internal cube-space, no room less than nine feet in height. There must be three bedrooms, separately lighted, with means of thorough ventilation, and also fixed means for ventilation at the junction of side wall and ceiling, by a long slit-like opening, and not in a square or block-shaped opening of any kind.

For each twenty (or more) dwellings there may be washing, drying, &c., apparatus, with (or not) an oven for common use. Washing, drying, and mangling, as also baking, may be done more cheaply for twenty dwellings than in each tenement.

Workmen's clubs may be provided, where tea, coffee, &c., may be obtained, and the newspapers and magazines of the day may be read. But the more any working man makes his own house his home, the better for himself, for his family, and for the whole community. "No place like home" cannot be too fully appreciated. Home must, however, afford shelter, isolation, comfort, and health, to be home—having no other place like it. A people without homes is a people unstable, disloyal, and dangerous; a people with homes will be healthy, peaceable, and loyal. No nation nor state can attain to safety until the masses of the people have homes suitable for men, women, and children to live in who are to be taught the pure doctrines of Christianity. Had I been at the meeting when Dr. Stallard's paper was read this is what I should have said.—I am, &c.,

Robert Rawlinson.

WORKMEN'S DWELLINGS.

Sir,—In the various suggestions for the supplying of adequate and decent dwellings for the working classes, I observe with regret that the wants of the mass of the population, the industrial classes, the hard-working costermonger and hawker, are invariably ignored. If a neighbourhood is to be improved, or a new street or railway to be formed, acres of poor, ruinous houses are demolished. What becomes of the occupants, who perhaps have lived there many years, and their parents before them, no one cares to inquire, or to remember that they must find a shelter in some already overcrowded district. Hence frequently the outbreak of those epidemics which are so fatal in our large cities. Permit me to call your attention to an effort to meet the requirements of the class referred to, and whose poor dwellings in Old Pye-street, Duck-lane, &c., had been replaced by a comfortable dwelling-house.

I enclose some particulars of Westminster-buildings, Old Pye-street, which were opened in July, 1866, for sixty-one families, at rents ranging from 1s. 9d. for a single room to 4s. 3d. for three rooms, every living room having a cottage range, with oven and boiler, and every bedroom a fireplace. This is not the case in the generality of model lodging-houses, the bedrooms having no fireplaces, so that when parent or child are sick, they must be in the living-room. As the tenements are entered from outer galleries, each tenant has his own key, and has thorough ventilation, through the windows being at each end of the rooms. The washhouse at the top of the building is a great accommodation for the poor women, six of whom can wash at the same time, at a separate copper and washing trough, water being laid on at each.

I wrote, some years since, to the Peabody trustees, inviting their attention to the terrible state of the Pye-street district, with its nests of common lodging-houses, &c. The late Sir Emerson Tennant courteously replied, but to the effect that the class of houses that could be erected in such a neighbourhood would not command rents that would ensure an annual dividend worthy of the trust committed to them."

I will only add that the rents of Westminster-buildings, after paying the salary of the superintendent, all rates and taxes, including water and gas, pay 3 per cent. on the sum of £7,500, borrowed on mortgage, leaving a balance each year ranging from £30 to £60.

Any particulars could be obtained of the architect, Mr. H. M. Eyton, 12, Buckingham-street, Strand, W.C. —I am, &c., Adeline M. Cooper.

Sir,—If Dr. Stallard's recent paper upon this subject had been as comprehensive as some desired it to have been, some reference might have been made to the house which I saw in 1851, in Hyde-park, south of the Exhibition building, erected as a model dwelling-house for labourers, according to a design, I believe, of H.R.H. the late Prince Consort, or, at least, at the Prince's suggestion. Can any of your readers state whether a model or plan of this snug building has been preserved; if so, where can it be seen?—I am, &c.,

Chr. Cooke.

London, April 24, 1871.

PATENT LAWS.

Sir,—There can hardly be a doubt as to there having been, in the discussion of this question, a great deal of confusion caused by its not having been kept clearly in view that it represents not only a "system" of reward, but also a "mode" of reward. I need not explain the difference, but hence, undoubtedly, the strange proposition on the part of one of your correspondents to sweep away what is in reality the life-giving principle of every social and political system. As a "system," particularly as the only system of reward to a class of men who are doing more for the advancement of industrial art than any other, it must ever command respect; but, as a "mode" of reward, the same cannot be said. The mode, that of bestowing the reward in the form of a monopoly alone, is a very questionable one indeed. Where the idea which the patent represents is of little value, or is questionable, it is a very convenient way of rewarding, but where the idea is of great practical utility, it becomes a very costly and ruinous way. For instance, valuable ideas are thus locked up for years, after which time the patentee retires with a fortune of, say £20,000, and the idea is then thrown open to the nation. This reward has been paid to him indirectly by the nation. Against this payment has to be placed the benefits derived in the meantime from the invention, emanating as they would from the works of the patentee as from a simple centre. Now, it would have been cheaper to the nation to have paid the money—to have purchased the idea—from the first, and it would have been better for the inventor. The former would, during all these years, have been reimbursing itself from hundreds of centres, instead of only from one; and the latter would have come into possession of his reward at the beginning instead of at the end of the period.

Under the present system, therefore, when the idea is a valuable one, the nation is a loser in the same ratio as is the difference between the benefits derived from a simple centre and those derivable from hundeeds of such; whilst the inventor loses the interest of the money and the freedom from all care and anxiety which otherwise would have been his. When the idea is not valuable, or is doubtful, the present system of rewarding by means of a monopoly may be deemed a very convenient one. If the idea is useless, the nation pays nothing for it; should it, however, turn out valuable the inventor still secures a reward.

In any alteration of our patent system, endeavour, should, undoubtedly, be made to secure, if possible, the advantages just mentioned, and this can only be done by a combination of the two systems.

We have seen that, by itself, our present system of reward is a losing one. To destroy it, and to substitute in its place a system of purchase, which appears to be

Mr. Macfie's proposal, would certainly also prove a loss, and be most unpopular. It would never do to buy up every idea that was brought forward, as many would be worthless. This rejection would cause a great deal of dissatisfaction amongst the unsuccessful applicants, and those with whom the matter lay would very soon find this out, as an outcry would be raised which they would never silence. Again, many of the ideas deemed from their extreme simplicity as valueless, might —as has often been the case in patents—be afterwards found of great value. These would all be discouraged, and men would leave such altogether. These, therefore, which in many cases are but steps leading up to greater ideas, and so of, perhaps, even greater value to the nation than the others, would all be lost. Under a system of purchase only, therefore, there is good reason to believe that the progress of industrial art, instead of being, as now, onward, would be comparatively retrograde.

By grafting Mr. Macfie's proposition on to our present system, and improving the working of this last in every possible way, undoubtedly a vast stride in the right direction would be made. The commission would simply invite all intending patentees to submit their ideas to it first, with a view to a direct purchase, but without binding themselves to this. Every valuable idea could thus be purchased at once, and thrown open to the nation, whilst those refused could take out patents as hitherto. Thus, what was good in both systems would be secured, and what was bad avoided. The evils of a system of monopoly alone would be done away with, for the granting of a monopoly in useless ideas can do harm to no one. It would also hold forth not only the same, but even a greater inducement to inventors than hitherto, whilst those whose ideas had not been purchased could have no right to complain.—I am, &c.,

H. F. ALEXANDER.

Edinburgh, April 5, 1871.

MUSIC OF ORNAMENTAL ART.

SIR,—The above idea, suggested in the *Journal* of 24th February, in the letter of Mr. William H. Goss, appears to be worthy of further analysis and confirmation, and may lead to a clearer comprehension of that "truth in ornamental art" respecting which so much has lately been written. Cannot something be worked out of the suggestions of the writer of that letter? He says that ornamental art may "be compared in its effects to the emotions produced by music, or tune without song. The sensations are similar. Truth in ornamental art is the accomplishment of its promise or purpose. What is its purpose or promise? It is to produce a pleasant emotion in the mind which is undefinable in words. I am now speaking of purely decorative art distinguished from pictorial art, even as an aid. If any natural objects are introduced, they are so many words mingled with the music."

Now, this last sentence, which Dr. Dresser, in the *Journal* of the 10th March, held up as an example of illucidity, appears to me to be forcibly suggestive, even of a reconciliation of the great difference between the doctor and his reviewers as to the nature of "truth in ornamental art." If purely ornamental art is comparable to music, and the admixture of natural objects comparable to "so many words mingled with the music," then in the same work the strictly ornamental part may be pure art, as a good tune is pure music, while the natural objects introduced may speak a vicious language, as did some of the Pompeian representations, and so be like the words of a lewd song accompanying a good tune.

I perceive that Mr. Cave Thomas, in the *Journal* of the 17th March, claims the thought that ornament is music without words, but I have referred to it as the suggestion of Mr. Goss, because he expressed it in the *Journal* of the 24th February, three weeks earlier.—I am, &c.,

JOHN HARRY EVENS.

5, Fitzroy-square, April 18th, 1871.

WILD BEASTS IN INDIA.

SIR,—The letter of Lieut.-Col. Wragge, in the *Journal* of April 14th, shows that the wild beasts of India are formidable foes, not only to the progress of agriculture, but to human and animal life; and the question which naturally occurs to one, after taking note of the Colonel's valuable statistics is, whether the desultory war which has been waged against them is likely to prove any sensible and permanent check to their ravages? It does not appear to me to be at all probable. A raid upon the wild beasts of India, to be effective, must be organised and under command, and I have little doubt that a corps of hunters might soon be formed, and that the government of India would find it more economical to pay such a corps than annually disbursing large sums of money in rewards, and without checking the evil.—I am, &c.,

W. CAVE THOMAS.

GENERAL NOTES.

Mr. Ferdinand Kohn, who lately read a very able paper, on "The Different Methods of Extracting Sugar from Beet-root and Cane," before the Society, died on Tuesday morning, the 2nd inst., after a few days' illness. It is with much regret that this announcement is made.

Essays by Workmen.—The Working Men's Club and Institute Union have determined to invite the members of their affiliated institutions to record their ideas on sundry important questions which deeply affect the welfare of the people at large. They believe that much good may be effected by inducing intelligent workmen to write papers on subjects which lie within the scope of their own personal experience, and by making other classes acquainted with their opinions and suggestions. Prizes have accordingly been offered for the best essays on the following subject, and others will shortly be announced:—"The causes of the alleged absence of thrift and saving habits among a considerable portion of the industrious classes of this country, as compared with the same classes in other countries, and the remedies for this state of things." The union will be very glad to receive aid and suggestions in carrying out this useful work. They have also offered a challenge cup for competition among the workmen's cricket clubs in London, and a prize to the best chess player.

Artists' Colours and Pigments.—Sir Francis Grant, president of the Royal Academy, referring on Saturday last, at the annual banquet, to the surplus arising from the Exhibitions of Old Masters, said—It appears to the members of the Academy that there is no way in which they can more efficiently promote the interests of art than by using the surplus for the immediate establishment of a Professorship of Chemistry, the sole object of which shall be the study of the properties of colours, varnishes, &c., so as to insure, as far as possible, purity and, above all, permanency of colour. We should require the professor to give practical lectures on the properties of colour. The attendance at these lectures would not be confined to members and students of the Academy, but every facility would be granted to artists generally who might desire to be present. The professor would be expected to give information both as to oil-painting and mural decoration to any artist seeking information. We hope eventually, when the government buildings are completed, to be able to build on our own premises a laboratory for carrying out experiments with regard to colours if we carry out this project. It will, I hope, be a pleasure to the many distinguished noblemen, gentlemen, and ladies who have so generously contributed to these exhibitions of ancient pictures to know that their patriotic liberality has led to a result which must tend so greatly to the value and improvement of modern art. The Society drew attention to this matter in the course of Cantor Lectures delivered by Professor Barth.

New Zealand Salt.—The *Canterbury Press* says:—"It is rumoured that a bed of rock salt of considerable extent has been discovered to the north of the province."

Street Railways in Milan.—A company is formed in Milan for making a line of railway to be worked by horses, from the Piazza del Duomo to Monza, a distance of about 13 kilometres. The works will be probably commenced in May, and a contract has already been made with the omnibus company for working the line.

Gas.—Dr. Letheby has reported upon Dr. Eveleigh's method of producing gas at a low temperature in iron retorts. The peculiarity of the manufacture consists in the distillation of the coal at a low temperature, and the subsequent conversion of the volatile constituents of the tar into permanent gas. This gas is much less offensive than ordinary gas, and it is so rich in hydrocarbons that it cannot be burnt, from a standard argand burners with fifteen holes and a seven-inch chimney, at a larger rate than four cubic feet per hour, giving at this rate the light of 15·7 standard sperm candles.

New Zealand Flax.—The following resolution was recently carried in the Provincial Council of Otago:—"That an address be presented to his Honour the Superintendant, requiring him to offer sixpence per yard as a bonus for the manufacturing of matting or bagging from New Zealand flax, such bonus not to extend to a greater quantity than 4,000 yards, manufactured by one manufacturer." Dr. Hector announces that an exhibition will be held at Otago during the next session of the flax prepared in the colony. Manufacturers are therefore invited to forward to the Flax Commissioners, through the Superintendent of the Province, samples of materials prepared by them from the New Zealand flax. The samples should not be less than 20lbs. weight, and ten or fifteen fathoms of each rope will be sufficient, together with the particulars and cost of preparation.

The Propagation of Sound.—Professor Tyndall gave the first of a course of eight lectures on "Sound" on Thursday week. He began by ascribing all our sensations to a kind of motion conveyed by the nerves to the brain; thus, the effect of an explosion upon the ear is propagated through it as a wave or pulse which strikes on the drum of the ear, causing it to shiver; its tremors are transmitted to the auditory nerve, and hence to the brain, giving the sensation of sound. Illustrations were then given of the propagation of sound in waves, analogous to those of water; and a sonorous wave was described as consisting of two parts, in one of which the air was condensed, and in the other rarefied, the rate of propagation depending upon the elasticity of the medium. It was shown, by means of an air-pump, that sound cannot pass through a vacuum, and that it becomes very indistinct in an attenuated gas like hydrogen. The distant effects of great explosions, such as those of gunpowder-mills, were referred to in illustration of the enormous increase of the elasticity produced by the violent evolution of heated gas; and the formation and propagation of the waves of sound were strikingly illustrated by means of diagrams, by the wave-machine, and by tuning-forks, to which small mirrors were attached—the optical effects being thrown upon a screen. In reference to the velocity of the passage of sound, Dr. Tyndall stated that at the freezing temperature the rate is 1,090 ft. a second, and that it increases about 2 ft. for every degree of the centigrade scale added to the temperature of the air. Newton, who did not consider the change of temperature, gave the theoretic velocity at 916 ft. a second. The velocity of sound in water is more than four times its velocity in air; in iron, seventeen times; and in pine-wood, ten times. Among many other interesting illustrations, was an example of the "telephonic concert" of Sir Charles Wheatstone. The notes of a musical-box in a room two floors off were distinctly heard in the lecture-room, when a guitar was placed on the end of a deal rod connected with the box.

Solubility of Metals.—Mr. Charles A. Seeley, of New York, has communicated to the *Journal of the Franklin Institute* some results of his recent experiments on the solubility of metals without chemical action. He has been investigating the properties of ammonium amalgam, which, from the mercury being increased tenfold in bulk, and also from the fact that it is compressible in a syringe, recovering, however, both its volume and appearance on pressure being removed, he believed to be a mercuric froth rather than an amalgam. Further investigation led him to the discovery that ammonia was a solvent of all the alkali metals.

Oppossum Skins for Gloves.—Considerable purchases, says the *South Australian Register*, have lately been made of oppossum skins, for shipment to England, for the manufacture of gloves. Liberal prices have been offered by shippers, and it is to be hoped that the same may induce some of the unemployed to turn their attention to procuring them. The oppossum has for many years past been a great nuisance in the wooded country and hilly districts throughout the colony. The white gum trees in many localities have been almost destroyed by them, and the injury they do to gardens, orchards, vineyards, and wheat crops is astonishing.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

May 10.—On "The Application of Steam to Canals." By Geo. Edward Harding, Esq., C.E.

May 17.—On "The Utilization of Prison Labour." By Captain E. F. Du Cane, R.E., Surveyor-General of Prisons.

May 24.—*Derby Day.*—No Meeting.

May 31.—On "The Education of Women." By Mrs. Grey.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...**SOCIETY OF ARTS, 8.** Cantor Lectures. Dr. T. Spencer Cobbold, F.R.S., "On our Food producing Ruminants, and the Parasites which reside in them."
Royal Geographical, 8½. 1. Mr. R. H. Major, "Landfall of Columbus." 2. Dr. J. Haast, "Southern Alps of New Zealand."
Royal Institution, 2. General Monthly Meeting.

Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion on "Blast Furnaces." 2 Mr. Arthur Jacob, "The Treatment of Town Sewage."
Photographic, 8.
Royal Institution, 3. Mr. Charles Brooke, F.R.S., "On Force and Energy."

Wed. ...**SOCIETY OF ARTS, 8.** Mr. G. E. Harding, C.E., "On the Application of Steam to Canals."
Geological, 8.
Royal Literary Fund, 3.
Archæological Association, 4½. Annual Meeting.

Thurs...Royal, 8½.
Antiquaries, 8½.
Royal Society Club, 6.
Royal Institution, 3. Professor Tyndall, "On Sound."
Mathematical, 8.

Fri.......Royal United Service Institution, 3. Captain C. B. Brackenbury, R.A., "The Military Systems of France and Prussia in 1870."
Royal Institution, 9. Col. Jervois, R.E., C.B., Secretary of the Defence Committee, and Deputy-Director of Fortifications, "On the Defence of the United Kingdom."
Astronomical, 8.
Quekett Club, 8.

Sat ......Royal Botanic, 3¾.
Royal Institution, 3. Mr. Joseph Norman Lockyer, "On the Instruments used in Modern Astronomy."
Royal School of Mines, 8. Dr. Spencer Cobbold, F.R.S., "Geology." (Swiney Course.)
Associated Arts Institute, 8¼. Mr. Michael, "That Art should Appeal to the Many, and not to the Few."

Journal of the Society of Arts.

No. 964. Vol. XIX.

FRIDAY, MAY 12, 1871.

PROCEEDINGS OF THE SOCIETY.

TWENTY-SECOND ORDINARY MEETING.

Wednesday, May 10th, 1871; SEYMOUR TEULON, Esq., Vice-President, and Vice-Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Adron, Henry, 78, London-street, Greenwich, S.E.
Fielden, S., Centre-vale, Todmorden, Lancashire.

The following candidates were balloted for and duly elected members of the Society:—

Barratt, Thomas James, 91, Gt. Russell-street, W.C.
Carte, R. D'Oyley, 20, Charing-cross, S.W.
Harcourt, George, 21, Stafford-terrace, Kensington, W.
Hovenden, Robert, 5, Great Marlborough-street, W.
Hughes, Robert, 52, Clifton-street, E.C., and the Mount, Devonshire-road, Forest-hill, S.E.
McKenzie, James, 19, Osnaburgh-street, Regent's-park, N.W.
Stainbank, William Henry, Hoolikul, Coonoor, Neilgherry Hills, Madras.
Strode, Wm. Winstanley, 19, Osnaburgh-st., Regent's-park, N.W.
Williams, Philip, 19, Osnaburgh-street, Regent's-park, N.W.
Wood, Wm., Winchmore-hill, N.

The Paper read was—

THE APPLICATION OF STEAM TO CANALS.

By George Edward Harding, Esq., C.E.

The immense capital invested in canal property, and the extended lines of inland navigation throughout the various districts of Great Britain, Northern Europe, and the United States of America, causes regret that, while so much has been done in past years to develop the trading interests of these countries, such extensive internal communications have been suffered to remain dormant, burdened by the same defective system of navigation which, once ample for the transportation of goods when the pack-horse and the country wagons were their only competitors, now is in most miserable contrast with the perfected system and dispatch that characterises the management of the railways of the present day. The defects and delays in the transportation of goods *viâ* canal, not lessened by the private interests and conveniencies of drivers, boatmen, and others engaged in their traffic, where heavy boats are dragged from one destination to another at the slowest possible speed by the wretched beasts that lean for support against the towing lines, point to the necessity of a radical change, to redeem them from the position to which they have sunk in the competition of the day.

Commencing with the early history of canals, we propose to present some of the more prominent experiments which have been designed to improve the construction of vessels adapted to inland navigation, and the application to them of mechanical means of propulsion.

Save that the large drains cut by the early churchmen in the Cambridge fens seem to have been employed for purposes of occasional inland navigation as early as the fifteenth century, the great commercial republic of Holland may safely claim centuries of European priority in the construction of a system of artificial water-roads which the industry of its people had turned to a good account of prosperity and power. France, Sweden, and even semi-barbarous Russia, had also taken the lead in this respect long before England had entered upon her career of canal construction, though in Egypt, long before the invasion of Great Britain by the Gauls, and in China, at a still earlier date, we know of their introduction, yet their origin is undoubtedly merged in the system of irrigation which, for unknown ages, has been pursued in those countries. Certain authorities have claimed that during the invasion of England by the Romans the works executed by them in the Fen districts were also used for navigable purposes, but of this we have no tangible proofs. In 1623, however, we find from Parliamentary records that Sir Hugh Myddelton was engaged in considering a bill "For the making of the River of Thames navigable to Oxford;" while, 23 years later, one Francis Mathew addresses to Cromwell and his Parliament a paper upon the immense advantages of opening up a water communication between London and Bristol, which purposed making the rivers Isis and Aire navigable to their sources, with a short canal to connect their heads across the intervening country; but, for Mathew's time, a scheme for the construction of three miles of canal, even by the State, was far too daring, and a century elapses before a canal is made in England.

Andrew Yarrington, gentleman, next publishes, in 1677, a curious book, entitled "England's Improvements by Sea and Land, to out-do the Dutch without fighting, to pay debts without moneys, to set at work all the poor of England with the growth of our own land," in which he strongly contrasts the prosperous energy of the Dutch, especially regarding their inland water-communication, with the passive indifference of Englishmen to the immense advantages in their numerous streams and rivers lying dormant at their very doors, wanting only improvement in their existing beds with proper connection, to develop the trade and prosperity of the country.

To the lack of capital at this time can be traced the secret of the little progress of the internal communication of the country, and though Parliament liberally granted permission for river improvements, yet, from the want of money, few were attempted, or, if commenced, failed from the same cause.

About the beginning of the eighteenth century, the opening of the navigation of the rivers Aire and Calder gave a great impetus to the trade of that portion of Yorkshire, and stimulated the demand for improvements in inland navigation, and we find its first fruits in an Act of 1720, to make navigable the Mersey and Irwell, from Liverpool to Manchester; and, at about the same time, Acts for the improvement of the Weaver, Douglass, and the Sankey navigations were granted, and, what was more to the purpose, the works carried out. Again, in 1717, as a reference to the pamphlets of the British Museum will show, Dr. Thomas Congreve published some views, headed, "A Scheme and Proposal for making a Navigable Communication between the rivers Trent and Severn, in the County of Stafford," which paper project slumbered for forty years, till, in 1755, a survey was made for this very line of canal, under the auspices of the "Liverpool Corporation of Merchants," which line proceeded by Chester to Stafford, Derby, and Nottingham; and from Brindley's "Note-book" we find that he executed a fresh survey over the same ground in the years 1759-60, but at the expense of Earl Gower and Lord Anson.

Thus, it is not till the middle of the last century that English enterprise was fairly awakened to the necessity of a system of artificial canals; and directly traceable to the execution and extension of these earlier river improvements can we date the present system of internal communication, which has conduced so largely to the industrial prosperity of the English nation; and to the consequent increase of British manufactures and their distribution do all countries owe many of their indispensible comforts of life.

Apart from the deductions that would naturally follow from the river improvements, it is well known that, in 1755, the deepening and widening of the Sankey-brook, tributary to the Mersey, with the application of a floodgate for retaining tide water, gave the hint which culminated in the construction of the well-known Bridgwater-canal, under James Brindley; but the rapidity of extension was afterwards such that, between the years 1760 and 1803, no less than 2,295 miles of canal were opened. From the exceedingly interesting history of this Society, written by Mr. Davenport, we learn that the Gold Medal of the Society of Arts was awarded, in 1800, to the Duke of Bridgewater, as the father of inland navigation, and for his general exertions in promoting the interests of inland water carriage, since which date there seems to be no note of special award to the workers in this particular field of the economy of nations. Indeed, since the adoption of canals, except in the substitution of horses for men at the towing-lines, and some improvements effected in the manner of passing boats from one level to another, they may be truly said to have remained stationary in the general march of improvement, and, unlike all other arts, have partaken of none of the benefits arising from the increase of mechanical science. It is in the hope of calling attention to the fact, that by the exercise of a tithe of the mechanical ingenuity which has been expended on railways, canals might again assume a position and importance which, if not in general economy superior to railways, yet may, in relative utility, compete in the transit of minerals and other merchandise, that this paper is now before you, and the immense capital embarked in canals certainly renders it a subject of national as well as pecuniary importance. A further enumeration of the progress of canal construction in this country is unnecessary, yet a glance at the commencement of inland works in America will be interesting; and in connection we find, as early as 1724, Cadwalladar Colden, then Surveyor-General of the colony of New York, suggesting a system of works somewhat similar to those now existing. Sir Henry Moore, the Governor of the colony, in 1768, also recommended the improvement of the inland navigation. These recommendations slumbered through the Revolutionary War which followed, to be again projected with the independence of the country. As in England, the improvement of the existing navigations was first in course, and, as early as 1791, Acts for surveys and estimates relating to the removal of obstructions to the navigation of the Hudson and Mohawk rivers were passed. In the following year, the Western and the Northern Inland Companies were incorporated, and, by 1802, the former company had succeeded in spending an immense sum of money, with but very small proportional results. The route now occupied by the Great Erie Canal was adopted in 1812, repealed in 1814, to be again revived two years later. Ground was broken near Rome in July of the same year, while the first boat passed from Lake Erie to the Hudson in October, 1825, thus consuming a little over eight years in constructing the distance of 364 miles, with a total of 71 locks. The Champlain Canal was commenced in 1816, and completed in 1823, since which date the many lateral branches of the Erie have been added to the system, and the application of inland navigation extended to many of the other States. It is a fact of interest that the original dimensions of these canals were established by the commissioners in 1817 at 40 feet in width by 4 feet deep, with locks 90 feet by 15; but, as early as 1834, the wants of a growing commerce demanded an increase of capacity, and in 1835 an Act of enlargement of the Erie Canal was passed, since which time the depth has been increased to 7 feet, its width to 70, and the locks to 18 by 110 feet. Before the commencement of the Erie, the cost of transporting a ton of merchandise from Buffalo to Albany equalled £20, and consumed 20 days; the canal at once reduced the cost to £4, or one-fifth, and the time to eight days. But mark, that the mere enlargement of the canal again reduced the average cost of movement, including all tolls, to ten shillings per ton, or one-eighth of the expense previous to the improvements. It may be interesting to review some of the more or less ingenious attempts to overcome the disadvantages of towing by horses, and hastily glance at the various methods of propulsion by mechanical means, which have been especially designed to supersede animal labour in propelling boats on inland navigable waters, in Europe and America, up to the present time. In this emuneration we shall necessarily find among the first experiments some which have been broadly designed for purposes of general navigation, and touch upon the early history of the steam-engine, but, so far as possible, preference will be given to those where application to canal or river navigation has been the paramount idea of their inventors.

In 1472, long before canals, attempts had been made to substitute for the manual labour of oars the propulsion of boats by wheels moved by oxen; while, on the 17th of June, 1543, with a precision of date which throws much doubt on the probability, the Spaniards claim the construction of a steam-moved vessel. Mention of galleys driven by side wheels are found in the years 1578 and 1587; while, in 1618, David Ramsay obtained a patent from the Crown to apply engines "to make boates for the carriage of burthens and passengers runne upon the water as swift in calms, and more saff in storms, than boats full sayled in great windes;" and again, in 1630, was issued to him a second patent for a similar purpose. The many schemes for propelling boats which have been carried to a farther or less degree of experiment or practical use since Ramsay's day, are too curious not to be classified, and at the risk of tediousness, the manner and means for obtaining power of various kinds are enumerated:—From wind, by sails, kites, balloons, and windmills on deck; from oars, worked by men, animals, and steam; from paddle-wheels and screw-propellers placed in every possible part of a vessel, and variously constructed and driven; from the vessel's motion, and from the motion of mercury; from the current-operating machinery on board; from springs and from weights differently operated; from the explosion of gunpowder, and from gases, either generated or exploded; from the discharge of steam, compressed air, and from falling water. Electricity is to afford the motive power in six instances; while an endless chain lying upon the bottom of the canal, and passing over various parts of the machinery, has strong advocates. Some haul the craft along by a rope fixed on shore, and some again by a smooth or rack-rail on the banks, with which wheels driven from the boats engage. Thirteen sanguine inventors claim that a locomotive moving along the canal, and towing after the manner employed by horse-boats, is the only solution of the vexed question, while nearly as many believe that an atmospheric railway is the only system suitable. The larger number of workers in this field have affected the direct discharge of water at the stern as the greatest good, a less number by the discharge of air in various ways. One by discharging fire under water is peculiar, though hardly so curious as Congreve's device of sponges for propelling a vessel by capillary attraction, forming a kind of perpetual motion. Several of the earlier motors were to achieve their end by thrusting poles against the bottom of the canal, two by water in a tube on the shore suitably connected with the boat. Bourne and others advise either wheels rolling on the bottom or the adoption of screws so working, which seem to have many disadvantages, but the action of reciprocating rods, armed with fixed floats or valved pistons, shaped as wedges, cones, or as hollow vessels, and worked at the sides or under the bottom of the boats, either in or out of channels, has always been a favourite plan, opposed again by a numerous class who allow the reciprocating motion, but insist that moveable floats only can succeed. Variations of this last consist in hinged boards and collapsing propellers, operated in divers ways, while some, in their search for novelty, call all the others wrong, and place the floats at once upon an endless chain, by which they hope to use less power and gain more speed. Water or steam acting in flexible tubes end the list. Among all our counsellers whom shall we select? Some of these devices are deserving of more than such wholesale notice, and we will particularise a few of the more prominent. Passing over one hundred and fifty years, during which time we have the invention of the steam-engine, and the early labours of such men as Papin, Savery, Jonathan Hulls, James Watt, and Symington, we reach the invention of Patrick Miller, who, in 1787, especially claimed an application of machinery for the purpose of inland navigation. His invention comprised either double or triple vessels, having two or three separate hulls, with one deck over all, with paddle-wheels, of any required number, placed in the space between the hulls, so as to be submerged to an advantageous depth. Originally designed to be operated by a capstan worked by a windmill or manual power, the arguments of Symington, who applied the steam-engine, changed the original idea of motive power, and successful experiments were made, in the summer of 1788 and the winter of 1789, upon the Forth and Clyde Canal, where a speed of nearly seven miles an hour was obtained. Notwithstanding this success, it seems that Mr. Miller did not consider the invention as practical, since, in 1796, we find Miller again applying for a patent for the construction of vessels propelled by wheels worked by capstans, as in the original scheme. In 1788, John Fitch, an American, obtained a patent from the States of Pennsylvania, New York, New Jersey, and Delaware, for the application of steam to navigation, and also successfully opposed the application of James Rumsey for a similar patent the same year. Fitch succeeded in driving his steam-boat eighty miles in one day, by means of six oars or paddles working perpendicularly on each side of the boat, similar to the strokes of the paddles of a canoe, but his invention came to no practical use. Rumsey, who had been refused a patent in his native country, came to England, and in November, 1788, obtained letters patent of Great Britain for propelling boats on rivers and canals, by alternately moving a valved box backward and forward under the keel of a vessel by means of his steam-engine. The box opened toward the stern, was provided with a valve at the forward end, which, opening as the box moved forward, allowed the water to pass freely, but, closing with the opposite movement, propelled the boat ahead. A second part of his specifications describes an arrangement for drawing water at the bow into a hollow longitudinal trunk parallel with the keel, and discharging the same at the stern by the reciprocating strokes of a large pump. Rumsey also devised two wheels projecting from the bow of a canal-boat, which carried an endless chain with floats. The current was supposed to actuate this mechanism, which, by operating a series of poles for pushing against the bottom of the channel, propelled the boat. The similitude of the plan with that of a man lifting himself over a fence by the straps of his boots is obvious. The death of Rumsey, in 1792, prevented any practical application of his inventions, though his associates, in the spring of 1793, obtained a speed of four miles per hour on the Thames, from a boat arranged upon his pump system as described, which boat Rumsey had nearly completed at the time of his death. Next in order, in the year 1801, Mr. Symington was employed by Lord Dundas to experiment, with the view of substituting steam for the horse boats on the Forth and Clyde canal. After two years experimenting, and at an expense of over £7,000, the *Charlotte Dundas* was completed, and launched on the canal in March, 1803. In this boat were first combined all the principal features of our modern paddle-wheel steamers, viz., the double reciprocating engine, with connecting rod, and the crank on the axis of the rotary paddle-wheel. The paddle-wheel —for there was but one—was placed near the stern, in the centre of the boat. This seems to have proved a perfect success in regard to self-propulsion and towing of other boats; but though the efficacy of the system was proved, the opinion of the canal proprietors that the waves it created would damage the banks prevented its adoption. Notwithstanding the decision of the Forth and Clyde managers, the Duke of Bridgwater, after a careful investigation of the advantages and the supposed drawbacks, gave Mr. Symington an order to build eight boats similar to the *Charlotte Dundas*, to ply on his canal, but the death of the Duke, soon after, prevented the execution of the scheme, and poor Symington and his canal navigation were neglected together. The ingenious experiments of Stevens, Evans, and Fulton, in America, about this time, being applied for purposes other than canal propulsion, do not particularly concern this narrative, for although, in 1796, Fulton published in London a treatise on canal navigation, wherein he advocates raising and lowering boats by means of inclined planes, yet he makes no mention of steam-boats therein, though in January, 1803, he described some experiments with paddle-wheels as more advantageous than the system of chaplets or endless band of floats for propelling a system of boats, which were designed to be formed with bows and sterns convex and concave, so that several would form a line with almost continuous sides. Yet he does not seem, even after his practical success on the North River in 1807, to have again advocated steam for canal uses. In later years, this arrangement of boats has been revived again and again. Richard Trevethick and Robert Dickinson took out a patent in 1809 for moving an oar, provided with valves, forward and backward in a channel under a boat; and two years later one Rose received a patent for constructing a canal boat, with water-courses open to the water below and at each end, with two or more paddle-wheels and cranks acting on the water. No drawings are known to be in existence of these plans. In this same year were also granted two patents for propelling boats by discharging water at the stern by means of a steam pump, similar to Rumsey's principle, but no experiments are noted. In 1812, but one patent was issued for improvements in canal navigation, where endless bands traverse over wheels at the end or sides of a vessel, and carrying hinged floats to act on the water when propelling the boat, but caused to lie flat on the reverse stroke in a manner not plainly described. In the following year, we find an invention by Thomas Mead, who proposes a double endless chain moving around two wheels above and below two parallel tubes; on the chain belt are a series of pistons packed so as to pass steam-tight through the tubes. Steam from the boiler forces the pistons continuously along one tube, at the end of which they are successively detained and released by catches, and pushed forward a small distance by eccentrics. The steam escapes by a hole in one of the tubes, which is uncovered at proper times as the pistons require. In 1815, Richard Trevethick patented a screw propeller, consisting of a worm or screw, or a number of leaves placed obliquely round an axis, which revolves, preferably, within a cylinder at the head, sides, or stern of a vessel. In some cases the screw is to be made buoyant, and works in a universal joint, the advantage of which construction is hard to perceive. John Millington, during February of the year 1816, lays claim to a propeller more modern in its features than any preceding. He also claims forcing air into tubes, which operated against the water at the stern to propel the boat. In the same year, we have an arrangement with several cranks on the side of a vessel connected with each other by horizontal connecting-rods, upon which are placed vertical vanes of a curved shape, so as to act upon the water by the revolution of the cranks one way (but carried forward above the surface); and in the next a method of propulsion by operating oars, held vertically at each side of the boat, in a similar manner to Fitch's earlier experiments, except that, by means of cog-wheels, the oar blades were feathered to pass edgeways through the water during the return stroke. About the same date, Niepce proposes propelling a boat by the pressure on the water of the gas and rarified air produced by the inflammation of the essential oil of resin injected at intervals into an air-reservoir and there ignited. The gases pass through tubes provided with valves into a well, from which they expel the water with force along a tube opening below water-mark at the stern of the boat. By the use of two receivers, and by spiral blowers refilling the air-reservoir, the propulsion is effected more evenly.

In 1818, John Scott patented an arrangement by which forked poles, operated by wheels, push against the bottom of the canal, and, in case the depth is unusual, broad vanes at the ends of the poles thrust against the water, and are lifted into the air for the return. We also find in this year hinged floats fixed to a reciprocating chain under the vessel. Two years later, George Lilley and James Fraser recommend the application of a forcing-pump to constantly supply water to a cistern upon the deck of a boat; while, by means of a condensing air-pump, the pressure of the air in the cistern is increased until the force of a stream of water, conducted from the bottom of such cistern to the stern of a boat, shall drive the vessel forward. Vanes driven by an engine, and oscillating through part of a revolution in an air-tight cylinder or drum floating upon the water, are also found to propel a boat, by alternately receiving water on one side of the vanes and discharging it from the other; and, in this same year, a sanguine inventor claims applying the paddle-wheels astern, or in the rear of the vessel, and so arranged that the part of the vessel which carries the machinery may be separated and applied to the stern of any number of vessels in succession to propel them. The next year, we have four inventions. The first places the propelling wheels in a horizontal position at one side of the deck, with the floats feathering as they return, folding against the periphery of the wheel by means of suitable levers, cog-wheels, and inclined planes, and thus prevent resistance to the water. The second revolves one or more pair of paddle-wheels in channels or sluices in the vessels, whilst the third, disdaining the aid of steam, operates his paddles entirely upon the treadmill system. The last is a repetition of the endless chain and floats. In 1822, the Brothers Binns claim the application of a rotary steam-engine with wheels feathering the floats by reason of loading the bottom edges of the paddles proportionate to their surface, which hardly seems certain in action at even a medium rate of speed, and a few months after, we have one of the earlier claims for increasing speed by the use of geared engines, though not specially claimed as applicable to inland navigation. In February, 1824, Moses Isaacs, whose name inclines us to the belief that he was of Jewish extraction, patents a swinging "fiery" furnace, which alternately heats three boilers, while the steam from the cylinders is received by the boilers first heated and now cooling. This scheme is decidedly visionary. An "ichthyodic oar" is next claimed by one Busk, which he describes as a "wedge between two planes under water moving back and forward, turning on an axis through its thick end, and so as to touch with its sides each plane alternately. Valves admit the water, and close when the wedge forces the water against them. The oblique pressure of the sides of the wedge on the water propels the vessel. In a modification of the above, a wedge is caused to move up and down in the water with its thick end forward and its edge horizontal, and includes in the specification revolving cones, with their axes horizontal and points turned towards the stern. He also presents as a novelty the pumping of water through tubes which, in his fondness for original names, he baptises as a "Hydropetic propellent," and the very next month, in partnership with James Neville, he desires protection for drawing along a boat by opening and shutting planes fixed at the bows after the manner of the covers of a book, and also claims forcing air through tubes against the water. Two months later this same irrepressible William Busk appears as the inventor of a method of propulsion evidently taken from the action of the tail of a fish. An elastic plate, fixed at one end to an axis, is caused to vibrate back and forward in the water, or two such plates revolve from a projecting shaft at the stern; but Busk, with all his ingenuity of devices and nomenclature, does not appear to have realised either fame or fortune, and he subsides for a couple of years, when he brings up two other arrangements, quite as theoretical and impracticable as any that preceded them. The first record of invention in which a chain lying in the water of the canal, fast at one end, and passing round a wheel on board the vessel, which wheel being turned by machinery the boat is propelled, leaving the chain behind on the bottom, is found in Samuel Brown's claim of March 15th, 1825, and is worthy of note, having been revived at various periods, and even reported at the present time as in use in Holland. The disadvantages of this system in regard to passing locks and bends of the canal militate against it. As a modification of this principle, we were lately shown a plan whereby a heavy chain was tried on the Bridgwater Canal, but instead of using a direct pull as the propelling power, the chain was taken on board over the bow, and lowered, with considerable slack, vertically over the stern, the gravity of the hanging loop being expected to move the boat forward. It is unnecessary to add that this failed as a practical means of propulsion. In this year John and Samuel Seaward patent the employment of a wheel or wheels placed in an opening or well through the bottom of the boat, and revolving upon the canal bottom, or against the sides thereof, and by that means to propel or draw the vessel forward. These wheels were provided with projecting knobs on their peripheries, in order to take a firm hold of the ground, or, if desired, projecting arms or radii could be used, in which latter case the arms were arranged to slide in and out of hollow spokes, so as to freely compensate for inequalities of the bottom. We can imagine some difficulties and considerable mud involved in the practical solution of this problem. Next year we have paddle-wheels at the bow or stern, which lift on deck for convenience in lockage, and also the employment of kites for drawing vessels; the multiplication of these kites was to give "indefinite power," and very indefinite it would be surely, not perhaps in the sense intended by the over sanguine inventors. Congreve's device we have already mentioned. This patent, issued in 1827, comprises a broad, thick band of sponge around a cylinder free to revolve in the water. The water rises into this band on one side by capillary attraction, and an endless chain compressing the band by its weight on the other squeezes the water out. The difference in weight between the two sides causes the cylinder to rotate and to draw the vessel on, or to move paddles to propel it. Glass or metal plates may be used to create the capillary attraction, and mercury in a tank instead of water. No boats on this system are known to be in use. This year also brings out an invention for propelling boats by setting in motion the system of levers commonly known as "lazy tongs," and probably intended to have hinged floats at its extremities; and, three months later, an idea is made public where hinged vanes obtaining their reciprocating motion from rocking shafts are employed. In 1829, two spirals at the stern of a boat, and covered by removable plate iron cylinders, to protect the banks from injury, is claimed by Julius Pumphrey; in 1831, a scroll-shaped propeller, revolving in a scroll-shaped case, by William Hall; while, in 1832, Woodcroft patented his increasing pitch screw-propeller, applied at the side or at the stem of a vessel or boat; but what Fulton did for the paddle-wheel in America, and Bell in this country, namely, its practical introduction, we must award to Ericsson in respect to the screw-propeller. Captain John Ericsson, as the first actual demonstrator of the submerged screw-propeller, in 1837, has afforded us a means for propelling boats on narrow water-ways, without the disadvantages arising from the use of paddle-wheels operating upon the water surface; for although besides those lately mentioned, Bramah, in 1785, patented a propeller on the principle of the sails of a windmill or the blades of a "smoke-jack," Littleton, in 1794, Fulton, in 1798, and Edward Shorter, in his claim for "a perpetual sculling machine," in 1800, yet to Capt. Ericsson is due the credit of the first successful improvement, carried out in May, 1837, on the *John O. Sergeant*, with a double propeller, though his patent is dated nearly a year previous. The success of this steamer induced the construction of the *Robert F. Stockton*, which, though provided with a double propeller similar to the *Sergeant*, was as frequently worked with one only. After several trials of her powers in England, she crossed the Atlantic in 1839, where she was at once sold to the Delaware and Raritan Canal Company for towing their boats. The value and importance of the screw to navigation having been clearly demonstrated of practical value, a number of screw boats were put on the lines of inland navigation which connected Lake Ontario and the St. Lawrence *viâ* the Welland Canal, and also on the route of the Chesapeake and Delaware Canal, which united the Chesapeake Bay and the southern waters with the River Delaware and the north. As instancing the capability of canals even in competition with railways, we find, according to Woodcroft, that the introduction of the small screw steamer, the *Ericsson*, between Philadelphia and Baltimore, by the inland route of the Chesapeake and Delaware Canal, completely ruined the goods traffic of the Philadelphia and Baltimore Railway. In the competition with this single vessel, the railway was compelled to reduce its passenger fares one half, and even with the attempted aid of the state, it lost its entire freight business. Capt. Ericsson also built, in 1839, an iron screw propeller, named the *Enterprise*, to run as passenger boat on the Ashby-de-la-Zouch Canal, but the introduction of railways prevented her being profitable for this purpose, and she was afterwards used to tow coal barges on the Mersey and Trent navigations with entire success. Returning to our inventors, we find Sir John Scott Lillie patenting, in 1836, the application of atmospheric railways for towing canal boats, but the practical inconveniences which have hitherto prevented the use of locomotives along the canal banks for the same purpose would hold ground as strongly here. Intending to overcome all objections, an enthusiastic American started a joint stock company, about two years since, for the purpose of constructing an elevated double railway over the line of the Erie Canal and its branches, from which the boats underneath could be towed at any speed; but the estimates of cost certainly exceeding four and a-half millions, while the dividends were not so positive, there yet remains opportunity for English subscribers to invest. However, this only goes to prove the awakening to the necessity of applying to canals some of the attention and improvements so liberally bestowed on all other carriage systems, and, sooner or later, a fortune will reward the lucky inventor who shall solve the great problem of canal propulsion. In case of the ordinary shaped boat being dragged along the canal by steam towage, any increase of speed, commensurate with the expense incurred, will create a wave more destructive to the banks than the use of an ordinary propeller, so that any system of railway towing requires the adaptation of a complete fleet of boats specially devised for high speeds with small resistance. For the tables on the resistance of canal boats at different speeds, and the disturbance of the water surface, reference is advised to the experiments of Stevenson in 1818, Beran in 1832, of Palmer, as published in the first volume of the "Transactions of the Civil Engineers," with Professor Barlow's report thereon, and those conducted by McNeil on behalf of the proprietors of the Forth and Clyde Canal.

This paper would be incomplete without mention of the experiments of Fairbairn in 1830 and 1831, as instanced in his "Remarks on Canal Navigation, illustrating the advantages of steam as a moving power on canals." The preliminary experiments of light single and double gig boats on the Forth and Clyde Canal, moved at a high rate of speed and variously loaded, as well as the partial success of the steamer *Cyclops*, built under the direction of Mr. Grahame, of Glasgow, with a single stern paddle-wheel, induced Mr. Fairbairn to suggest the construction of a small steamer named the *Lord Dundas*, 68 feet in length by 11 feet 6 inches in breadth, and 4 feet 6 inches in depth, provided with a wheel through 3 feet 10 inches wide and a paddle 9 feet in diameter, driven by a 10 horse-power steam-engine; but he also recommends, as an after improvement, a steamer with two narrow paddles, close to the stern, and on each side of the rudder, urging that this plan would remove every impediment to the free access of water to the paddles, and allow an open outlet for the discharge, the paddles to be protected by fenders, sliding down on the outside of the wheels. Mr. Fairbairn figures the cost of conveyance of a passenger by steamer between Edinburgh and Glasgow, fifty-six miles, at twopence, or less than a fifteenth of the least possible expense by horses. Though the results given by these boats were not, in practice, so satisfactory as expected, yet Mr. Fairbairn never despaired of a future when steam should be as universal in inland navigation as it at present is in all other of the arts.

Following up the interest which about this period seems to have been excited on canal behalf, we have an influx of applications of machinery to inland water propulsion, many of which are but modified forms of the less elaborate devices we have already mentioned, in which the paramount idea of their authors would seem to be that of advancing the boat without creating a wash damaging to the canal banks, and with arrangements for discharging the water directly aft or directly down, while some have curved platforms, or "*wave quellers*" to moderate the swell produced by the propelling machinery.

For actuating vessels on canals, one Henry Pinkus submits a railway constructed alongside, with one rail, on which a suitable carriage traverses. A tube conveys gas along the rail from a stationary engine and reservoir. The gas is brought through a longitudinal valve on the rail tube to a flexible tube from the carriage to a reservoir on board the vessel, and from the pressure here derived machinery is set in motion, which again, by an endless band, turns two horizontal wheels (one on each side of the rail) on shore, and supported on the carriage before mentioned. Finally, these wheels, by revolving, draw the carriage forward, and the carriage, in its turn, tows the vessel. We can imagine that this plan would never depend upon its simplicity for success. The same inventor offers the plan of a steam-engine on a vessel driving a horizontal wheel, which, by an endless band, turns on shore a pair of horizontal wheels similar to those described, and these, by revolving, tow along the vessel. The carriage holding these wheels has a curved guard arched over it, formed like the rail on which the carriage runs. This is to enable another carriage meeting it to pass over the first, thus providing for the use of the same rail by boats travelling in opposite directions. In place of the steam-engine, the machinery on board may be turned by an electro-magnetic-engine, actuated by electric currents from on shore. Whether this "leap-frog" arrangement for passing-boats could be extended to skipping playfully over the locks is not stated.

A claim, in 1841, proposes a locomotive steam-engine on the towing-path to drag itself along a chain fixed at one end, and the boat by a towing-line to the engine; while another alternately expands and contracts an elastic sack in a water-channel along the bottom of the vessel by the smoke from a furnace, and thus ejects sufficient water to propel the boat. Later on, there are variations of this. Still another drives an upright shaft in a vessel which carries a horizontal grooved wheel, on which is an endless rope, moving a drum on a carriage on shore, by which its wheels are turned, so as to advance the carriage, which then tows the craft along. The carriage is guided by a wheel in front, directed by a man. Steam is made to issue from a pipe against the air in one, and cog-wheels working into a rack-rail on the banks in another, while a third places an exhausted atmospheric tube at the bottom of the canal, and moves the boat above by a travelling piston. A fourth inventor makes his tubes of wood, and places them upon the banks, or on piles driven along the canal. In fact, "about this time," as the almanacks say, the numbers that considered themselves each the sole possessor of the idea of working canals by atmospheric pressure is amusing. In 1847, we have flexible tubes placed under water on each side of a boat. They are alternately filled with steam and allowed to collapse. The boat is supposed to advance by the action on the water of the protuberant parts of each tube. There is certainly no needless complication of details about this. In this year we find proposed the towing of canal-boats by compressed air contained in portable reservoirs, and an arrangement added to heat the air, in order to restore the caloric lost by its expansion. The next year, a patent is granted for a tube laid along a canal, and water forced through it under pressure enters nozzle-pipes, fixed at certain intervals along the tube. Connected to the boat to be propelled is a receiver, with a series of open cells, and as these pass under the end of a nozzle-pipe a valve is opened which allows the water to impinge on the cells successively, and thus force on the boat and the receiver, until they set the next nozzle-pipe in action, and close the valve of that which is passed. Still, notwithstanding the ingenuity of this scheme, one would desire much solicitation to invest in its success. Next, we have a shaft extending the entire length of the vessel, with propellers on its projections working one at the bow and one at the stern. The advantages of this novel feature are not mentioned. The last of 1851, a patent for fastening iron rails upon walings, supported on piles, and extending the entire length of the canal on both sides was issued. Wheels on each side of the boat, and driven by a steam engine, are rotated on these rails and pull the boat. Instead of locks, the boats move up inclined planes, gear wheels engaging in racks on the walings, while rollers at the bottom support part of the weight. Unless compensated for all variations of water level we might expect to find occasional lines "high and dry." In 1856, a provisional is filed for propelling boats by discharging a stream of fire from an inflammable composition in a tube into the water at the stern, but, from want of faith or of means, the scheme was abandoned. At a later date, John Bourne patents an arrangement of propellers at the bow, or paddle-wheels at the side to work on the bottom in shallow water, "and thus clear it away" and propel the vessel.

With their usual ingenuity and perseverance, American inventors have explored this branch of engineering practice, but, like their Transatlantic brethren, have taken the question of mere propulsion as the desired end, attaching thereto some device to still the agitation of the water, and very similar schemes in this field to those already touched upon have been the result of their labours. The question is not that of a motive power alone, but simple application of the motor that will prevent waves at the bow, suction and settling at the stern, and afford a mean speed of from three to four miles per hour when fully loaded, with a minimum quantity of fuel. The propelling machinery must be simple and compact, that it may be managed by men not especially educated for the purpose, to economise both space and expense. These are the requisites, and a boat fulfilling the conditions will be sure of success.

Some 25 years ago, Captain Ericsson launched a boat with a screw propeller at each side of the bow for the Champlain Canal. There was no difficulty in the propelling force, but it did not carry sufficient cargo to be profitable. Henry R. Worthington, five years later, ran a steam canal-boat from New York to Oswego during one season. This vessel had a skew paddle-wheel on each side of the bow, and a *fighting crew* to overcome any *prejudices* which the opposition boatmen should venture to express. Notwithstanding the *extreme force of the arguments* employed, the enterprise was abandoned with the season, there not being sufficient capacity for a paying freight. A boat was fitted with feathering side-paddles, some 16 years ago, by John Baird, for the purpose of towing barges on the Erie Canal, but not carrying cargo itself, and depending on the tonnage fees from the old boats, failed to be a pecuniary success. In 1860, there was a line of sharp propellers built in Buffalo, New York, which, with an expenditure of from three to four tons of coal per day, averaged six and seven miles per hour. The annoyances caused by the opposition of the horse-boats, and the heavy expenses of fuel and engineers, caused their removal to a lake route. Wire rope traction and submerged chains have been frequently tried as well, and found wanting, the canal locks and numerous bends having so far proved insurmountable obstacles.

As late as last year, the duck-foot, or expanding propeller, so many times tried in England, was attempted in Albany, New York, by Mr. Cornelius T. Smith, and also at Cumberland, Ind., by Mr. Marshall, without satisfactory results, while a Cincinnati doctor, abandoning his pills, conceived that he had hit upon the correct thing by the similar device of a reciprocating hinged shutter. The result made more noise and waves for the canal than greenbacks for his pocket, and our worthy disciple of Esculapius returned to his surgery. At Lockport, New York, a wheel with spokes on the surface, made so as to rise and fall in a recess in the boat, and rolling along the bottom of the canal, was lately tried. It was driven by a chain, and so propelled the vessel. No provision for deep water or soft mud being made, this enterprise came to grief. A scheme now being tried consists of a canal tug-boat provided with an endless band or chain on each side of the boat, carrying paddles, which, dipping in the water to propel the vessel, return through the air in a manner akin to similar plans which have been tried here and abandoned. There has been a large sum of money expended, and a frightful noise is produced, still otherwise it is not considered a success.

We close the list by calling attention to the arrangement for applying steam-power to canal-boats, which has been recently designed and practically operated in the United States by Mr. Thomas Main, mechanical engineer, of New York, and presented in longitudinal section and plan on the diagram. It will be seen that it possesses all the happy features for obtaining propulsion by steam on narrow channels, for which many have striven, but none before fully accomplished; but, as has been justly remarked by a modern writer, "an invention is progressive in a regular series." There may be a long order of elementary principles developed without the occurrence of a single practical result, so far as any useful application is concerned, but the perfect machine will be found by somebody. Analyse the diagrams, and there will be found a propeller placed in the bow of the boat (its advantages are readily seen), working in a channel underneath the vessel. The peculiar sloping of the channel is the most convenient arrangement for overcoming any tendency to create a wash, which has been, in some form or under some name, the object of several inventions. The high pressure machinery and tubular boiler is the very locomotive engine so strongly urged by Mr. Fairbairn, only in this instance the inverted cylinder and upright boiler economise the space to the utmost. In fact, the general position of both the channel and the motor interferes least with the cargo-bulk, and the water, after passing the propeller is deflected in the line of least resistance and passes under the entire length of the boat to form scarcely a ripple upon the surface, while the channel sides are a safeguard against any lateral waves. It may be asked if the peculiar shape of this channel does not cause friction of the water, and great loss of power. This would certainly be inconvenient in any case of high speed, but in the slower movement of canal traffic, we shall not find any appreciable loss from this cause. A boat constructed on this principle has been for some time regularly employed upon the Erie Canal in America, carrying, besides the machinery, 200 tons of cargo at a rate of three miles per hour including lockages, or 72 miles in 24 hours, consuming only a ton of coal at five dollars, against 28·50 dollars for two days' horse towage for the same distance—a saving of half the wages of crew, and transporting the goods in the same proportion of time—and additional to its own cargo, can tow a similar loaded barge at very nearly the same speed. This boat can go through a lock in six minutes against 12 minutes required for a horse-boat, and is then handled by one man with ease. There is no injurious action on the banks, and the boat can leave the canal, and proceed as quickly and safely on river navigation with her self-contained power. In 12 months, such a boat, 70 feet long by 16 feet wide, and 9 feet depth of hold, with an eight-inch cylinder, driving a 4½-feet propeller, can pay for her entire cost from the saving over horse boats, to say nothing of the certainty and despatch which alone ensures the confidence of the mercantile community, and is the foundation of extensive patronage. Every comparison between the expense of steam *versus* horse carriage that is attainable, gives great economy to the former system; and sooner or later, with her canals enlarged, and steam-propelled boats giving a system of trackage indefinitely superior, cheaper, and more regular than anything hitherto dreamed of, England's internal navigation will take a position worthy of those talents that conceived them. The party of croakers who are ever found in opposition to improved communication, will, with the present *employés* and certain railway interests, loudly cry out against any innovation trenching on this special province, and predict sad disaster to the country by any interference with the ancient customs now cherished so fondly; but if the step is not now taken in the spirit of enterprise, it will be forced upon the country as a necessity, after other nations shall have led the way. Notwithstanding the immense amount of freight conveyed by railways, now burdened nearly to their utmost limits, we find trade, with its gigantic strides, tasking the carrying capacity of the canals in spite of their many disadvantages, and ever steadily increasing in its demands. In 1835, before the opening of the London and Birmingham Railway, the through tonnage conveyed on the Grand Junction Canal was 310,475 tons, and in 1845, after ten years opposition of this road, the tonnage had increased to 480,626 tons; while, at the annual meeting of the canal proprietors in 1860, the receipts for the previous six months had been the largest ever experienced.

America, at the present moment, is alive to the necessity of canal improvement. Nearly £4,000,000 have recently been recommended by the Canadian Canal Commissioners for the enlargement and construction of slack water navigations. And, within a few weeks, the Legislature of New York have introduced a Bill, offering a reward of 100,000 dollars for the best plan of canal navigation, in the substitution of steam or other motive power for animal labour; and England should not remain backward in the race, especially since to her canal system she owes so much of her present prosperity and greatness.

The cumbersome barge, with snail-like advance, feebly contrasts with the iron horse, thundering by with its speed and power. Yet, improved as they should and must be, canals will always continue to form an essential part of internal communications, to be missed quite as much as roads, railways, or even the telegraph itself.

In conclusion, the author expresses his sincere regret that this glance at the canal systems, and the mechanical methods which have been suggested as applicable to the propulsion of their boats, had not fallen into abler hands. Its compilation has been gathered from many sources and authorities, with but limited time spared from usual avocations. But trusting that it may at least draw attention to a most important field in the economy of nations, such as it is, this paper is presented in the hope of a favourable reception.

DISCUSSION.

Mr. Hyde Clarke said he might contribute a small, personal portion to the history of the subject, having been one of the minor actors in this movement from about 1836 to 1840, when he was one of those who had the misfortune to be an inventor, although, happily, he had escaped figuring in the satirical list given in the paper, which was probably owing to his having escaped the hands of their friend Mr. Newton, the patent agent. He recollected that, being a young man, he gave his own views without much reference to what other people had done, and some of his first publications on the subject in the *Railway Magazine* having attracted some attention, he was attacked by a leading man in Liverpool, who accused him of plagiarising his ideas. Since that time he had always been very careful how he published anything as original; but it always happened that when any subject of real importance was engaging the attention of the public, a number of persons were engaged upon it, and each thought himself the first, and was ready to treat any of his contemporaries who broached the same ideas as having borrowed them from him. His attention had been attracted to the subject from having seen the great advantage to traffic in the Netherlands, which had been developed for centuries, and in his early days it was a regular part of the tourist's scheme to make a journey by the canal-boat. It was always recommended by the "Murray" of that day; and though there were no Cook's tourists then, those who did venture abroad generally made a rule to carry out, at any rate, that portion of the programme. When so large a portion of the passenger traffic was carried in that way in Holland, he could not but contrast it with our own canal system, although at that time a certain number of passengers did avail themselves of that means of transit, even on the Grand Junction Canal. His branch of practice then, as a railway and hydraulic engineer, led him to turn his attention upon the subject, and he was put in communication with some of the leading men in the canal interest, and the late Mr. Richard Walker, M.P. for Bury, took an active part in promoting his views. The difficulty, however, was to move the canal interest. At that time they hardly believed that railways would ever be carried out, the whole landed interest being arrayed against them; but it was even then held by many eminent men that canals should be utilised to a much greater extent even than they were, but they would never stop railways any more than they would ordinary roads. That necessity existed then, and it existed none the less now, when the commerce of the country was so much developed, and there was a great field for the extension of the same enterprise in India. At that time, in 1837 and 1838, the case was fully proved by many eminent men who turned their attention to the subject, but the prejudice amongst the canal directors it was impossible to make head against. It was proved that a high speed could be obtained without injuring the canals, but the system was then in a transitional period, the directors being principally half superannuated, or the successors or sons of the old directors, and the companies either paying very good dividends or very bad ones, the directors were not inclined to make any outlay in such a way. Although he had long since ceased to take an active interest in such a subject, he must say it was one well worthy of attention, and he hoped it would be taken up in a practical way by those were competent to deal with it, and could influence public opinion.

Mr. Newton said he should like Mr. Harding to give fuller information on the peculiar construction of the propeller, which he considered was so peculiarly eligible for canal navigation. It was not described in sufficient detail in the paper, and he hardly understood its peculiarities from the diagram.

Mr. Harding said the propeller was constructed rather differently to those in ordinary use. The propeller was four and a half feet in diameter, with six and a half pitch. The peculiar construction of the blades, as shown in the drawing, was for the purpose of getting a strong pull on the water. The propeller being in the bow drew the boat along, and insured the water reaching it without any obstruction or any of the difficulties which had been found in the case of propellers at the stern. In fact, on looking over some papers read in the early season of 1867, before the Institution of Civil Engineers, it was mentioned that one great disadvantage of propellers in canal boats being placed in the stern was, that if the space between the boat and the bottom of the canal were not sufficient for a quick passage of water, a large amount of force would be expended in churning the water against the bottom of the canal. Now, in this boat that difficulty would be obviated. The water passed down the sloping channel under the boat, and along the bottom to the stern; the force was dissipated by the time the broken water reached the surface, so that there was no lateral wave. If there was any objection, which he had not seen, urged to the water being forced down in shallow water, it could readily be obviated by putting across the opening, under the propeller, a thin plate of iron, which would prevent any downward action, and pass all the water directly aft. The water was distributed so evenly that if there was a strong wind on the canal which canted the boat a little, the bubbles could be seen rising up a little on the weather side. The cylinder of the engine was eight inches in diameter, and they consumed a ton of coal in each 24 hours, which gave a speed of three miles an hour, with 200 tons of cargo. He had seen a boat, loaded almost to that extent, and towing another boat with an equal load, keep up a speed, including lockages and stoppages, of $2\frac{3}{4}$ miles an hour.

Mr. Newton said Mr. Harding seemed to consider the important point was to place the propeller at the bow, in a channel so arranged as to cause the water to pass under the bottom of the vessel and rise at the stern, thus preventing any lateral wash. He recollected an invention, patented some few years ago by an American gentleman, whose name he did not recollect, in which the same thing was done, though it was effected in a somewhat different manner. He employed two paddle-wheels, the paddle-wheels being enclosed in a cylinder, and allowed to project beyond, and were placed inside the vessel parallel with the keel. By actuating the cylindrical-paddles they acted on the water below, and, there being a space left for them to project, they threw the water back, just in the way Mr. Harding had explained, the effect being that the vessel was propelled along without causing any lateral wash. The invention was tried in the north of England, and was found successful, but, owing to the difficulty of moving canal companies, referred to by Mr. Hyde Clarke, and the inventor being obliged to return to America, the invention had not been practically carried out to any extent. With reference to the system of pulling vessels by hauling on ropes laid at the bottom of the canal, he knew of an instance in which it had been found to answer very well indeed. This was in Hungary, where it was carried out by Mr. Murray Jackson, who had a very ingenious way of overcoming the difficulty which had been previously found in this system, viz., that in order to get a sufficient adhesion to the rope, it was nipped so tightly that the rope was soon destroyed. He overcame that difficulty by passing it over several grooved pulleys, six, eight, or even a dozen, having the pressure-wheel at the top forced down by springs. By this means he got sufficient grip upon the rope without in the slightest degree damaging it.

Mr. Olrick said everyone who knew the labour involved in collecting such a mass of information would appreciate Mr. Harding's labours in writing the present paper, and as an engineer, he must say, the system described seemed far superior to anything of the kind. It had this advantage, that it was not exposed, if properly protected, to those disadvantages that propellers often were when placed at the stern, of getting ropes and other matters entangled in them, nor would it have the effect of sending the wash of the water against the bank of the canal, and interfering with the foot-path. It however appeared to him, that there ought to be near the stern a slight slope, so as to allow the water to get up more gradually, but that was a matter of detail which would no doubt be altered by simple experience. As for comparing steam-power with horse-power, either with regard to economy or other advantages, it was not necessary to say a word, because it was so well known already. It was quite a mystery to him that proprietors of canal boats did not make use of the knowledge of engineers, who were only too willing to serve them, and to produce practical inventions for navigating canals much more quickly than at present. It was an undoubted fact that many of the railways were so overloaded with goods transport, that most deplorable accidents happened in consequence, and if a system of quick and cheap canal navigation were arranged, he was quite sure it would have a beneficial effect on the railways. As an engineer, he must congratulate Mr. Harding on the scheme he had brought forward, and he hoped it would reap that commercial success which, after all, was the great test of merit.

Mr. Hamilton Towle said Mr. Newton had described in a very brief manner a system of propelling boats with two wheels, but did not state whether they were at the bottom, the side, or the top. With regard to the invention described by Mr. Harding, it had many advantages. When a boat was heavily laden it squatted, and would drop on the bottom, but when Mr. Harding's invention was applied to it, the water being drawn in at the bow and drawn under, instead of allowing it to drop, raised it up, so that by that system the boat could carry a larger load in the same canal than any other. About a fortnight ago, when at Ostend, he met the engineer in charge of the whole of the canals through Belgium, who described to him a system about to be tried, at the expense of the man who proposed it. It consisted of a traction-engine going along the bank, and drawing the canal boat by means of a rope. It appeared to him that this plan would never answer, inasmuch as the pull of the rope would tend to bring the engine and the rope together. In the case of the boat, that might be avoided by steerage, but he did not understand what was to prevent the engine being pulled overboard. If ropes along the bottom of the canal were used, it would be very awkward when two boats were pulling on the same rope, and wanted to pass in opposite directions. It would be something like two trains meeting on a single line of rails.

Mr. Dipnall inquired of what material the boat referred to was constructed. He supposed plate-iron would be the best, as giving the greatest capacity and the least amount of friction.

Mr. Harding said the boat he had described was simply an old wooden boat adapted to the experiment, but the new boats which were now being built upon this plan were entirely constructed of iron.

Mr. Dipnall said he had no practical knowledge of this subject, but it appeared to him that a self-contained motor must be infinitely superior to any of those schemes of ropes or chains, which might get out of order, to say nothing of the various entanglements which might happen with them. If a vessel, with so small a force as had been described, could carry 200 tons at the speed mentioned, he thought it would be not only a mechanical but a great commercial success. With regard to the mode of getting rid of the wave wash, he was struck with the vertical sides which the front of the vessel presented. It seemed to him that this was so blunt, and presented such a large surface, that there must be a considerable amount of lateral wash. He was not quite satisfied either whether the propeller was sufficiently protected against any such contingency as a sunken anchor, or anything of that kind, which might throw the whole affair out of gear.

Mr. Hancock inquired whether there was any guide for the discharged water along the whole length of the boat.

Mr. Harding said there was not. The sloping channel was only continued a short distance, as shown in the drawing.

Mr. Hancock said he could scarcely agree with Mr. Towle as to the advantages derived from Mr. Main's propeller, with regard to sustaining a greater weight in the barge, unless the laws of liquids had suddenly undergone a change, because the flotation of such a vessel must depend upon her specific gravity; and if there were a small quantity of water brought underneath the bottom of the boat, it must immediately find its way to the surface. Some time ago, he had seen a plan tried of propulsion by means of air, which was exceedingly ingenious, and, at the same time, very simple. There was a false sloping stern to the boat, and the air was forced against this sloping stern, and so sent the boat along with very little disturbance, the pressure required being very slight. The only objection that occurred to him in the one he saw arose from attempting to get too much pressure. The experiment was tried in a very clumsy way, but still a very respectable speed was obtained and he thought that further experiments would be proved successful.

Mr. Towle said that whenever a heavily laden boat was propelled by steam power, by which the water was thrown from the stern, the vessel invariably sank at the stern from one to two feet; that was a fact which could not be rubbed out. This system remedied that evil, so that there was a clear gain of the depth of water to which the boat otherwise would sink. With regard to the atmospheric plan just mentioned, it occurred to him that if the water moved away so quietly, the boat would move forward also very quietly, and with much less velocity. Mr. Main's boats certainly possessed advantages which he had not seen in any other.

Mr. Harding, in replying to the remarks which had been made, said the propeller was protected by an iron grating across the front (somewhat indistinct on the diagram), which did not interfere with the passage of water, but which would intercept anything large enough to interfere with the working of the screw. With regard to the rope scheme, mentioned by Mr. Newton, he could only say that he had alluded to similar systems several times in the course of the paper, but time did not allow of entering into details with respect to them. It must be remembered that all these methods were open to several objections; they retained the full effect of the bow wave, which, if any degree of speed were attained, would be considerable; and, in addition to the power required for moving the boat, there was the friction and weight of the rope itself, which had to be pulled through the water. Then, again, there was a great difficulty with the locks. If they were to be roped through, there was a great difficulty with the sill, and it had always been found that you not only damaged the sill, but also soon cut the rope or chain. It would be extremely difficult to arrange any system of that kind which should prevent leakage and not injure the chain or rope. The great advantage of a boat with self-controlled power, was that it could leave the canal at any time and travel on a river, or anywhere else without being towed, and at the same speed. Any self-contained motor would always possess superiority in this respect over a system of rope or chain traction. Again, if the machinery of a self-propelled vessel was defective, that particular boat was alone detained, whereas, let one portion of the rope plan get out of order, and the entire system from one end of the canal to the other is disarranged. The advantage mentioned by Mr. Towle, that of preventing settling at the stern, was of great importance, since in shallow water every inch of draft was of consequence, and one foot settling at the stern meant six inches less draft available for cargo, thus causing a loss of carrying capacity with greater expenditure of motive power. This settling or "squatting" at the stern interfered also with the steering qualities, while the bow-propeller in Main's patent did away with all these objectionable features, kept an even keel, and was easily steered. The very thorough papers already mentioned as read a few years ago before the Institute of Civil Engineers, while advocating steam propulsion against horse-towage, and propellers in preference to paddle-wheels, particularly specified the disadvantages of propellers in respect to these points. On the table was a model of a rotary steam-engine, invented by Mr. J. C. Wilson, which he thought would be very well adapted, from the space it would occupy, to canal boats, and he had arranged with the inventor to give it a trial. They also economised the use of the steam, by expanding it into a second cylinder. He reckoned that an engine about three times the diameter of the model on the table would drive a boat carrying 200 tons of cargo. He had just received a copy of the *Scientific American*, the most able paper of its class in America, which, speaking of various modes of propulsion for canal boats which had been tried on the Erie Canal, this same method of Mr. Main's was of all methods the most simple, and seemed most likely to be popular. With regard to the bow section appearing very blunt, it was the ordinary shape of a canal-boat, and would, of course, cause a certain wave if propelled through the water by any usual means at a rate of three miles an hour, but the water drawn in to the propeller was really collected from a much larger area than that represented by the size of the channel, which had the effect of greatly reducing the resistance, and prevented bow waves. With regard to the lateral action of fluids, there might be something of the sort if the boat were stationary, but being in motion, there was no time for any perceptible lateral wave until the boat had passed, and then the water did not have the action on the banks as questioned. This was proved by the fact he had before referred to, that when the boat was heeled over by the wind, the bubbles could be seen rising; but as this did not occur when she was on an even keel, it supported the statement.

Mr. Botly moved a vote of thanks to Mr. Harding for his interesting and instructive paper. He remembered some years ago, one of the railway "kings" remarking to him that, if railways could get rid of a part of the heavy traffic, they would pay much better dividends.

Mr. Varley seconded the motion, and said he had always been favourably impressed with the idea of propelling boats by taking water in at the bow and expelling it at the stern, from having noticed that this was the method of propulsion employed by the larva of the dragon-fly, which, though very bulky, moved with great rapidity through the water by an exactly similar means of propulsion.

The Chairman said Mr. Harding had hardly stated the full extent to which travelling by canal and steam power had attained. Mr. Hyde Clarke had referred to the Netherlands, and he would add that even at the present day the large steamers leaving the Thames were accustomed, when the state of the tide was convenient, to enter and go along the canals, and you might see steamers there daily going in each direction at full speed. The method adopted there to prevent injury to the banks by waves, was to plant on each side of the canal rushes and willows, which broke the force of the water. The English canals were in a much better condition than formerly, for there having been a great increase of traffic, these banks had been put into a better state, and they were now, therefore, well adapted for steam navigation. The form of propeller used by Mr. Main reminded him very much of the first model of the propeller which he ever saw, which was patented by a Mr. Smith, and exhibited in a large room opposite Garraway's, as long ago as 1824 or 1825. The inventor had a model boat moved by clockwork, and a pair of paddle-wheels, but at the end of a certain time the wheels were unshipped, and the screw brought into play, when the boat made something like twice the speed. That, he believed, was the first public trial of a screw propeller as compared with wheels, and the form of the screw blades was very similar to the one in the drawing. With regard to the form of bow, there was no doubt that a square-bowed boat was the most convenient shape for stowage, and it occasioned less dead weight. It had been found in the Navy that very handsome, sharp-pointed bows gave a large amount of dead weight with no flotation power, and, therefore, that build had been discontinued.

The vote of thanks having been passed, the meeting adjourned.

INDIA COMMITTEE.

A Conference on the subject of Indian fisheries was held on Friday evening, May 5th, Mr. HYDE CLARKE, Treasurer of the Society, in the chair.

The Chairman, in opening the proceedings, said he had the honour of presiding in consequence of the gentleman who was to have occupied the chair being engaged with his Parliamentary duties. He was sorry the meeting was not more numerous, as the subject was one of great importance, especially in relation to its bearing on the supply of food to the people. Much had been done of late years in this country to increase the supply of fish to inland towns and villages, by means of improved railway communication; and now that an impulse was being given to the development of railways in India, it was of great importance that the fisheries should be also further developed, in order that an additional source of food should be available for a people who were liable to frequent famine, in consequence of the vicissitudes of the climate.

The Paper read was—

ON THE FISHERIES OF INDIA.

By Colonel G. T. Haly.

It may not, perhaps, be quite unknown that I not only take a great interest in India and all that concerns that magnificent empire, but likewise that I have devoted much time, and been at no little expense, in the endeavour to show that it is only by the development of its manifold natural resources that that truly fruitful country can be regenerated.

Strange as it may appear, India is still a *terra incognita* to most Englishmen, and, to use Lord William Bentinck's words, "there is a profound ignorance of India amongst the English generally, including even those actually residing in India, regarding its people and its wants." True, this was said some forty years ago, but is it not quite, if not more, applicable at the present time? Nor is this lamentable state confined to the European sojourner alone, as the natives themselves know but little of the actual needs and capabilities of their own land, and certainly have gained but little in this wise by the teaching of their present rulers.

It is thought by some that the fact of there being so many intelligent and well-educated natives at present in England will be the means of removing much of this deplorable state of things; but this is a fallacy, as the description of natives resorting to this country, except the very few on flying visits, are not of the sort calculated to do so. Young India, in the shape of law and medical students, may become very enlightened, and do honour to their separate professions, but I doubt if these are the men best calculated to further the real interests of India. Again, there are some eminent merchants trading with, and others long resident in, this country. These Indian-Anglo City men may, without doubt, be first-class in many ways, and some are even what may be called merchant princes, yet they, too, must fall short of that knowledge required to place India in its allotted position as a first-rate agricultural country, and make it assume a position as the great grain and seed-growing country of the world. My time being limited, I shall now proceed with the subject proposed for discussion this evening, viz., the fisheries of India.

Although agriculture may not be supposed to have any direct affinity to the subject of the fisheries, yet do those of India bear so intimately on the food supply of its people, and those of the inland waters especially, on the rural classes, that I must be excused if I occasionally appear to deviate from my theme.

I have already written so much on the momentous question of the fisheries of India, in urging their great importance on the government, that to me it is a theme almost worn threadbare; yet the encouragement given by the partial success that has attended my efforts to obtain governmental legislation and supervision, to save the fisheries from impending ruin, leads me to hope that now they are placed under the new Department of Agriculture, a good measure of the needful pains may be devoted to their preservation. Great care, however, will have to be taken that the piscatory interests do not get swamped by what may be supposed to be matters of greater moment in the newly-formed Agricultural Department, the gigantic proportions of which scarcely argue promisingly for the due carrying out of the minutiæ thereof; therefore would I have preferred to see the great matter of the fisheries worked as a separate department on its own merits, for which its magnitude affords ample material. However, as it has been otherwise decreed, it is to be hoped that this large and important branch of the agricultural State administration may meet with all the consideration that its vast dimensions and vital needs call for.

It may be as well here to mention that, although it has never been actually denied that I originated the movement that has lately taken place, and brought forth a most voluminous report by the officers appointed by government to inquire into the state of the fisheries in India, yet a strange attempt has been made to ignore me and my representations as much as possible, so much so, indeed, as to have necessitated my taking steps to prove that I was the originator, and that it was through my persistent representations that the late investigation took place, as the following correspondence will show:—

Copy of a letter from from Sir A. Cotton, K.C.S.I., to Colonel G. T. Haly.

"Dear Sir,—With reference to our conversation about the effect of the irrigation works in India upon the fisheries, I beg to state that, in my opinion, it is a matter of considerable importance that this matter should be attended to.

"In 1836, we built a weir in Tanjore, called the Colleroon Anicut, about thirty miles from the sea, where that river is about 1,100 yards broad, in two channels. In the following years, a prodigious quantity of fish were stopped by it as soon as the freshes came down, and immense quantities were annually taken at it, of course generally full of roe. I have not heard of the weir for nearly thirty years, so that I cannot say whether the fish continued to ascend the river; and, in 1850, we constructed another weir across the Godavery, about forty miles from the sea, where it is 4,000 yards broad, in four channels. The weir is now 14 feet to 16 feet high, and the water passes over it to the depth of 14 feet to 16 feet in a full fresh. In the following years, the quantity of fish assembled at it as soon as the first water of the monsoon reached the sea was prodigious, and many tons used to be killed in a day, some of them 5 feet or 6 feet long. I have not heard how the case is for many years. I should suppose that the injury to the coast fisheries must be very great, now that seven of the principal rivers on the east coast,—viz., the Colleroon, or Cauvery, the Pennaar (in South Arcot), the Pullaw, the Pennaar (in Nellore), the Kistnah, the Godavery, and the Mahanuddy—are thus barred. It seems to me that this matter must be well worthy of the attention of the government.—I remain, &c.,

(Signed) "A. Cotton.

"July 26, 1867.

"P.S.—I should mention that there is a long interval between the arrival of the monsoon water and the time when there is sufficient passing over the weir to allow of the fish going over it."

Nos. 79—89 I.

"*Government of India. P. W. D. Irrigation. Fort William, March* 11, 1869.

"Destruction of fish in Indian rivers.

"Read again—Despatch from Secretary of State to the Madras government.

"Read also—Home Department. Memorandum No. 4,257, 24th October, 1868. Letter from Surgeon F. Day, on special duty, 15th February, 1869:—

"Observations.—The discussion which has taken place on this subject originated with a letter from Major-General Sir Arthur Cotton, in which attention was directed to the large quantities of fish that were destroyed annually by the weirs for irrigation works constructed on the rivers of Southern India."

On bringing the above to Sir Arthur Cotton's notice, I received the following reply:—

"Dorking, September 10th, 1869.

"My Dear Sir,—The letter you refer to, as mentioned in the official report, headed 'Destruction of Fisheries in India,' as written by me, must be that I addressed to yourself, in reply to your letter to me, asking to substantiate what you had written on the subject, as I never wrote anything else on the matter, nor had done anything about it till you originated this important inquiry. —I remain, dear Sir, yours sincerely,

(Signed) "A. Cotton.

"You are, of course, at liberty to make any use of this letter.

"To Colonel G. T. Haly."

I trust that the correspondence I have just read is a convincing proof that it was I who first drew attention to the necessity that measures should be adopted for inquiry into the subject of the fisheries of India, and the preservation of this great source of food and wealth for the people of India, which I shall now endeavour to show.

Of all our shortcomings in India, perhaps there is not one calling for more surprise than the entire neglect by the government of her fisheries that has prevailed till quite recently. It would have been supposed that their vast importance, fiscally and commercially, must alone have been sufficient to draw some little attention to them from British rulers, even if their more vital importance to the community at large, more particularly the agricultural classes, from whom the bulk of the revenue is derived, had not demanded the attention of the legislature of India; yet I am not aware that there was any legislative Act touching on the conservancy of the fisheries of this mighty empire, nor any regard of any direct official character paid to the subject by the supreme authorities, till persistent efforts have, at length, led to some attention of the government, both here and in India.[*] But nothing has hitherto been done at all adequate to the necessities of the case, although the conservancy of these fisheries is of far greater magnitude, and of manifold more importance, to India than to perhaps any other country in the world.

What makes this neglect the more surprising is, that the British government is well aware of the necessity for such legislation here in England, as it is exerted in this country to the protection of even the smallest streams; yet is a seaboard of some 5,000 miles in extent (over which the same government rules supreme) and extensive lakes, with thousands of miles of length of rivers, in India, left, it may be said, as far as legislation is concerned, unheeded and uncared for.

This hitherto unaccountable apathy in a matter of such vast importance, as well to the rulers as the ruled, is much to be lamented; and now that their extent will be much increased by the works of irrigation about to be carried out at last—it is to be hoped on the scale so long demanded—the value of the fisheries will be much enhanced or entirely destroyed, as measures are adopted; and therefore a strict legislative conservancy is more than ever called for, and the neglect of which, if not given, will indeed subject the rulers again to more of such imputations as are now cast on them in reference to the famine in Orissa, which no doubt might have been considerably modified had those in authority been up to their work, or even listened to the advice and warning voices of many of the outsiders, who certainly showed how much better they were conversant with what was actually going on than the government, or even the local authorities, who allowed the Orissa famine to drift into such fearful dimensions.

The fisheries of India are, perhaps, more prolific throughout the far greater part of the land than in any other country, in spite of all the disadvantages they have hitherto laboured under, and of their frequent, almost entire, destruction in many localities by droughts, and, at the present time, worse than all, by their wholesale destruction consequent on a want of foresight in carrying out otherwise immensely beneficial works of irrigation. Yet does every river, stream, puddle, and even roadside ditch swarm with minute fish as soon as replenished with water. This stock of young fry, in a scarcely developed state, is pounced upon by the native population for immediate consumption, without even a thought for the future, or the suicidal act that they are committing in the prodigal destruction of hundreds for a single meal, when, if even left for a few months, a tithe of the number would suffice for a full and nourishing repast for a whole family.

This wholesale and indiscriminate capture of young fish at the commencement of the monsoon is practised even more destructively during the dry season, by the drainage of tanks and ponds, and turning the course of rivers, and thus destroying to the utmost the parent fish as well; and to such an extent is this at times carried, that it is not uncommon to see even a lake drained, and the surrounding population by hundreds—men, women, and children—up to their middle in slime and mud, capturing small and large alike, and catching disease as well.

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[*] See Dr. Day's voluminous report.

The foregoing is, of course, in allusion principally to the inland and fresh-water fisheries; but the sea fisheries are not quite free from the same charge, for there, too, they make a wholesale destruction in the back-waters at low tide; and, in the sea, "all is fish that comes to their net," the meshes of which are so small that not even a shrimp can escape.

From the scarcity of inland salt deposits in India, saline articles of food have to be drawn from the coast; and consequently, throughout that country, even to the most remote districts, very great store is laid on salted fish, which even the lower classes endeavour to procure to flavour their miserable meal of inferior grain with, for few natives of the poorest class can now afford to eat rice, except on rare festive occasions.

I particularly wish to draw attention to the fact that works of irrigation, as now carried out heedlessly as to fish preservation, are destroying the inland fisheries, instead of being made to foster them, as they might be, and would, were they conjointly and properly worked as a means of fish-culture, as well as of agriculture, transit, &c., and which they could be, not only with the greatest ease, but at little, if any, extra expense. As the matter stands, nothing is done to stop the fearful mischief that is now daily inflicted on the inland fisheries of India. For instance, at the several weir-barred rivers in the Madras Presidency, millions of fish on their way up the river to spawn are now annually being destroyed, as shown by the letters that I have just read from that eminent engineer officer, Major-General Sir Arthur Cotton, who was employed for so many years on those works, and who, it may be remembered, states that he has seen the wholesale and indiscriminate destruction of fish full of roe by tons, and other observers can bear similar testimony. Such a course as this, allowed to continue, must eventually not only exterminate the fish of these large rivers, but also of all streams tributary to them. In fact, as now constructed and worked, works of irrigation cannot prove otherwise than destructive to the whole of the Indian inland fisheries. This devastation could not only be remedied, but the increased water supply could be made the means, by the appliances now so universally adopted in Great Britain, of multiplying this great staple of food for the millions of India a hundredfold, instead of, as at present, causing its diminution in the same ratio.

I need not go into the details of the names and kinds of the multiform species and varieties of Indian edible fishes, as they are so minutely set forth in the special report of Dr. Day, the Commissioner of Fisheries for India, Burmah, &c.

With respect to Burmah, a commission on the fisheries was unnecessary as regards their preservation, at least, as to the territory of Pegu, the exuberantly fertile and prolific delta of the Irrawaddy, which is the main and by far the most valuable portion of British Burmah; for the supply of fish in that land of plenty is so abundant and unfailing as to be practically inexhaustable. This arises from several circumstances.

But India is very differently situated, and hence my efforts to move the rulers of the empire to take immediate adequate measures for piscicultural conservancy. And not only in the way of legislation, but in all great national enterprises for the public good, in opening up and fostering the development of the enormous, the incalculable resources of the Indian Empire, it is government that must take the lead; for though private enterprise has done much, and would continue to do so—tea and coffee plantations, to wit—still it is too slow and circumscribed for the actual requirements of our vast Indian possessions. Until the people of India have their own House of Assembly, and a voice in the matter of supply, expenses of state, &c., it is to the government they must look on all great subjects of national advancement. And the government should be a parental one in every sense of the word, as well as being what the Anglo-Indian government actually is, and should continue to be, the lord of the manor and liberal landlord; and those who wish to see it otherwise are either no friends of India, or are lamentably ignorant on the subject. Let it be well understood on this point that what may be the right method of administration in the West is totally unsuited to the East. Indeed, even here in Britain, enlarged ideas of the sphere and direct functions of government begin to prevail and grow popular.

The conservancy of the fisheries might be made the means of ameliorating the generally miserable condition of the fishing class of the people, and raising them in the social scale, particularly the sea-coast fishermen.

Feeling all these things, the immense value of her fisheries to India, the destruction impending on them, the practicability of preserving and vastly increasing their supplies, and the pressing necessity for government to interpose, I have addressed myself to the subject as a special object of interest and exertion.

With respect to government encouraging the fishermen along the coast, besides the benefit to the fisheries, there is the fact that, owing to the few ports of refuge for large ships in distress, particularly in the Bay of Bengal, these men, under better training, would be found to be of the greatest assistance to our navies in times of emergency. Indeed, with the buoyant material of which their boats are made, by the application of a little scientific knowledge, a life-boat system might be established all along the coast. In their present state, with the noble exception of the catamaran-men at Madras, the Indian coast boatmen in the Bay of Bengal, as a rule, never attempt to render the slightest aid to ships in distress. The Madras catamaran-men, however, have done most heroic deeds, in saving both life and property on occasions of shipwreck during some of those fearful cyclones that rage on that coast, which shows there is no want of actual courage and vigour for such hardy undertakings in these people, and that, with the means at hand, they would be as ready as most others to afford the required help in emergencies.

Unfortunately, neither their present training nor their wretchedly-built boats encourage this, or, indeed, admit of its being done, though the principle of the construction of their boats, and the buoyant nature of the material of which they are formed, would render their craft peculiarly fitted for life-boats; and the people themselves are naturally most fearless in the water, for all, even in childhood, are first-rate swimmers. They would likewise be found most useful in taking off supplies to vessels during war, or in meeting the ordinary requirements of commerce; and, considering the few ports for large ships along that extensive seaboard, this of itself would be a matter of importance.

In the transport of grain and other supplies, and in coasting communication and trade generally, under a good system of training and superintendence, the coast-fishing boatmen would be invaluable; and what might not have been done by them for the relief of the starving millions during the late famine in Orissa, who were so long left to their cruel fate?

Further, such an improvement of the coast boatmen would be a direct means of increasing and improving, in all sorts of ways, the much-needed coasting trade in general that is now carried on so primitively, and on a scale so little adequate to its requirements. This all acquainted with the west coast of the Bay of Bengal, or from the Sunderbunds to Cape Comorin, must know; nor is the coasting trade and traffic on the opposite coast, or from Cape Comorin to Kurrachee, on the eastern shores of the Arabian Sea, though much better, by any means what it might be under better supervision. In fact, it would be a general boon, as well to English interests as to the natives themselves, were more encouragement given to these people, and some endeavour at least made to instil into these subjects of the British Crown a little of that maritime spirit that the English boast of possessing pre-eminently above all others.

In elevating the status of the fishing population, a large class of British subjects, now sunk into the lowest scale, would be themselves bettered, at the same time that a most important industry of imperial magnitude and interest would be proportionately advantaged. Whether owing to their poverty, or to their generally isolated positions, the fishermen are, perhaps, amongst the most neglected classes in India; and, except in the vicinity of a few of the largest stations, they are without religious or other instruction, though in the smallest and poorest agricultural villages there is some sort of school for teaching natives, at least in the idiom of their district.

Of late years, the sea fishermen have rapidly degenerated, and are fast decreasing numerically, as the many deserted fishing-stations and villages along the coast will fully certify.

I will not trespass on the attention of my hearers by prolonging this paper, but will simply recapitulate the points of chief notice. They are—that fish is an immensely important article of the national diet throughout India; that the Indian fisheries, under good and sufficient conservancy, are able to supply most amply quantities of fish to all classes of the population; that without such conservancy they will be destroyed; that their exhaustion is making fearful progress, both in the amount and in the rapidity of their destruction; that nothing is actually being done to stay the progress of their annihilation, yet their value and urgent need for protective measures are shown in the very report of the commissioner specially appointed to investigate this momentous subject; and that, properly devised and conducted, the measures for conserving the fisheries might be made a means for greatly benefiting the people of India in other important respects, particularly in raising the social condition of the fishing class, and in improving the coasting trade It is most especially to be noticed that the very works of irrigation, formed by the government for most beneficent purposes, are, although an admirable blessing to the agricultural interest, a most grievous and intolerable source of destruction to the fisheries, and that through faults in their construction which are capable of being quite easily and cheaply remedied; and a matter never to be forgotten or opposed is, that government must take the lead in all great undertakings, on a national scale, for the public good in India.

In conclusion, let me again urge most earnestly the extreme importance of the government immediately taking adequate means of conservancy—real, tangible, practical measures to save the fisheries ere the devastation goes farther. For, as already represented by me to the government on several occasions, every day's delay is of the most serious consequence, inasmuch as the terrible waste and destruction that takes place, even in one season, will require, it is impossible to say how many, to redeem.

I must here again remark that the official report errs in assigning to a letter from Sir Arthur Cotton the discussion, action, &c., that has lately taken place on the subject of the fisheries of India, the letter from Major-General Sir Arthur Cotton, alluded to in the report, being simply one addressed to me in corroboration of what I had previously advanced, and was submitted by me to the Madras Government, which, doubtless, accounts for the mistake.

I shall conclude by offering a few remarks on poisonous fishes and the frequent cause thereof. This latter cannot be better exemplified than by calling attention to the present state of the fish in the Coon River at Madras, on which the government of that presidency have deemed it advisable to issue an order to prohibit their being caught or utilised. This certainly may be a very practical way of preventing these poisonous fish from being detrimental to the public health, but what about preventing the fishermen from gaining a livelihood by the exercise of their legitimate calling, and depriving the inhabitants of so much of their needful food; and, further, the noxious vapours arising from this now more than ever polluted and sluggish stream must be more detrimental to the general public health than ever. Certainly, if this is the way that the Madras people have of getting rid of a difficulty, most deservedly do they bear the name of "the benighted."

The Coon River runs close to what is termed Black Town, and from thence through decidedly the most populous part of the suburbs of Madras, and flows about midway between Government-house and Fort St. George. Being bridged in several places, this noisome stream is passed and re-passed daily by thousands of Europeans as well as natives. These bridges are the only routes by which the *élite* can reach the favourite beach promenade, therefore is it the more extraordinary that no practical means have yet been adopted for purifying this running infectious stream, to which several sudden deaths of European ladies and gentlemen have been traced; and if this numerically small class of society have been known thus to fall victims, what must be the numbers of the bulk of the population who have likewise been so sacrificed?

I am not now going to enter upon the subject of how the nauseous Coon might be purified, but suffice it here to say, that at present it is the great open sewer for nearly the whole of Madras proper, as used the Thames to be till lately of London. It is only the matter of expense, and the "penny wise and pound foolish" system that have prevented the works required for converting into and keeping the Coon a pure and limpid stream of refreshing water, alike requisite as a beverage for man and beast as for the production of wholesome fish, that great article of food among the natives.

These advantages could be easily secured by diverting the sewage-drainage from the river. This highly essential measure ought to be at once insisted on by superior authority, if the Madrassees and their government are unwilling or incapable of carrying it out.

Madras, which has long been noted as the most healthy town in India, is fast drifting into a most unsatisfactory sanitary state, cholera being now the normal state along the banks of the Coon; and no wonder, when the exhalations from this turbid stream continually rise in pestilential vapours, diffusing poison far and near, besides destroying much wholesome food, as rendering it unfit for use; and be it remembered that, acre for acre, well-farmed water, as has been proved, will yield as much aliment as equal portions of land.

As a rule, however, the rivers of India are tolerably free from such pollutions as that complained of with reference to the Coon, though the practice that exists in some parts of throwing the bodies of the dead into certain supposed to be sacred streams is most prejudicial to the interests of the fisheries in those parts; for though the famed Mango fish of Calcutta is generally supposed to gain much of its high flavour from feeding on fat Brahmins, yet there are people to be met with who have a distaste to fish so nurtured.

Poisonous fish do, however, exist, without any apparent local causes, an extraordinary instance of which is the mackerel in St. Helena's roadstead; but this curious fact, and the matter of poisonous fish generally, with the causes thereof, would occupy more time to treat on fully than could this evening be devoted to it. The whole subject, likewise, of ichthyology much requires ventilation, as, notwithstanding the praiseworthy attention that it has lately met with from a few enthusiasts, it is still in its infancy, a kind of muddy-water groping being all that has yet been effected. It must be evident to even the greatest tyro that there never was a fuller exemplification of the saying, that "a little learning is dangerous," than the self satisfied demeanour shown by those now entrusted with the great subject of the ichthyology of this country. True, some kinds of fish, salmon in particular, are said to have vastly multiplied in some of the inland waters through conservancy; and the sanitary measures of rivers, now so generally adopted, has done much to assist it. This appears to have quite satisfied those concerned in carrying out the important matter of the fisheries of Great Britain, sight apparently being lost of the great fact that though it may be and is very desirable to look after and care for the inland fresh-water fisheries, yet that those of the sea-board waters of the British isles are as a thousand to one in extent with those of the inland, which yield not one in a million in food produce to the people. Fish in Great Britain ought to be the cheapest and most abundant food, in fact, the staple aliment for the people generally, coming within the reach of the poorest.

I do not wish to detract in any way from the merit due to those who have put themselves forward and applied their best endeavours to open out this great subject, but I do maintain that as yet there has been nothing really satisfactory accomplished either in India or in this country. Dr. Jordan's work, the only dependable one there is on the fisheries of the former country, however useful and able a production it may be in its way, falls very short of what really is required to render assistance to carry out productive farming of the fisheries of India.

DISCUSSION.

Mr. Maitland said the subject was almost entirely new to him, but the first thought which occurred to him was that Colonel Haly and those who were working with him in this matter must not be discouraged because they did not immediately meet with the success they anticipated. It was just the same, not so long ago, with regard to the forests of India, which were utterly neglected, but they now produced a revenue of £40,000 a-year, and would, if properly looked after, yield much more. He should like to ask if anything was done in India in the way of salting fish, or whether the salt-tax prevented this. He had heard, only that morning, before the Parliamentary Committee, the evidence of Sir Cecil Baden and Sir Frederick Halliday, which he understood to be to the effect that fish were not salted in India, but only dried in the sun, and that the climate would not allow of their being cured with salt.

Colonel Haly said there was no doubt that the revenue was considerably evaded by fishermen. They let the salt water flow into shallows near the shore, where it partially evaporated, and the fish were then thrown into the salt water, and afterwards dried. This was carried to a great extent with the small fish, which were so common in India, but it was a very imperfect process, and the fish were generally covered with sand.

Colonel Wragge said he was present at the Parliamentary committee, and he understood Sir Cecil Baden to say that there was no fish salted in India, because it would turn bad before the salt would penetrate. He had never seen any fish salted in India except what he had got his own servants to do. If fish could be salted, it would be a most valuable resource for the people of India, if they could be taught to do it, for the quantity was almost unlimited; but, so far as he had seen, it was only sold in the nearest markets to the localities where it was caught.

Captain Taylor said large quantities of small fish were salted and sold in the bazaars all over the Madras Presidency where they went by a name which was probably a corruption of a Tamil word, meaning salt, or brackish.

Colonel Haly remarked that he had seen large quantities of fish taken, the roes taken out and salted, to be sent up the country, the collector thinking nothing of the waste thus occasioned, but only of the slight increase of revenue by the sale of the salt. Fish could be cured very well, either in the hot or the cold weather, but not during the monsoon, when it was too damp. The small fish before spoken of was carried thousands of miles, and sold in all the bazaars. In his opinion, there ought to be regulations to prevent such small fish being caught, such as fixing a minimum size for the meshes of the nets. As reference had been made to the forests of India, he might mention that he had long ago suggested the planting of cocoa-nut trees near Madras, between the town and the beach, where they would grow very well, and, at the same time, add to the salubrity of the town by sheltering it from the long-shore winds.

Colonel Wragge said it was stated that the weirs across the rivers prevented the passage of the fish up stream for the purpose of spawning, but the fact was that the fish always began to run when the freshets commenced, but at such times the under sluices of the anicuts were always open, and through these the fish could make their way. It was, therefore, only those weirs which were not provided with under sluices which proved impediments to the rise of the fish. In the canals fed by tidal waters, like the Godavery, the fish went up the canal locks; and he had been informed by Colonel Rundle that he had seen a fish of 109 lbs. weight taken out of a lock. Those anicuts which had not under sluices should be provided with them, and then, he thought, there would be no impediment to the rise of the fish. With regard to fish being found in dry tanks, the same thing was well known in England. If you found a fish-pond completely dried up, you could generally find carp and tench by digging down. They seemed to absorb enough moisture to keep them alive until the ponds were again filled. He should recommend the utilisation for fish preservation and cultivation, of the extensive tracts of salt marshes with which the presidency of Madras abounded. They might easily be converted into fish-ponds, as was done in the island of Java. Fish preservation was no novelty in the East, for as far back the sixteenth century, large fisheries were established in Java, in which young fish taken from the ocean were placed, and allowed to fatten for several months, until they were fit for the table. It was found necessary to have an annual supply of young fish, in order to keep up the stock, and the natives asserted, whether truthfully or not he could not say, that the fish did not attain their full size in the sea. It might be so, because it was known that soles, grey mullet, and other sea-fish, were much improved by being fattened in ponds. True, the sole did not increase in size under such circumstances, but it considerably improved in depth of flesh. There was a very peculiar method of river fishing in use in the island of Java, which was looked upon as a great source of amusement. A time was selected when the river was unusually low, and by means of two or three stages erected in the bed of the stream, with the aid of stumps of trees, or pointed bamboos, a temporary bridge was constructed. Coarse matting was then carried across from one side to the other, with the exception of a small aperture in the centre, against which was placed a sloping platform, pointing up stream. *Coculus indicus* was then thrown into the river, and the fish were driven down by the natives, and, being half intoxicated, they came up the platform almost into the hands of the persons engaged in the sport. The maritime fish-ponds he had spoken of belonged to the government, and, in 1868, returned a revenue of 224,000 florins, or nearly £20,000, and this was only from those on a small portion of the coast. It was evident, therefore, that money was to be made by fish in the East. He could see no reason why the same thing should not be done in India, either by government or by private enterprise.

Captain Taylor said that Colonel Wragge was in error about the under sluices allowing the passage of the fish, through not taking into account the head of water, which, at the time the sluices were open, was so great as to prevent the fish ascending.

Colonel Wragge thought that only applied when the fresh was at its height.

Captain Taylor said Dr. Day had gone into the matter very carefully in his report, and proved that the fish could not ascend, whether the fresh were at its maximum or minimum. The explanation he gave was that, having commenced to ascend the stream at the beginning of the fresh, they so injured themselves with struggling and knocking against the weirs and anicuts, that when the river was down they had not strength left to make their way up. Still, there was no reason why some modification of the present system should not be adopted, such as building what were called "water cushions," by means of which the water, instead of falling over the whole depth of the weir at once, thus shaking and injuring the fish, it fell in a succession of steps, like a salmon ladder. He might remark that fish preservation was not altogether unknown in India, and oysters certainly were cultivated to a considerable extent. One great drawback to the cultivation of river fish was the rapidity with which the mouths of rivers closed up with sand, a bar being reformed almost as soon as a passage was cleared through it, so that it was a very expensive matter to keep the passage clear. The rivers on the eastern coast were the worst in this respect, owing to the very slight fall, very often not more than three feet in a mile, as he had ascertained from a personal survey of many of them.

The Chairman said he regretted there were no native gentlemen present, as they could doubtless have afforded valuable information on this important subject. Looking at this question only from one point of view, viz., as it affected the consumption of vegetable produce, it was still of great importance, because a great quantity of the vegetable produce of India went into the rivers, and would be wasted but for the fish, and it was, therefore, very desirable that this waste of vegetable matter should be replaced as largely as possible by the animal food which it produced. The question of salting fish was also of interest, because when a quantity of fish was caught beyond the means of the locality to consume, it was very desirable that it should be carried into the interior, for which railway facilities were gradually being afforded. It was of great importance to bear in mind that a great proportion of the fish of India, greater perhaps than that in this country, was not, as many people supposed, always to be found in the same spot, but migratory in its habits. Means, therefore, should be provided by which they might be enabled to ascend the rivers, and thus, without expense for carriage, be placed within the reach of the inhabitants of the interior. Railways, no doubt, were very valuable for the purpose of carrying both salt and fresh fish, but it was much better, where practicable, to let the fish carry themselves. Tanks might be provided in the interior, where they might be stored until required. It was gratifying to find that the attention of Colonel Haly, and also of Sir A. Cotton, had been directed to this matter, and it was evident that the government was taking some degree of notice of it. Still, as they all knew, the government of India had so many demands upon it that, unless they were constantly kept up to the mark by such exertions as those of Colonel Haly and others, it would soon be neglected. The managers of the South Kensington Museum had found it worth their while to place the fish department under the care of Mr. Frank Buckland; and it seemed to him there ought to be a fish department for India, to look after all the details of this important subject. The question of acclimatisation, for instance, had been referred to, and there seemed no reason why India, rich as she was in fish, should not have her supply increased by the introduction of fish from other parts of the world. It was perhaps a misfortune, that hitherto the government had treated the matter rather as one of revenue—looking only to the revenue derived from the letting of the fisheries—than as a great question, affecting the food of the population. Governments were too apt to look rather to their own immediate wants than to the necessities of the population, for whom they acted and whom they represented. So it was in India. All that the government knew about the fisheries until lately was, that in certain collectorates so many thousand rupees were produced by them. They did not consider for a moment whether the fish themselves could be increased to almost any extent, so as to afford a large addition to the food resources of the population. That, however, was the real question, and if it were properly treated, there could be no doubt, from the facts mentioned by Colonel Wragge, that the revenues also would be immensely augmented. If the Netherlands government could obtain £20,000 a-year from one or two fisheries in Java, there was no reason why the government of India should not do the same, especially as they would be largely benefiting the people at the same time. In conclusion, he begged leave to move a cordial vote of thanks to Colonel Haly for his valuable paper.

The vote of thanks having been passed,

Colonel Haly, in reply, said his object was to increase the food of the people, and therefore he hoped schemes of acclimatisation would not succeed, because they only wasted efforts which would be better employed in developing the native fish of India, which were some of the finest in the world. Unfortunately, the normal state of India was starvation, as he should show in a book on which he was at present engaged, treating of the whole question of food supply. Not a year passed in which there was not a district in a state of starvation, although he contended that much of the misery which ensued might be avoided. The Orissa famine need never have happened under proper management. He had not gone into the question of providing rare fish for epicures, but wholesome food for the people themselves. The natural resources of India were almost inexhaustible, but they wanted developing by means of European colonisation. In conclusion, he would read a passage from Dr. Day's report, showing the extent of the ravages committed by crocodiles, &c., and he might also mention that snakes, tigers, and other wild beasts were so numerous as to call for much more active measures to destroy them. Formerly, the government gave every encouragement to European officers to hunt them, supplying them with all necessaries for the sport, but they had become much more niggardly of late. They offered rewards for the slaughter of tigers, but the natives, from a superstitious feeling, would not kill them.

The meeting then adjourned.

ANNOUNCEMENTS BY THE COUNCIL.

CONVERSAZIONE.

The annual conversazione of the members will be held on Thursday, June 1st, at the South Kensington Museum. Cards of invitation will be issued in due course.

DRILL REVIEW.

The Council have the satisfaction of announcing that H.R.H. Prince Arthur has consented to review the boys from the district and other schools, in or near the metropolis, where drill forms part of the system of education. The review will take place in the Royal Horticultural Gardens at South Kensington, on Wednesday, the 14th of June. Further particulars will appear in future *Journals*.

CANTOR LECTURES.

The fourth lecture of the course on "Our Food-producing Ruminants, and on the Parasites which reside in them," was delivered by T. Spencer Cobbold, Esq., M.D., F.R.S., on Monday, the 8th inst. The fifth and last lecture will be given on :—

Monday, May 15th.

The general question of the Parasitism of Ruminants in relation to Sewage and Public Health.

These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

THE LIBRARY.

The following works have been presented to the Library :—

The Parliamentary Buff Book, for 1866, 1867, 1868, 1869, and 1870. Presented by the editor, T. N. Roberts.

The Gold Yield of Nova Scotia. Presented by the author, A. Heatherington.

"Pearl, or Sea Foam ?" or some thoughts on Secondary Education for Girls. Presented by the authoress, Miss A. E. Ridley,

Memoir of Daniel Maclise, R.A. By W. Justin O'Driscoll, M.R.I.A. Presented by Messrs. Longmans, Green, and Co.

ANNUAL INTERNATIONAL EXHIBITIONS

The Exhibition will open daily at 10 a.m., when the public generally will be admitted, but a privileged admission, for study, may be obtained at the South Entrance, in the Exhibition-road, from 8 a.m., at a charge of double the ordinary fee for daily admission. Season-ticket holders will have this privilege free.

Her Majesty the Queen has paid two visits to the Exhibition since it has been opened. The first visit was on Saturday morning, the 6th inst. Her Majesty entered from the Prince Albert-road, at a quarter-past eleven, and first inspected the alpacas and other hair or wool producing animals in the Western Annexe, and proceeded from them to see the British pictures and the other objects in the Western Fine Arts Gallery. Her Majesty then crossed the Horticultural Gardens, and ascended to the Foreign Fine Art Galleries. In the French Department, her Majesty was received by M. du Sommerard; in the Austrian, by Baron de Wertheim; in the Hungarian, by Count Posner; in the Italian, by Signor Baccani and Mr. Gullick; and in the Belgian, by Baron T'Kint and Mr. Corr Van der Maeren. The Queen afterwards passed through the Woollen Department in the Royal Albert Hall, and left by the Royal entrance. The Queen was accompanied by the Princess Beatrice and Prince Christian, and was met in the Exhibition by the Count and Countess of Flanders.

On the occasion of the second visit, on the 10th instant, the Queen was accompanied by H.R.H. Prince Arthur, H.R.H. Prince Leopold, and H.R.H. Princess Beatrice. Her Majesty was received at the north-east entrance by the Royal Commissioners for the Exhibition of 1851 :—The Duke of Buccleuch, K.G.; the Duke of Buckingham and Chandos; the Earl Granville, K.G.; Sir Thomas Bazley, Bart., M.P.; Major-General Sir Thomas Biddulph, K.C.B.; Sir F. Sandford; the Right Hon. A. S. Ayrton, M.P.; A. J. B. Beresford Hope, Esq., M.P.; E. A. Bowring, Esq., C.B., M.P.; Colonel H. Ponsonby; H. Thring, Esq.; T. Fairbairn, Esq.; C. Vignoles, Esq., C.E., F.R.S.; and Colonel Scott, R.E., C.B. The royal party passed through the Porcelain Gallery, the annexe in which are shown the various processes for making clay-pipes, bricks, *tesseræ* for mosaic work, and pottery of all kinds; then ascended to the Foreign Gallery; and, after a visit lasting over an hour, Her Majesty left by the north-east entrance.

The number of visitors admitted to the Exhibition last week is as follows :—Season tickets, 28,650; on payment of 10s., 2,068. Total, 30,718.

On Saturday evening a grand instrumental concert will be given, in the Albert Hall, by the band of the Royal Belgian Guides, who, by permission of His Majesty the King of the Belgians, have arrived in London expressly to perform at the International Exhibition.

The Exhibition of 1872.—At the last meeting of Her Majesty's Commissioners for the Exhibition of 1851, it was resolved to announce the following as the classes of manufactures to be exhibited next year :—

Cotton.
Jewellery.
Musical Instruments.
Paper, Stationery, Printing.
  (*a*) Paper, Card, Millboard.
  (*b*) Stationery.
  (*c*) Plate, letterpress, and other modes of printing.
Machinery for the group.
Raw materials for all the above-mentioned objects.

EDUCATIONAL NOTES.

The London School Board and Endowments.—At the meeting of the Board on Wednesday, Professor Huxley proposed the following motion, which was carried :—"That measures be taken to ascertain whether any, and, if so, what, charitable or other endowments in the London school district ought to be applied, wholly or in part, to the augmentation of the school fund." In the course of his speech, Professor Huxley referred to the subject of the Emanuel Hospital dispute, and he said what the Endowed School Commissioners proposed to do with that charity was the very model upon which he should desire to see legislation follow with regard to other charities.

Free Schooling in Denominational Schools.—It will be remembered that a bye-law, to enable the Liverpool School Board to pay the fees of the children of indigent parents in denominational schools, was recently submitted to the Education Department by that Board, and a memorial from certain ratepayers, who objected to it, was also presented to the Department. Mr. Forster has now given his reply to the Board, in which he expresses his opinion that "the Education Department cannot refuse their sanction to the principle involved in the disputed bye-law, viz., that the School Board undertakes to pay the fees, at any public elementary school, of any child whose parent is too poor to pay for his schooling, provided that—(firstly) the Board has reason to believe that the poverty of the parent does really prevent his making such payment; and (secondly) the choice of the public elementary school be left to the parent. In carrying out this principle, subject to these conditions, the Board are merely exercising the power given them, by section 25 of the Act, to do so by their own independent authority, and that whether they do or do not pass compulsory bye-laws; and it is impossible to deny that the application of the principle of compulsion strengthens the argument for making use of this power. It is urged that, in aiding the parent, the Board should confine such aid to the remission of fees in School Board schools under section 17; but it is possible that the parent, from motives of convenience or conscientious conviction, may prefer a public elementary school not provided by the Board; and it would not be just to deprive him of his right of choice because he is compelled to send his child to school, and is known to be unable, by poverty, to pay the school fee. At the same time, Mr. Forster does not doubt that the Board are as anxious as he is to keep before the mind of the parent his duty first, and before either the State or the borough, to pay, if he is able to do so, towards the education of his child. Mr. Forster would, therefore, suggest whether the wording of the bye-law might not be so altered as to make it absolutely clear that it is not intended to release the parent from this obligation." Mr. Forster also asks the Board to consider whether it might not be well to provide that the fee paid at any school should not exceed the ordinary fee charged at such school, as well as the scale mentioned in the bye-law. Accordingly the Liverpool Board have revised the bye-law in accordance with Mr. Forster's suggestions, and it now stands as follows:—"If any parent who has been served with a notice under these bye-laws, requiring him or her to cause his or her child to attend school, satisfies the School Board that he or she is unable, from poverty, to pay the school fees of such child, the School Board, in the case of a school provided by the Board, will remit, and in the case of any other school will pay, the whole or such part of the fees as, in the opinion of the Board, the parent is unable to pay, for a renewable period, to be fixed by the Board, not exceeding six calendar months, provided that the amount of fees to be remitted or paid shall not exceed either the ordinary payment at the school selected by the parent, or the following scale:—For any child under eight years of age, 3d. per week. For any child exceeding eight years of age, and under ten, 4d. per week. For any child exceeding ten years of age, 6d. per week." On the general question of the remission of school fees, Mr. G. C. T. Bartley points out the evils likely to arise from extending the area of exemption too widely. "With pauperism and dependence assuming the gigantic proportions which they have now attained, everything should be done to encourage feelings of self-reliance in such matters, and individual cases of occasional hardship which may have to be put up with are not such serious evils as the loss of honourable and independent self-reliance among the poorer classes. The importance of the subject of fees is derived not so much from the amount that is likely to be realised from them as from the general principle whether or no it is desirable to extend the system of making persons rely more and more on outside assistance. In reality this assistance, in whatever shape it come, amounts to relief, and however much it may be disguised and classified as a free and national system, it has a demoralising tendency."

The Efficiency of Existing Schools.—Sir Francis Sandford, in his reply to the communication of the London School Board, asking the Education Department to undertake an inquiry into the efficiency of schools now in operation, says:—"My Lords are glad to learn that the Board have been able, within the prescribed time, to obtain the school returns called for under the 67th section of the Education Act; and they are prepared to give effect to the wishes of the Board in regard to the proceedings to be now taken for the completion of the inquiry into the school provision of the metropolitan district. The object of the inquiry will be to ascertain, with respect to each of the divisions of that district:—1. The number of children within its limits for whom means of elementary education should be provided; (*a*) between the ages of three and five, and (*b*) between the ages of five and thirteen. 2. The provision to meet the requirements of these children (*a*) already made by efficient schools, or (*b*) likely to be made by schools either contemplated or in course of erection. 3. The deficiency (if any) in the supply of efficient elementary education, as shown by comparing 1 and 2. 4. What schools are required to meet this deficiency? 5. The localities in which such schools should be provided. My Lords understand it to be the wish of the Board that the Education Department should undertake so much of the inquiry as relates to the efficiency of schools now in operation, but that the remainder of the inquiry should be conducted by the officers of the Board. They, therefore, propose to entrust the examination into the efficiency of the existing schools to a staff consisting of nine of Her Majesty's inspectors, who will enter on the charge of the several districts of the metropolis. They will be assisted in this duty by inspectors of returns, who will be shortly appointed by this Department. The returns forwarded by the Board will be placed in the hands of Her Majesty's inspectors, who will be instructed to furnish my Lords, as soon as possible, with a report upon the efficiency of each of the schools from which a return has been received. These reports will enable the Department to form an opinion as to the extent and efficiency of the school accommodation already provided in London. The Board, meanwhile, will obtain information as to the amount and character of the public school accommodation which is required by the metropolis. So soon as these distinct parts of the inquiry are completed, a comparison of the results thus obtained by two independent authorities will enable some trustworthy conclusions to be formed as to the extent of the deficiency to be supplied, and the best means of supplying it."

CORRESPONDENCE.

THE PRINCE CONSORT MEMORIAL IN HYDE PARK.

SIR,—In continuation of my former letters, I would say that, as regards the central support to the memorial, containing four niches for the reception of the standing marble statues of the Prince Consort, there is no difficulty in its being built up so as wholly to relieve the structure from the superincumbent weight of the great central pinnacle, with the object of adding such monumental stability to the memorial as would enable it to endure for ages. It would have also the following advantage in addition to those already quoted. The pillared canopy is at present so little connected with the statue, that it has been remarked that it almost suggests its own removal, leaving the statue the apex of the composition. But, on the other hand, if the central pinnacle, instead of impending over a vacancy, were continued downwards so as to supply its own support, and receive in niches in itself the four statues of the Prince under the four fronts of the canopy, it would then be so structurally and intimately connected with the great object and subject of the memorial, the presentation of the Prince, that it would thus attain and afford a combined unity in fact and effect, the lack of which at present has given rise to comment.—I am, &c., EPSILON.

May 8th, 1871.

GENERAL NOTES.

Coal.—Mr. R. Hart, F.R.S., has published in the *Popular Science Review* a calculation, showing that one pound of pure coal yields, in combining with oxygen in combustion, theoretically, an energy equal to the power of lifting 10,808,000 lbs. one foot high. The quantity of heat necessary to raise a pound of water one degree will raise 772 lbs. one foot; a pound of coal burning should, therefore, yield 14,000 units of heat.

Government and Inventors.—Colonel Strange will read a paper at the Royal United Service Institution on Monday evening next, the 15th inst., on "The Necessity for a Permanent Commission on State Scientific Questions."

Sale of Horses in Russia.—From a report lately published at St. Petersburg, by M. Mörder, on the breeding of horses in Russia, it appears that the number of horse fairs held in 356 towns and villages is 1,071 every year. The number of horses sold at these fairs is upwards of 300,000, at an average price of £9 each. The total number of horses in European Russia amounts to 19,226,667, or one to every three inhabitants.

The Institution of Civil Engineers.—At the last meeting of the members of this society, Mr. C. B. Vignoles, F.R.S., the President, announced that he proposed to give a *conversazione* at the House of the Institution on Tuesday, the 6th of June, for which occasion he should be glad to receive the loan of any engineering models, small and light pieces of mechanism, or scientific instruments, as well as of paintings, or water-colour drawings by ancient and modern masters of eminence, depicting some engineering work, object, or matter of interest, as "a bridge, lighthouse, aqueduct, harbour, &c., set in its appropriate landscape."

The Patent Laws.—At a meeting of the London Association of Foremen Engineers and Draughtsmen, held at the City Terminus Hotel, Cannon-street, on Saturday evening, Mr. Joseph Newton, president of the association, in the chair, a paper on the Patent-laws was read by Mr. W. Lloyd Wise, who explained the existing practice relating to letters patent for inventions, and suggested certain alterations whereby the abuses which have brought the patent system, as hitherto administered, into disrepute, might, in his opinion, be corrected. An interesting discussion ensued, and the following resolution was carried:—"That the recognition of property in inventions contributes most materially to the wealth of the community, and that the abolition of such property would be most injurious to the industrial progress of the nation."

Shrines, Tabernacles, and Pulpits.—Shrines and tabernacles are usually left free and open in the centre, to receive the image of the saint or angel destined to occupy them, as in the shrine of St. Sebaldus at Nuremberg (1506-1512), by Peter Vischer, and that of Peter Martyr (1339) in the church of St. Eustorgio, at Milan, by Balducci, of Pisa. These are quite small and narrow, and therefore do not require centre supports. The tabernacle, however, Della Madonna d'Orsan Michele, in Florence, by Andrea Orcagna, which is of great beauty of detail, and much celebrity, appears to be a wholly solidified work. Pulpits afford examples of a structure resting on a single support or wide column, or occasionally are supported on outer columns, supplemented by a central shaft, this latter arrangement presenting a very agreeable effect. Two of these belong respectively to the baptistry at Florence, and to the neighbouring cathedral. They are by the Pisani, father and son. In that in the baptistry, by Nicolo Pisano (1260), the central shaft consists of a simple column; but in the one in the cathedral, by Giovanni Pisano (1302-1311), and moved after the fire of 1596, the central support is more decorated, this feature being formed by three caryatid figures, back to back—if this term can be rightly applied to three figures. We refer to these, as casts of both may be consulted in the South Kensington Museum. In the beautiful little gem of a chapel by the side of the Arno, at Pisa, namely, that of Santa Maria della Spina, the votive shrine of the watermen of the river, and of the mariners who came up from the Mediterranean, is seen a profuse decoration of niches and small tabernacles for the images of saints. Various of these tabernacles and their images are now destroyed, as well as some of the niches injured, so that, in as far as these are concerned, this elaborate architectural casket is little more than a beautiful ruin, a ruin, however, which no visitor to Pisa should miss seeing.

Education in Italy.—General Torre, in his report upon the conscription for the Italian army, from 1st October, 1869, to 30th September, 1870, publishes some interesting statistics respecting the education of recruits, the total number of which were 81,181. Of these, 27,360, or 33·70 per cent., could both read and write; 3,466, or 4·27 per cent., could only read; and the remainder, 50,355, or 62·03 per cent., were entirely ignorant. But even this is an improvement on the preceding year, when $64\frac{1}{2}$ per cent. were found totally uneducated. This lamentable state of ignorance is greatly to be deplored, and the General urges the government to take example from Prussia, where at the last conscription only 2,696 out of 80,028 recruits, or 3·37 per cent., could not read or write. Some progress is made in the regimental schools, and he recommends that steps should be taken to enable all soldiers to profit by them. He further shows that out of the 25,545 completely illiterate conscripts born in 1845, 8,726 learned to read and write in the regimental schools, although this class were only three years ten months under arms, during which period they were engaged in the war with Austria and in supressing the tumults at Palermo, and therefore could not devote much time to education. If all conscripts were compelled to serve five years under arms, and the garrisons alternately changed in such a manner as to allow each corps a certain period for instruction, it is certain that a considerable number of men, who on entering the service were without education, would return to their homes every year with a certain amount of knowledge.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

May 17.—On "The Utilization of Prison Labour." By Captain E. F. Du Cane, R.E., Surveyor-General of Prisons. On this evening Sir Charles Trevelyan, K.C.B., will preside.

May 24.—*Derby Day.*—No Meeting.

May 31.—On "The Education of Women." By Mrs. Grey.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...**SOCIETY OF ARTS, 8.** Cantor Lectures. Dr. T. Spencer Cobbold, F.R.S., "On our Food producing Ruminants, and the Parasites which reside in them."
Victoria Institute, 8. Rev. C. Graham, "On Miracles."
Royal Colonial, $8\frac{1}{2}$.
Anthropological Institute, 8.
Royal United Service Institute, 8. Colonel Strange, F.R.S., "On the Necessity for a Permanent Commission on State Scientific questions."
Asiatic, 3. Annual Meeting.

Tues. ...Royal Institution, 3. Mr. Charles Brooke, F.R.S., "On Force and Entry."
Civil Engineers, 8. Mr. Arthur Jacob, "The Treatment of Town Sewage."
Statistical, $7\frac{3}{4}$ Mr. R. H. Patterson, "On the Influence of a High Bank Rate of Discount on Monetary Crises."
Pathological, 8.
Zoological, 9.

Wed. ...**SOCIETY OF ARTS, 8.** Capt. E. F. Du Cane, R.E., "On the Utilization of Prison Labour."
Pharmaceutical, 11. Annual Meeting. Conversazione at 8 in the South Kensington Museum.
Royal Society of Literature, $8\frac{1}{2}$. Dr. C. M. Ingleby, "On "Shakespeare's Birthday."

Thurs...Royal Institution, 3. Professor Tyndall, "On Sound."
Antiquaries, $8\frac{1}{2}$.
Chemical, 8. 1. Mr. R. J. Friswell, "On a new Double Salt of Thallium." 2. Dr. Armstrong, "On a new Benzolic Derivative."
Numismatic, 7.

Fri.......Royal Institution, 9. Professor Huxley, F.R.S., "On Bishop Berkeley and the Metaphysics of Sensation."
Philological, 8. Annual Meeting.
Royal Botanic Society, 4. Professor Bentley, "On Economic Botany."
Architectural Association, $7\frac{1}{2}$.

Sat ......Royal School of Mines, 8. Dr. Spencer Cobbold, F.R.S., "Geology." (Swiney Course.)
Royal Institution, 3. Mr. Joseph Norman Lockyer, F.R.S., "On the Instruments used in Modern Astronomy."

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FRIDAY, MAY 19, 1871.

PROCEEDINGS OF THE SOCIETY.

TWENTY-THIRD ORDINARY MEETING.

Wednesday, May 17th, 1871; the Right Hon. Acton Smee Ayrton, M.P., in the chair.

The following candidates were proposed for election as members of the Society:—

Bromilaw, David, Battlesden-park, Woburn.
Lister, Simeon, Great Horton, near Bradford, Yorks.
Sams, John Sutton, St. Peter's-lodge, Eltham-road, Lee, S.E.
Tolhurst, George E., 38, Elgin-crescent, Notting-hill, W.

The following candidates were balloted for and duly elected members of the Society:—

Boase, Francis, Mayor of Penzance.
Bridgeman, Greswolde D. Orlando, Tudor-lodge, New-road, Hammersmith, W.
Challis, George Ward, 6, Winterslow-place, Vassall-road, Brixton, S.W.
Moyle, Rev. Vyvyan H., M.A., Normanby-house, Middlesborough, and St. Stephen's and Clergy and Laity Clubs, London.
lter, Jonathan, 211, Albany-street, Regent's-park, .W.

The Paper read was—

ON THE UTILISATION OF PRISON LABOUR.

By Capt. E. F. Du Cane, R.E.,

Surveyor-General of Prisons.

The subject of prison labour is one of more general importance than it might, on first consideration, appear to be to those who have not had occasion to look into it. The view which most obviously presents itself is that which gives rise to the question, How can the labour of prisoners be best applied, so as to recoup as far as possible the cost of their maintenance?

This cost amounts to about £900,000 per annum, for maintaining about 33,000 male and female prisoners in Great Britain and our penal settlements. Out of these, about 13,000 are government prisoners, and the remainder are in county and borough gaols, under short sentences.

But though the most obvious, this is not the most important of the considerations involved in this question, even pecuniarily.

The primary object of punishment is to *deter* people from committing crime, by fear of the consequences; and in every well-considered scheme of penal discipline the labour forms a considerable contribution towards both the deterrent and the reformatory effect of prison punishment. Thence arises the question, What way of employing prisoners will produce the most complete effect in checking crime, either by its deterrent effect, as punishment, or by its reformatory effect, in forming such habits of useful industry as may remove from a prisoner, on his discharge, some of the inducements to a life of crime?

The number of known criminals at large in England and Wales was returned, in 1870, as 54,249; and in making this return, every discharged prisoner who is not found to have committed a crime within a year of his discharge is reckoned as an honest man—a very doubtful assumption. The whole number of crimes committed was 58,441. The loss of property by these crimes is not returned, but may be calculated by taking the loss by crime in the metropolis as a guide, for I find by Colonel Henderson's returns for 1870—

Crimes in metropolis, 1870 ..	19,095	..
First loss from these crimes..	..	£98,946
Crimes in England and Wales	58,441	..
Proportional first loss	..	306,815

The cost to society of the depredations of this army of criminals, who live upon the fruits of other men's industry, may therefore be estimated at £307,000 per annum, without including the cost of police and such expenses; and what it would be if many were not deterred from crime by fear of its consequences it is impossible to say—no doubt very much larger; so that, even from a pecuniary point of view, the most important point is the prevention of further crime, and no secondary object should be allowed to interfere with this one.

I have assumed, in what I have now stated, that the actual principle of our criminal law is the correct one; but I think it must occur to anybody who considers the figures I have given, and who knows that criminals form a complete class, and that most of these crimes are not committed by merely casual or chance depredators, that it is a question whether the true principle would not rather be to try and stamp out the evil. A philsophical writer, who discussed this subject in the time when transportation beyond the seas was the usual punishment, put forward the opinion that these offenders should be transported *vertically*. This, perhaps, would be too strong a measure, but it is a question whether we might not confine for life proved incorrigible offenders, and certainly the 2,600 people who, by acting as receivers of stolen goods, not only derive the greater part of the profit from the crime, but act as the recruiting officers for the criminal army.

As a sample of an incorrigible offender, I might mention such a man as he who made the bone model of a key, and whose thoughtful portrait is attached. He seems to have really taken a pride in the profession of housebreaking, which he followed while in prison. He managed to write a full set of instructions for the manufacture of false keys of various kinds, which he intended to have got smuggled out (perhaps through some prisoner on his discharge) to a friend. This paper was seized and handed to the police, who found it very useful. The key in bone is a model of one of the keys used in the prison he was confined in. The prisoner observed that the chaplain was in the habit of carrying his key in his hand, and taking opportunity to engage him in conversation, he took mentally so accurate a pattern of the key as to be able to make this model, which is formed of a piece of bone he had in the soup, and mounted on a wooden spoon as a handle. This man could evidently not be *deterred* from crime, nor could he be reformed. He was one of our failures, and might be disposed of either by locking him up for life or transportation vertically.

I do not wish now to raise this question of the criminal law, and only advert to it merely because the labour question which we are met to consider would assume a different feature in the case I have suggested, for we should then, without actually giving up the idea of punishing and reforming, think more of making the criminals pay their expenses. I am under the impression that such a system would pay its expenses over and over again.

There are three objects, therefore, to be attained by the employment of prisoners at labour:—1stly, to create a deterrent effect on the prisoner himself, and on the criminal class; 2ndly, to produce a reformatory effect on the prisoner himself; and 3rdly, to recoup, as far as possible, the cost of maintaining the prison.

There are certain matters I should advert to here, because they materially affect the difficult problems we have to solve.

1st. A large number of prisoners are persons who are absolutely unable, or find it extremely difficult, through mental or physical incapacity, to earn their livelihood, even under favourable circumstances. Of the 8,362 men now serving out sentences of penal servitude in government prisons in England, no less than 252 are absolutely lunatic or weak-minded, 308 are subject to bodily infirmities which render them unable to earn a living, and 1,140 are fit only for the lighter kinds of labour, making in all 1,700, or 20 per cent. of the whole. Of the women, out of a total of about 1,300, 36 are lunatic or weak-minded, 79 permanently incapacitated from earning a living, and 110 fit only for light labour, making in all 225, or 17 per cent. These people, even if they were out of prison, would still be, in a greater or less degree, a charge on the public; it is hopeless, therefore, to expect them to repay by their labour the cost of their custody and maintenance in prison.

2nd. Prison labour must always be carried on under the disadvantage of being without that stimulus to industry which is afforded by the prospect of immediate benefit as a result of it. In some foreign countries, where great weight is given to the object of making the prisons pay, the prisoners are allowed to draw and to expend a certain portion, generally about one-third, of their earnings on various small luxuries, such as additional and better food, tobacco, &c.; a certain other portion is set aside for them on their discharge, and the government takes the remainder.

In convict prisons in England the system did at one time allow a prisoner to profit more or less directly by his industry, by obtaining more or better food in prison, and a larger sum of money on discharge. This gave rise to a great deal of hostile criticism. It was said that prisoners might be better off in regard of food than many an honest poor man, and that this, with the fact of his possessing a sum of money on discharge, which an honest, hardworking labourer would be unable to accumulate, produced a comparison too much in favour of a dishonest instead of an honest career. Public opinion therefore demanded that the condition of prisoners throughout their sentence should be that of having only the barest necessaries in the way of food, and just sufficient money on discharge to enable them to maintain themselves while seeking employment; and this principle, which I believe to be a correct one, was adopted by a Royal Commission which inquired into the subject of prison management in 1863, and has been carried out by the direction of the Government.

The only stimulus we can afford to a prisoner, therefore, is that of gaining by his industry a remission of some portion of his sentence, or that of punishing him if he is idle. Even with only these means we are able, by steady supervision, to obtain very good results, as I shall be able to show. But there are prisoners, chiefly the habitual criminal class, who actually prefer any punishment which involves a partial relief from labour to the steady industry required on the public works.

3rd. A great deal of opposition is made to the government, either local or central, entering the market as manufacturers, and competing with free labour. Of course this is utterly unreasonable, but that does not prevent its having a certain effect. The particular trade which happens to suffer from the competition of prison labour is naturally loud in its outcries, and can always find active advocates; and, on the principle that everybody's business is nobody's business, this agitation is not counterbalanced by a corresponding agitation on behalf of the public, and in aid of those who act in the public interest. The customs of trade societies are also adverse to the action of government in this way, and I have lately seen that a certain trade society has passed resolutions against being subjected to the competition of prison labour.

It is so obvious as hardly to require stating, that as persons who are earning a livelihood while free are competing with somebody or other, so it is perfectly reasonable that they should work, and therefore compete equally, after being put in prison.

There is, however, some limit to the degree in which prisons should be converted into manufacturing establishments. I doubt whether such employment should be carried on as requires the purchase from public funds of a large and expensive plant and machinery, the value of work done by which would bear a great proportion to the value of the prisoners' labour, because in such a case it is not merely competition against prison labour but against government capital. The circumstances of a prison render the profit a secondary transaction, and moreover it cannot be ensured that in a government establishment the profit will always be so narrowly looked after as if it were private property, so that the profit which should be earned by the public money so expended is liable to be neglected or forgotten, and this would enable the goods made to be sold at a cheaper rate, and so to cause undue disadvantage to the free workman.

Many of the disadvantages which attend the system of making prisons into manufactories are avoided by performing in them work required by the government, either central or local, and certainly work of this kind should be preferred to any other.

I can now continue the main question. The most practical way of carrying out the ideas I have stated, as to the three aims of prison employment, viz., deterrent, reformatory, pecuniary, is to divide the period of punishment into different stages, during one of which the penal or deterrent object should be considered almost exclusively; during the other, the reformatory and pecuniary may prevail in various degrees.

The most effective system of continuous punishment we can carry out consists of strict isolation, diet reduced down to the barest necessaries, deprivation of all the comforts which men of the prisoner-class usually allow themselves, and among these I may mention the comfort to them of being dirty, for many of those who visit our prisons remark on the cells as being so "clean and comfortable," whereas many prisoners, if they expressed their ideas on the subject would call them "clean and uncomfortable." Above all things must be mentioned the deprivation of tobacco. In addition to these is the punishment of hard, dull, useless, uninteresting, monotonous labour, such as crank, treadwheel, shot-drill, oakum-picking, and so on.

There is a limit to the time during which a prisoner can be advantageously subjected to these punishments. Labour of the kind I have described is decidedly brutalising in its effects. If it is desirable to resort to it for its penal effect, it must not be continued for too long a period. To men of any intelligence it is irritating, depressing, and debasing to the mental faculties; to those already of a low type of intelligence, it is too conformable to their state of mind, out of which it is most desirable that they should be raised. The period during which isolation can be strictly carried out is also limited. At the first establishment of Pentonville Prison, it was inflicted for 18 months, but the effect on the minds of many prisoners was so marked that it was considered absolutely necessary to shorten the period, and it has been reduced, step by step, until it now stands at nine months. No ill effects are observed on the mind now, but it is a question whether even this period might not advantageously be shortened, as being more than is necessary to produce the required result, and perhaps it might be divided into portions, and a part undergone at the end of the sentence. When a prisoner's sentence is very short, there is obviously no time to do much in the way of reforming by labour, and the exclusively penal stage will occupy the whole of his time in prison.

In some rules lately drawn up by the Directors of Convict Prisons, for military prisoners who are under their management undergoing short sentences, it is provided that during the first month the strictest penal labour shall be enforced, such as crank in solitude, pumping. After this, more interesting labour is allowed them, always in isolation. It is in this stage that the difficult problem arises of providing suitable employment, which shall fulfil the necessary conditions and yet be remunerative. It is obvious that it must be such as can readily be acquired by unskilled persons, capable of being carried on in isolation and not too easy, as prisoners should (when capable) be employed on *hard* labour. Work which can be performed well by machinery is not likely to pay.

The employments which have been introduced into county and borough prisons are—Grinding corn by treadwheel or crank; weaving cocoa-nut mats or carpets, or woollen and linen stuffs; matmaking; sawing firewood; tin work. Flax scutching has lately been recommended by Dr. Briscoe. Ship fender making is profitably followed in the neighbourhood of seaports, and there are other employments fitted to the various localities.

In those government prisons in which the period of isolation is carried out for nine months, the following are some employments carried on by prisoners in this stage:—

	Average earnings per day
Tailoring	$7\frac{3}{4}$d. to $9\frac{3}{4}$d.
Shoemaking	$7\frac{1}{2}$d. ,, 1s. 1d.
Matmaking	$5\frac{1}{2}$d. ,, $6\frac{1}{2}$d.
Weaving	8d. ,, $11\frac{1}{2}$d.
Knitting	2d. ,, $2\frac{1}{2}$d.
Oakum-picking, which is carried on mainly for the penal character of the work	$\frac{3}{8}$d. ,, $\frac{1}{2}$d.
Shoe closing (for women)	6d.
Needlework	3d. ,, 5d.
Basket making	1s. ,, 1s. 6d.

Matmaking is an industry carried on in a very large number of prisons in England, and, in fact, it is so general that I believe the prisons actually compete with one another for custom in this trade.

The cost of a prisoner may fairly be taken at £26 per annum, at least the actual cost at the county and borough prisons varies from £16 per annum up to £139 in one case. There are many prisons in which no earnings are made at all, and the most profitable do not earn more than one-fourth or one-fifth of their cost; very few, indeed, come up to this result, so it is clear that the problem of finding remunerative labour for prisoners in this stage has not been solved. In America, I am told, there are prisons which pay more than their expenses, but I do not know that those in which the separate system is carried out do so. Taken altogether, the New York prisons show a deficiency in five years to a very considerable amount, although great efforts have been made to ensure an opposite result. One of these prisons is built on a marble quarry, and the marble raised and sold more than covers the expenses. Another is built on an iron mine; and in others the labour of the prisoners is sold to contractors at 40 to 50 cents per day, the contractor finding material. This latter system is the most common one in continental prisons, but it is deservedly condemned by well-qualified people. It introduces into the prison an element which is directly adverse to discipline, to which it is obvious that everything should be made to yield.

In our government prisons, after the period of nine months' labour in isolation has been passed, prisoners are transferred to other establishments, where they work in association. As the conditions under which they work in this stage more resemble those which prevail outside, it is obvious there is more chance of the work being such as may be useful to them on the conclusion of their sentences, of their being taught useful trades, and of the work being made to pay. Outdoor employment is best in every way; it is healthiest both for body and mind, and generally requires less skill.

Some years ago, these convicts were employed in jobbing work about the dockyards; they worked in chains, scattered in gangs over the yard, and a great deal of the work was mere brute labour, such as dragging heavy loads, which would have been done far better and cheaper by horses. Such work is neither reformatory nor remunerative.

The first improvement on this system was when the Convict Prison at Portland was opened, in 1848, and shortly afterwards that at Dartmoor, in 1850, the prisoners in the latter being employed in reclaiming the moor-land and converting it into a farm. It was a bold experiment to depart so far from previous practice as to employ 1,500 prisoners in the open country without any wall to keep them in, or any chains to hamper their movements, but it was completely justified by the result, and there has never, during the whole years, been any difficulty in controlling the prisoners or ensuring their safe custody. Such work as the farming at Dartmoor answers many of the conditions, but it cannot be said to pay. The land is of the poorest description, the climate very unfavourable, and much preliminary labour is necessary in draining and clearing away the rocks. If government should utilise the prisoners' labour by farming, it would be better to take good land and make the best of it, instead of bad land in which much of the labour is thrown away.

The best system ever devised for the employment of convicts is that of executing large public works by means of their labour. It furnishes them a means for their acquiring a variety of trades which will be useful to them on their discharge. This is an advantage which is largely made use of, and it is highly appreciated by the prisoners. It is more interesting, and therefore more likely to make the prisoners fall into habits of useful industry than if they were always employed at work which must present labour in the most repulsive form to their minds. The prisons in which works of this nature are carried on do absolutely perform work to an amount equal to, and sometimes beyond their expenses. Lastly, important works may sometimes be executed by this means, which the public might not be always willing to pay for in money, because while only a comparatively few may quite understand their importance, everybody appreciates and inclines to oppose a proposal to increase debt or taxation.

The earnings of the convicts at Portland, Portsmouth, and Chatham, during the year 1870, amounted to £143,507, exclusive of the value of any work which they performed for the mere carrying on of the prison, such as baking, cooking, washing, repairing clothes, and so on, all of which are of course done by prisoners. The cost of maintaining these prisons in 1870-1 was £128,960, in which sum is included the cost of maintaining those who, from sickness or from being under special punishment or for other reasons, added nothing to the earnings; and it includes also the cost of conveying the convicts under escort to the prisons, and removing them on expiration of their sentences, as well as the amount of gratuities paid to them to maintain themselves while seeking employment on discharge. There is a clear balance, therefore, in favour of these prisons of £14,547.

The greatest care is taken that the earnings should be correctly calculated and truly stated. A staff of men is employed, whose business it is to measure the prisoners' work. A schedule of prices for the labour has been formed (not by the Convict Department alone, but in conjunction with the Admiralty and War Departments), which correctly represents the amount which would be paid by those departments to a contractor for work of a nature similar to that done by the convicts. The work measured is then priced out at the rates given in the schedule, and an abstract, given as fully as possible, is given every year in the Report of the Directors of Convict Prisons.

The greatest desire has therefore been felt, and the greatest pains taken to make these returns at all events true, and the result, as shown by the earnings, I think, is not unsatisfactory, considering that the men have to be taken as they come, many quite unaccustomed to work, that they have no pay, that the necessities of safe custody tend to a certain loss of time actually at labour, and that as, for the same reason, the men must work in gangs, it occasionally happens that labour must be wasted.

Some comparisons made by Captain Harvey, in 1867, between a gang of 20 free labourers working in Portsmouth Dockyard and a gang of 20 convicts working near them at the same labour, shows very clearly the difference in the material we have to deal with, and the difference in the results.

The 20 navvies were brought up to that work, and, excepting three hodmen, had never done any other. Only two of the gang of convicts had been navvies before, the rest were stokers, sailors, hawkers, spinners, drivers, coal whippers, &c. The navvies averaged 35 years of age, were 5 feet 7¼ inches in height, 36⅓ in. round chest, and weighed 155 lbs. The convicts averaged 28½ years of age, 5 feet 5½ inches in height, 34½ in. round chest, and weighed 132 lbs. The gang of navvies drank 413 pints of fluid in a week; a good deal of this was beer, no doubt. The gang of convicts drank 285 pints, nothing stronger than tea or cocoa. The navvies ate 10,808 lbs. solid food. The convicts ate 6,377 lbs. In physique, skill, and diet the navvies, therefore, are immeasurably superior to the convicts, and, further, from the requires ments of regularity and security, the convicts were a shorter time actually at labour. The earnings of the navvies at day-work was 3s. 3d., the convicts 1s. 11d., or nearly two-thirds of what the navvies earned, and this is, I believe, as much as could be expected.

This comparison bears upon another point which has sometimes been raised in connexion with proposals for the useful employment of prisoners, viz., whether or not prisoners should be employed at the trades which they have followed before conviction. My own impression is, and our actual practice is, to do so as far as practicable, excepting the period during which *penal* labour is enforced. But, practically, it is not possible to carry out the rule at all generally, because many of the occupations followed by prisoners outside are not such as are possible in a prison, such as shopkeepers or servants, hawkers, drivers, miners, &c.; and many others would require the provision of tools, special workshops, and so on, which it would not pay to establish without the certainty of providing a continual current of men through the prisons to carry on the trades in question.

If anybody has the feeling of suspicion about figures which is embodied in the saying attributed to Canning, "Nothing is more deceptive than facts, unless it be figures," then I say let them go down and see the prisoners at work, and I think they will be satisfied that they show a very considerable degree of industry, and that their labour is altogether well directed. Such, at least, was the opinion of a large brickmaker who visited the works at Chatham, where this employment is carried on, and who observed that if he could get his men to work like the convicts he had seen he should do much better than he found he did.

To give some idea of the public works done by convicts since the system was introduced, I may state that, at Portland Convict Prison, labour has been employed in quarrying the stone for the construction of the breakwater, a stone dam in the sea, nearly two miles in length, and running into water fifty or sixty feet deep; they have also done the principal part of the work of defence intended to prevent an enemy obtaining possession of the island; and I may say, *en passant*, that these works are in my opinion impregnable to any attack except blockade and starvation of the garrison—a contingency which is out of the question.

As a measure which may give some idea of the amount of work done at Portland, of one kind alone, viz., quarrying, I may say that the prisoners have quarried upwards of 6,000,000 tons in all, and dressed a large part of it. In executing these works, every variety of mechanics' work necessary in building or engineering has been executed by convicts—quarrying, and dressing, and placing the stone, all sorts of carpentry, casting and forging ironwork, and so on. The large and extensive plant have also been made by the convicts and kept in repair, including the construction of the large cranes and derricks in the quarries, and the laying of the rails for the quarry waggons, to run on their way to the place for delivery of the stone.

The extensive works which have been undertaken of late years at Chatham and Portsmouth for the enlargement of these dockyards have been largely done by convict labour. The prisoners have been employed in excavating basins, and building the sea wall and the dock walls, besides a vast quantity of preliminary work, such as demolishing the old fortifications at Portsmouth, and draining St. Mary's Island at Chatham. The bricks used in these works have been made by convicts, to the number of 77,181,545 at Chatham alone, and the Portland-stone for them has been raised and worked by the convicts at Portland Prison.

The work at Portsmouth comprises excavations 30 feet deep, below the mud surface of the harbour, and driving piles and sheeting both by hand labour and by engine, the engine being attended by prisoners. The dock walls of concrete and brickwork, faced and laced with stone, have been formed by convicts, the bricks being made on the spot, and the stone supplied from Portland.

Work requiring a still higher degree and greater variety of skill has been done for the Convict Department, in the building of new prison accommodation, rendered necessary by the cessation of transportation. Within the last few years, prison accommodation in cells for 1,889 prisoners has been erected entirely by convict labour, and a number of accessory buildings, quarters for officers, and so on. The actual cost to the government of buildings of this kind, erected for the Convict Department during the last few years, has been about £93,000; the same work done by contract would have cost £165,000, showing a clear gain by convict labour of £75,000 in this comparatively small department of their labour. In these works, the bricks have been made by prisoners, stone quarried and dressed, timbers sawn and wrought, and iron cast and forged from the raw state; one thing only, almost the only one, we have, for obvious reasons, bought ready-made, and that is *the locks*.

Among these works the largest are—a new prison for 700 women, built entirely by convicts, new wings to the prisons at Chatham and Portsmouth (of which a model is exhibited, showing a new mode of ventilation adopted). At Pentonville, an addition of 327 cells has been made under rather peculiar circumstances. The ground space is so restricted, that the only way to add to the prison was by raising the roof and adding a story, and as we were much pressed for room, this had to be done while the prisoners continued to inhabit the prison. This work is still being carried on, and has proceeded thus far very successfully, thanks to the energy and constant care and watchfulness of the responsible officers at the prison.

I have said that all the mechanics' work of these buildings is done by convicts. It must not be supposed that we found these mechanics ready to our hands among the prisoners. Out of 2,245 prisoners now employed at trades, 1,650, or three-fourths, acquired their skill in the prison; and these men will, it is thought, on their discharge be less likely to relapse into crime, as they will have full opportunities of pursuing an honest calling. The governors of Portland and Portsmouth prisons call attention to the great desire exhibited by the prisoners to acquire knowledge of trades, so many being anxious to learn that it is made a privilege to be obtained only by good conduct. It is also reported that the reports for misconduct are much fewer among those prisoners employed in trades than among others who are employed jobbing about, though the latter is much the easier work.

As samples of the capacity of convict labour for work requiring skill, I may refer to the church now being built at Portland for the families of the officers—work which, as the photograph shows, involves a great deal of stone-cutting and good mechanics' work. The value, in fact, of the skilled labour done in the prisons I have the average earnings of some of the principal trades being named amounts in one year to £78,433 out of the total I have named, as follows:—

	s.	d.		s.	d.
Carpenters	2	4	to	3	6
Bricklayers	3	0	„	3	10
Smiths	2	7	„	3	6
Painters	2	8¾	„	3	1
Masons	2	1¼	„	3	11¾
Platelayers	2	5	„	2	9
Quarrymen	2	1	„	2	5
Sawyers	2	2			
Brickmakers	1	9¼	„	3	6¾

Female convicts in the associated stage are employed in washing, tailoring, needlework, shoe-closing, &c., at which employments they earn up to 1s. 3d. per day. But some additional varieties of work are very much wanted for female prisoners.

The manufacture of mosaic flooring has lately been suggested to me by Mr. Cole, and has very successfully been carried out. The material is refuse marble, and it is broken to a size and bedded in cement to form a pattern. A specimen is exhibited, the cost of the material of which is 3d. per foot.

Some specimens of this work, of a rather artistic character, are exhibited in the International Exhibition, and it is thought sufficiently successful and distinctive to entitle it to a special name, having been christened (to distinguish it from other kinds of mosaic work) *Opus criminale*. A good deal of pavement of this kind has been made for the South Kensington Museum and for Bethnal-green Museum. It is work which could be undertaken to a much larger extent, and would be suitable where an artistic and durable pavement is required, as I believe it is preferred to any that has been laid down at South Kensington.

Terazzo is another material which has been made experimentally. A specimen of this is exhibited. I have tried them also at leading in glass for painted windows, which they have done very well. (Specimen exhibited). The success of the mosaic work shows, I think, that if manufacturers and inventors would bear the subject in mind, they would find many kinds of employment in which prisoners' labour might advantageously be employed.

An account of the manner in which prisoners are employed would not be quite complete, if something was not said of the way in which they sometimes employ themselves in surreptitious industry. The discipline is now so strict that manufactures of this kind are not very common, but there are here shown some specimens which have been collected. The great object of most prisoners' desire is to get a bit of tobacco, and many of these articles were made out of some material which the prisoner picked up, and were intended to buy tobacco. The chain and collar, and the little fancy padlock were made by a prisoner at Gibraltar, who had a tame rat. The following account of this is given by the governor:—

ARTICLES SURREPTITIOUSLY MANUFACTURED BY GIBRALTAR PRISONERS.

No. 1. *Chain for a Tame Rat.*—Some years since, it was customary (and to a certain extent the practice seems to have been tacitly allowed to obtain) for prisoners to keep pet animals, such as rats and mice, snakes or lizards, especially the large species called guana, two feet or more in length. They would find the reptiles basking in the quarries where they labour and secure them, bringing them into the prison in their bread-bags. These creatures soom become tame and attached, at all events to their captors. To the too inquisitive warder in the execution of his duty, searching the bags, they were, on the other hand, highly obnoxious, and many an officer has suddenly dropped the bag, from which sprang a yard or so of snake, with a frightful hiss, or has quickly withdrawn his hand from his prying mission with a lacerated finger. Luckily none of the rock snakes are venomous, otherwise an opportunity might frequently be afforded for malicious prisoners to gratify their revenge terribly, for fancied persecution on the part of the "screw." The accompanying neatly-made article was manufactured some years since, by a prisoner named Pimm. It is a collar, with a very ingeniously contrived padlock, and a chain attached of links of flattened wire, for a tame rat. Pimm was a singular character, and this rat was his constant and only companion, for he never would associate with his fellow-prisoners in the same ward, or speak to them. He had taught the rat many performances. It would run up a gas pipe when ordered, and come down, at a whistle, from any elevation. It slept in his hammock, and he would take it out with him to labour, chaining it up whilst so engaged. At last Pimm so seriously misconducted himself as to necessitate a lengthened period of restraint in the cells, and the rat was doomed to be destroyed. From that time forth, Pimm obstinately maintained, and until his discharge, a sullen and morose demeanour towards fellow-prisoners and the authorities alike.

No. 2. *Compasses and Pencils.*—Such instruments were frequently made by prisoners, to facilitate the study of geometry in their wards. Being prohibited articles, they would secret them in crannies in the wood-work of the ward.

No. 3. *Prisoners' Rings.*—In one is inserted a piece of the congealed stone commonly made into ornaments at Gibraltar.

No. 4. *Saws*, for cutting the congeal (which is a stalagmitic formation), into ornaments, for trafficking with free men for tobacco, &c.

No. 5. *Improved Weapons* from hoop steel, a material much sought after by prisoners for knives and files, for which purpose a piece of hoop from an old crinoline is admirably adapted. With such implements, which are easily secreted, a prisoner can effect a variety of operations, shave, carve stone, wood, or bone, or tamper with his cell with a view to effecting his escape.

No. 6. *Razors*, prison-made. Since the substitution of clipping with scissors for the use of the razor, prisoners have often been detected shaving with blades of their own manufacture, apparently preferring a smooth chin with the risk of punishment.

No. 7. *Skeleton keys.*

No. 8. *Brass guns*, made in the workshops, for trafficking with free men.

The saws are mostly made of crinoline hoop, pieces of which occasionally are found lying about.

I have said that the execution of public works of a suitable nature is the kind of employment which best fulfils the conditions required for convict labour. The prisoners can learn trades, they can learn to habituate themselves to useful work; the nature of the employment is healthy, the objection of competition against free labour is less felt, and the prisoners pay their expenses, or more. These advantages are secured by no other system of employment in the same degree; it is therefore very desirable that we should continue this system.

It can hardly be doubted that there will always be an abundance of useful public works to which prisoners' labour might be devoted, and it cannot be too generally made known what resources are at the disposal of the government for the execution of such as are of admitted importance, and to invite suggestions on the subject.

It happens that at this moment these resources are about to be largely increased, not because crime is increasing, for, on the contrary, returns show that it is decreasing, but the abolition of transportation to Western Australia is causing a gradual accumulation of convicts in this country. All existing prisons are full, and have been added to as much as possible, and it is therefore necessary to undertake the construction of another prison, and this might be placed wherever the labour of the prisoners would be most useful. But, further than this, the time is not very distant when the works on which our convicts are now employed, viz., the extension of the dockyards at Chatham and Portsmouth, will be completed, and then the labour of those men in part of them will be available for any new public work.

I am, myself, disposed to think that there is no class of public work on which convicts could be employed more advantageously than on the construction of such a system of defences as would for ever put an end to our periodical panics (well founded, as I think), and would render such a project as the invasion of this country so entirely out of the question as to be beyond discussion. It appears to be admitted on all sides that our defences are not in a satisfactory condition. The chief Parliamentary measure of the session is devoted to the subject, pamphlets abound on it in the booksellers' shops, and the magazines are full of it; for we have begun to see what immense forces may be put in motion, to contrast our means of resistance, and, finally, it is clear from the tone of the debates and discussions, that we are willing to pay anything in reason to secure what our common sense tells is a vital object, viz., the inviolability of our shores and capital. I will venture to give my reasons for advocating the employment of convicts on such works, as being the most valuable to which their labours could be devoted, and as solving the question in a most economical manner.

It is necessary briefly to state what are the elements of a proper system of defence. It is obvious that our first and great line of defence is the sea, on which we should determine to keep a force superior to any combination likely to be brought against us.

But naval means alone cannot afford complete security; our fleets will have the duty of guarding our colonies and commerce, as well as our shores; they may be outmanœuvred, as they have been before; storms or accidents may occur; they may even be beaten in battle (a contingency which it is usual but very dangerous to ignore); and, finally, it is quite possible that, through imperfect arrangements, we may find ourselves unprepared at the moment when the fleet is wanted.

But besides this, it is important to remember that, in proportion as we are without proper defensive arrangements on land, the size, composition, and material of an invading army would be diminished; and to the same extent, the facility for preparing an invasion, and for evading a defending fleet, would be increased.

Our first object, therefore should be so to arrange our system of land defences as to increase the naval difficulties of an invasion, and to set our naval forces free for the extensive and important duties which they only could perform.

The true system of land defence for England is to cover all those vital parts which an enemy would endeavour to capture by defensive works, so constructed that they can be defended by troops sufficiently instructed for duties of this nature, but who could not have had the incessant training necessary to enable them to manœuvre against an enemy in the field. These points being secure, a small but perfect standing army could operate freely in the field, with every chance of maintaining a superiority. The construction of such works would have the effect which, as I have before endeavoured to show, we should aim at in organising our defensive system. They could not be attacked, except by regular approaches, requiring such an amount of heavy artillery, ammunition, and siege materials as could not possibly be transported from a foreign country to the shores of England without enormous preparation beforehand, and such an utter prostration of our naval forces as to leave the sea permanently in the uninterrupted command of the enemy. They would therefore vastly increase the naval difficulties of an invasion.

Assuming, therefore, that it is admitted that defensive works form a necessary and material part of our system of national defences, as very largely increasing the security we derive from our insular position, and therefore enabling us to conduct our defences on land by means of an economical land force so organised as to interfere but little with the ordinary industrial occupation of the country, it remains to consider (1) where these works should be placed, and (2), by what means they should be constructed.

1. The first and great object an enemy would undoubtedly have would be the capture of London, which, in our present state, would be effected in all probability in four or five days after he had landed, and with it we should lose our only manufactories or arsenals of military weapons and stores, and so be deprived of the possibility of further resistance. London should therefore be surrounded by defensive works, which an enemy could not pass without a regular artillery attack. They should be placed at such a distance as to remove the inconvenience of attack as far as possible from the population, and to develop such an extensive line of defence that any force an enemy could bring would be unable to invest it, so as to reduce the town by starvation. They would probably be placed at a distance of 12 to 15 miles from the centre of London, and would consist of four or five entrenched positions, connected by detached forts on commanding situations. Occupying a circuit of 60 or 70 miles, cut in two by a large river, their investment would require two armies of 200,000 men each, and would, therefore, be out of the question.

2. Our next care should be to establish factories for warlike stores in one or more positions less assailable than those they occupy at present, such as at Cannock Chase, where it was proposed by the Royal Commission on Defences, in 1858, that a central arsenal should be placed; here they would be connected with all the great manufacturing resources of the country. This central arsenal should also be surrounded by suitable defensive works, and would form a centre of defence independent of the capital.

3. Proper arsenals of arms, ammunition, and stores should be formed in each of our great naval stations—Portsmouth, Plymouth, Chatham, &c., in order that they might have within themselves all requirements for resisting attack, and for fitting out a fleet, even if communication with other parts of England were cut off for a time, and that they might not have to yield to mere blockade.

4. The defensive works proposed by the Royal Commission for the protection of Chatham on the land side should be carried out.

5. It is a great defect in our defensive system, as at present arranged, and especially in view of the great changes that are taking place in the distribution of power in Europe, that all our warlike establishments, naval and military, are in the southern portion of the kingdom, and principally on the Channel. When France was the only enemy we had to provide against, the possession of the Channel and the closing of the Straits of Dover protected the whole of the south and east coasts. Any considerable attack on the east by a fleet which would not have to pass the Straits of Dover, was evaded by the political arrangements which prevented France from gaining possession of Antwerp. Circumstances have now changed, and, independently of what may finally be the fate of Antwerp, we should provide against the possibility of a formidable attack on our east coast. It seems, therefore, necessary that a naval station should be formed on the east coast, in some such position as Filey Bay, or in the vicinity of the mouth of the Humber. Here should be placed the means of assem-

bling and fitting out a fleet, and the establishment should be rendered defensible by works on the land and sea side, so that the fleet would be free to move away to guard the coast, and to form any necessary combinations with other naval forces.

6. Similar considerations would require a naval station on the west coast, and for this purpose Pembroke Dockyard seems to afford a good groundwork, as there are already establishments there, strongly defended on both the land and sea side, and which only require to be developed and extended.

7. Considering the immense importance of Liverpool, the vast naval establishments there, which would render it in times of war equal to a government dockyard, and the effect which the destruction of Liverpool or its capture would have upon the commercial wealth of the country, it would be right that it should be protected against such a disaster, both by land and sea works.

We have ample experience to justify us in saying that there need be no difficulty, or any material increase to the expense, for housing the prisoners on the spot where the labour is required, nor in providing effectively for their security while at work. I venture to think that no work on which convicts could be employed would be of higher value to the country than that of preparing these defensive positions, and that such employment would be, beyond all comparison, more advantageous than any system of employment instituted with a mere view to recoup a certain portion of their expense, such as by farming, or manufacture of articles for sale, &c.

What I have already said will, I think, show that there would be no difficulty in providing men capable of performing all the work such defensive positions would require; and, further, I am encouraged to believe that these prisoners would even fulfil still further duties in connexion with them, for in a very kind letter I have received from Sir John Burgoyne on the subject of these proposals which I laid before him, occurs the following passage:—"Among the applications of convicts to useful account, did you ever hear of what happened at a siege of Gaeta (Naples) in the early part of this century, how they were enrolled in a corps for the defence of the place on a promise of subsequent freedom, and how greatly that corps was distinguished for its gallantry."

I hope now that I have succeeded in showing that prison labour is a subject of some importance to the country; that a great deal has been done in providing them with labour which is beneficial to them; and that the country has, by means of the convict labour at its disposal, been provided with some magnificent national works. I have also ventured to suggest further employment of a similar nature, which would, if my reasoning is correct, provide at a very small cost what would have inestimable value to the nation, and have only to conclude by hoping, in laying these matters before you, I have not unduly trespassed on your patience.

I hope that I have succeeded now in showing that there are considerable interests connected with the subject of prison labour, making it one well worthy of consideration, and I have endeavoured to lay down as clearly as possible what are the objects that have been aimed at in providing a proper system of employment for prisoners; also to show you how far we have as yet succeeded in securing those objects, both in the borough and county gaols and in the government prisons. I have been still more desirous of showing how far the problem we have to deal with remains unsolved, and I have great hopes, in bringing this subject before a meeting such as this, that some valuable suggestions may be made by those who have not been engaged in pursuits such as would lead to their becoming acquainted with the subject already.

One thing I venture to think must have become abundantly clear to those who have had any long experience connected with the question, viz., that in dealing with prisoners, either as regards the system of labour, or any other branch of the subject, there is no one patent system equally applicable to all cases. Human nature cannot be dealt with in the lump, if any effect is to be produced upon it, still less can it be so in those abnormal developments of human nature which we who have to deal with prisoners come in contact with. All that should be done is, to lay down sound general principles, and these will be a field for the greatest skill, intelligence, and, I may say, sometimes devotion, on the part of those whose business it is to apply them.

It was in England, a century ago, that the first practical steps were taken to deal with the subject of prisoners in a humane and philosophical manner. I believe, with the exception of the United States, England is far ahead of all other nations in regard to the treatment of criminals, and, above all, in that branch of the subject, viz., the labour question, which we have met to consider. She has, up till recently, had the inestimable advantage of having colonies to send them to, where they have had every opportunity, and have in effect, after expiating their offence by due punishment, taken their place as useful members of the community; but now, having lost that advantage, the question of the disposal and employment of our criminals becomes one of double importance.

I have referred to the system of employment on public works, which, to those foreigners who visit our country for the purpose of inquiring into our prison systems, always commends itself as the best and most complete solution of this part of the problem, offering, as it does, such great variety, suitable to the many classes of men who have to be dealt with. And for the institution and first carrying out of the system the country should not forget the name and services of Sir Joshua Jebb, and those associated with him, who first initiated and carried it out to success; and I am glad to have this opportunity of referring to the valuable services of Sir Joshua Jebb, for he devoted a great part of his life to the question of prison management. He died in harness, in the middle of a great controversy on the subject, and I do not think that the memory of his services should be allowed to pass away.

I have ventured to make my own proposals for continuing this manner of applying the labour of our prisoners; and although I have a strong opinion that it would be difficult to find employment which would be at once more suitable to the prisoners, or more advantageous to the country than that I have proposed, I think it in every way desirable that those who have other suggestions to make should be invited to do so, and I feel confident that such suggestions will receive from the government careful consideration.

The remarks I have made touch on only one branch of a very large subject, and in bringing them before you my desire has been less to exhaust the subject than to give a basis for discussion.

DISCUSSION.

Mr. Christian Mast said it appeared to him a strange idea to employ convict labour in constructing national defences, and, as a German by birth, although a naturalised Englishman, he begged leave to say that any idea of a German invasion was quite out of the question. England was suffering under a panic caused by certain articles which had appeared in foreign journals, but which were only conceived in a spirit of humour, or for some ulterior object. In his opinion, England must always rely for her defence upon her navy.

Admiral Ommaney had had some experience of convict labour, his last appointment being at Gibraltar, where such labour had been employed in the construction of an important breakwater, which was of considerable value, as affording a refuge both for our navy and also for merchant shipping. He quite agreed with Captain Du Cane that such labour should be employed in improving our imperial resources, which was a readier way to relieve the tax-payer than any other; but he must take exception to the idea of employing convicts to construct defensive forts. Rather let their labour be utilised in constructing breakwaters and similar works for the protection of our commercial interests. Our coasts were far too deficient in harbours of refuge; Mount's Bay, for instance, might be immensely improved by the construction of such a breakwater as that which had been so well described at Portland. He did not believe forts would ever be required round London; and if convict labour were to be employed with public money, by all means let the commercial interests of the country be first looked to in the manner he had suggested. What he had seen of the convict system convinced him that the deterrent principle was not sufficiently brought into force; for instance, the hours of actual labour were but eight daily, and in that was included going backwards and forwards, and perhaps half an hour to luncheon. A common expression amongst the men was "gentle and easy," and that was the way they got through the day's work. There were too many indulgences allowed them, in his opinion, which gave a sort of charm to their life, so that, in fact, from his experience while at Gibraltar, 30 per cent. of the men were re-convicted, after spending eight or nine years' of hard labour, and came back quite delighted to their old quarters. Their clothing was of the very best description, and their food much better than the rations of the soldiers.

Mr. J. Jones thought it was a false philosophy to attempt to justify using the capital of society to be employed on any special trade, since by so doing the ratio which existed between the capital of the country and all the individuals engaged in each particular department of industry was disturbed. When a large amount of capital that had no natural alliance with a trade was superadded to it, the result was a disturbance, not merely of the relations between capital and labour in the trade, but also between the products of that trade and the demand for such produce. Much more wrong was it to teach a man a trade when he was in prison. Society was divided into sections, and apprentices were admitted into the different trades just according to the prospect which they afforded of remunerative employment. This principle was pretty strictly acted upon by the higher classes, as in the medical and legal professions. Men were not allowed to enter them indiscriminately, but those who already enjoyed the fruits of these particular departments of industry guarded the entrance still more and more strictly as society increased in numbers, lest the profits of the craft should be diminished. And if that were a good principle when applied to judges, legislators, and the higher walks of life (and they had it lately on the authority of Professor Huxley that medicine was the very highest occupation to which man could devote himself), if such an example were set by those to whom all ought to look up with reverence, on what principle could it be justified that a man should be taught in prison to compete with the honest workman who learned his trade outside. As soon as he was discharged he became a competitor with those who had entered the trade he had been taught. Following the natural order of things, and the law of supply and demand, and even in the ordinary course of events, there was a superfluity of labour in almost every trade. There was, however, a still higher law, that no man should live on this earth without work, and, therefore, it would be an illegitimate act to lock any man up, to keep him in idleness because he had been an offender. But there were works on which no private industry was ever likely to be engaged, and which interfered therefore with no anticipation that any individual workman had any reasonable right to form—such public works, he meant, as did not hold out the expectation of a profitable [return, but still were necessary or desirable, and he was glad to find that Captain Du Cane recommended the employment of convict labour on such works as these. Of course, his mention of fortifications was only an illustration, and was such a one as would naturally occur to the mind of a military man. The question of the utilisation of waste land might well be considered in connection with this subject, and here he could not agree with Captain Du Cane that it would be preferable to take good land and use it for agricultural purposes. Rather should they take land which was not profitable for cultivation and make it productive. If you carted a few thousand square yards of earth on to the face of a barren rock, two great natural agents, the sun and air, would aid in the work, and you would soon have an acre of fertile land which would support life for all time to come. If Dartmoor had too thin a covering of earth upon it for anything to grow, let the convicts bring earth and cover it, and if they could not get earth let them go into the towns and empty the cesspools and cover it with that, so making convict labour do that dirty work which honest men would not willingly perform. Such were the principles on which, in his opinion, convict labour ought to be organised; and, in conclusion, he would only add that he desired to join Captain Du Cane in the tribute he had paid to the late Sir Joshua Jebb, who had rendered valuable services not only to the cause of progress in connection with prison discipline, but also in regard to improved systems of ventilation for large public buildings of all descriptions.

Mr. Edwin Chadwick, C.B., said—The objections just made to the employment of prisoners in common private productive occupations, involve for their refutation the exposition of a chapter of political economy beyond the immediate subject, for those objections would go to the expulsion of foreigners and the destruction of machinery. The objections assume that food and the fields of production are fixed and limited quantities, and that all incomers must needs be only dividers and reducers of them, but we deny that assumed fixity, and allege as a general fact that they come as producers and augmenters of the common stock of produce. Take that great field of production, Lancashire, for example. From the beginning of the century, it has been the scene of the immigration of foreigners, Irish and others, and of large introductions of labour-saving machinery. According to the objectors, wages should have fallen, and the prices of food should have augmented. The reverse is the fact. Take the great article of production there—cotton. By an improvement in labour-saving spinning machinery less than twopence per pound is paid now for labour that, at the beginning of the century, cost a shilling. Yet the workers of that same machinery then divided only 4s. 6d. a week, man, woman, and child, who now, man, woman, and child, divide 10s. 6d. a week. Bread was then often more than a shilling a loaf that is now seldom more than sixpence or sevenpence per loaf. Meat then was rare; it is now, as an article of diet, common with the lowest class of working population, has increased there more than in any other part of the country, and so have wages. In agriculture, when the use of machinery extends, wages rise. By the very fact of a man's employment for wages he must, over and above the actual cost of his subsistence, yield a surplus beyond that of capital, as profit to the capitalist who provides the wages, or the capital or the worker would not be employed at all. The worker is therefore, to the extent of that surplus, an augmenter, instead of being a reducer; he augments the capital—the fund that supplies wages. Now, the object of reformation is to make men honest, to make them self-supporters by regular industry. If the prisoner is let out on that condition, he must needs be let out as a stronger and more persistent competitor than he ever can be in prison. The protectionism which we have just heard should keep him there for ever as an unproductive consumer, or indeed, in logical consistency, should kill him. It should do the like with pauper children. False economy treats the prisoner as a divider and reducer. True economy treats him and trains him as a producer and as an augmenter. Instruction in sound elementary principles of political economy, founded on fact and wide observation, is greatly needed. On the more immediate question, raised by the valuable paper read by Capt. Du Cane, of the deterrent and reformatory objects of prison discipline, I may observe, as a Commissioner of Inquiry on the state of crime and on the means of its prevention by the agency of a police force, that we found, as respects habitual depredators, that the very condition of their careers was that, by default of information to the police, by want of police in some places, or by defects of the police, which have yet through a great part of the country to be remedied ; by the want of systematic public prosecution and pursuit, which has yet to be generally provided ; by defects of penal procedure, and its deterrent influence against information and pursuit on poor parties injured by petty offences, grievous defects which have yet to be remedied—the chances of impunity are so large as to allow a career of habitual depredation and subsistence to a higher amount than was then or would now be obtainable by regular industry. For example, the chances were, to a pick-pocket in London, that he would there, with only few interruptions, have a career of six years' impunity, during which he obtained double the amount to be got by ordinary day labour. I believe that the present estimate of the habitually criminal class is, that they will pass one-third of their time in prison, and two-thirds of their lives out of it, living by spoil. Proof was given in respect to some careers of depredation, that they had ceased, not by the effects of any punishment, or any deterrent work of the judiciary or of the prison, or by any reformatory process, but simply and solely because, by the agency of the police, and by other causes, the career was so interrupted and shortened that it ceased to be paying. Take, for example, the career of the highwayman. A Dick Turpin might probably mount horse, and stop coaches, omnibuses, and rob the passengers on Hounslow or Wimbledon-common, or suburban districts, as heretofore, and perhaps might succeed in a score of cases, but now, by reason of a mounted police force and other obstructions, the career which endured for centuries as against the gallows and the gibbet there, is so far shortened as to be reduced from years (like that of the common pick-pocket), to months or weeks, and as to be no longer a "paying" thing. We had evidence that it was so with some species of house-breaking and other careers of habitual depredation. It was our general conclusion that, by improvements in the action of a general police and in public prosecution and pursuit, the careers of all habitual depredators might be similarly shortened and extinguished. But we have as yet failed to get due legislative and administrative attention and support to our conclusions, which have yet to be advanced and completed in this respect. If the outside chances were narrowed to the extent they might be, then prison discipline might be brought in aid, simply to reduce the profit of careers of depredation, and to make them no longer paying. Thus the depredator, when caught, might be allowed to work his way out at any indoor industry he could find, to make restitution to the person pillaged, to pay all the expenses of capture and maintenance, and something beyond that. If for a ten pound depredation we extract a fifty or a hundred pound retribution, and shorten the outdoor chances of escape and living to below that sum, we shall put an end to habitual depredations. Whilst the chances of escape and profit are wide and large, Chinese tortures in prisons will have little deterrent effect. Crimes of passion are of course of another category. In respect to prison discipline and administration, the works of Mr. Bentham are still in advance of our time. He maintained that, saving the regard due to life, health, proper instruction, and future provision, economy ought in every point of management to be the prevalent consideration ; and that no public expense ought to be incurred, or profit or saving rejected, for the sake of punishment or of indulgence, in which I entirely concur. To these general observations I will only add that, on the very valuable paper read to night, we shall all agree that in this instance it is matter for public congratulation, that in Captain Du Cane an eminently right man is got into an eminently important and right place.

Mr. Frederick Hill said it was with great pleasure he had attended that evening and heard the paper read by Captain Du Cane, because the principles which he had so ably laid down, and supported by illustrations, were, to a very great extent, the same as he (Mr. Hill) had an opportunity of bringing forward and carrying into operation thirty years ago in Scotland, when he held his former office of Inspector of Prisons. He could, in the strongest language, confirm all that Captain Du Cane had said of the admirable effects, moral, civilising, and deterrent, of useful productive labour in prisons. Impressed deeply with that belief, he had endeavoured, as quickly as possible, to get such work introduced into the Scotch prisons, and to abolish all such work as the tread-mill and the crank, which the paper they had heard properly described as brutalising. When he left Scotland he had the pleasure of seeing the last tread-mill taken down, and he was sorry this kind of labour still existed, to some extent, in England. If we had in the direction of public affairs on such subjects men like the author of that evening's paper, it could not last very long. The system was founded in utter error, and the sooner it disappeared the better. As regarded the productive labour that was utilised in the Scotch prisons having the effect which Admiral Ommanney had spoken of as rendering prisons too attractive, no such effect was produced in Scotland, and in corroboration of that he would mention this circumstance, that for many years this rule had been in operation there—many might suppose it to be a very strange rule, but he thought it a wise one—that when a prisoner completed his period of imprisonment, he could, if he chose, prolong his term ; and not only so, but even if persons were desirous of going into prison without previously qualifying themselves by committing crime they could. The temptation in Scotland to enter or remain in prison, where of course the occupants were well fed, lodged, and clothed, was far greater than it was here, inasmuch as to this day in Scotland there was no legal claim for relief on the part of the able-bodied poor. An able-bodied poor man or woman might, as far as the law in Scotland went, lie down in the street and die. Consequently, in times of great distress, the prisons in Scotland might be looked upon as a kind of workhouse, and most assuredly if there had been anything attractive in them, they would have been overrun with volunteer prisoners. As it was, the number of prisoners of this class, who were a recognised class, and were known as voluntary prisoners, was but 40. Capt. Du Cane had said that formerly among the English convicts a greater motive to industry was given than now existed by allowing prisoners to be like persons out of prison, and he (Mr. Hill) believed that the more the rules of prisons were assimilated to the conventional rules outside the better it would be, because the prisoners would have a direct motive to labour hard, inasmuch as they would partake of part of the benefit arising from their work. If this practice was abused, and was abandoned, he was disposed to say it was from errors of administration, and not from errors inherent in the system itself. The practice was this, that every prisoner had to do, not eight hours' work, with drawbacks for marching to and fro, but a solid day's work of ten hours, and, as far as possible, not measured by time, but by quantity. A certain task was given to him ; if he could do it in eight hours instead of ten, so much the better for him, for as soon as he had finished that he could work on his own account. So beneficial was this arrangement, that in Glasgow it was no uncommon thing to hear the prisoners at work till three or four o'clock in the morning for the purpose of earning something for themselves and their families; for much money was sent out of the prisons there by the inmates to assist their families. This was a most important regulation, which he would recommend to the consideration of Capt. Du Cane. This money, when accumulated, was not, as he (Mr. Hill) believed was the arrangement with regard to English convicts, put into their hands when dismissed from prison, but every farthing of it was spent under control, and no portion of it was therefore allowed to run to waste. The purchase of tools, the temporary provision of the necessaries of life, and so forth, were among the purposes to which it was applied; and many times, he was glad to say, was it applied in the most legitimate way in which a prisoner's earnings could be employed—defraying the expense of his emigration to other countries. If that principle were adopted with the very productive labour which Captain Du Cane had succeeded in establishing among the convicts, it would be found that when they left prison, instead of returning to society in this country to the extent they now did, where they were met with all the dangers of old associations, old haunts, and the severity of competition for their labour, a large number would be found to go over to Canada and the States, and disperse themselves, and find the means of getting an honest living away from the dire temptations which beset them here. But to do this there must be some principle like the one he had mentioned, of setting apart for the prisoner the profits of all the labour after he had completed a given amount of work. Public opinion in Scotland did not in any way disapprove of this arrangement; he had never heard a word against it, so satisfactory had it been found. Then, with regard to the kind of work in which prisoners might be employed, he was disposed to agree with the principle which Admiral Ommaney had named, that there was no distinction between the political economy effects of government labour and any other labour. Government labour, if not performed by convicts, must be performed by other men. The true principle was that no kind of labour in prison would yield the largest amount of profit, and best prepare the prisoner for honest industry after he had left prison, which was not founded on the calculation of Captain Du Cane of being the most profitable for the country. If it was not the most profitable for the country at large, let them have free labour; but as long as labour was legitimately followed in prison, avoiding that which was waste, and seeking only that which was profitable, no danger was to be apprehended.

The Chairman, as the time had come for closing this discussion, wished to make a few remarks. No doubt he had been asked to preside because, when he was Secretary to the Treasury, his attention was directed to the cost of prisons and the extent to which the State received a return for its expenditure. It then appeared to him that there were some questions which deserved much more consideration than they had yet received, and he had ventured to call the attention of Colonel Henderson, the predecessor of Captain Du Cane, to these questions. The first seemed to be that we fell into a very great error in mixing up the question of industry in a prison with the question of punishing the prisoner. They were two separate and distinct subjects. If a sentence was pronounced on a culprit of imprisonment with labour, it was an affront and a degradation of labour, because labour was thereby regarded as a punishment for an offence. If it were a punishment, then he was sorry to say all the working classes of the country were undergoing punishment. That appeared to him an error into which we had imperceptibly fallen, and it should be eradicated from the minds of those engaged in the administration of justice as soon as possible. When persons had to be sent to prison for committing crime, nothing should be said in the sentence pronounced on them about labour or industry of any kind. The punishment should consist in the severity of the imprisonment, that is to say, of the discipline to which the prisoner was to be subjected, by depriving him of any will of his own, and compelling him to be amenable to that of his jailors. Having got so far, we should consider labour, not as a punishment, but as a mitigation of punishment and a relaxation of the severity of the discipline. Such toil as the crank and similar tasks should be placed in the same category as flogging, or any other kind of physical suffering and punishment of a character not to be encouraged, and should be regarded by prisoners as the consequence of their evil deeds. The ground being cleared to that extent, they had then to consider the question of industry in prisons. They might put aside the doctrines they had heard, which proceeded on the assumption that prisoners were not to be reclaimed to the pursuits of industry, as that would lead to the absurdity that the criminal class, being excluded from industry, were for the rest of their lives to commit crimes, but in truth, every one in prison was as much a member of the industrial class as any one out of prison. If that were so, the question was, how could these people be kept within the class to which they properly belonged, viz., the industrial class of society? The experience of prisons had taught us a great deal, and, among other things, that where a prisoner in prison practised an industry which was suitable to him, it could be carried on with profit to the State and to himself, and if it was consistent with his physical development, and congenial to his tastes, he could carry it on when he left the prison walls behind him. That was completely made out in the branches of industry to which Captain Du Cane had alluded, viz., the working in the stone quarries at Portland, and other work of a similar description, because it had been found that among our criminal class a great many were able-bodied workmen who could well perform the work of quarrymen, hodmen, &c. Passing from that class, there was a numerous body which from their sex, age, physical development, and customary pursuits, could not be so employed with advantage. There were many prisoners whose weakness precluded their being put to labour which required great strength and bodily vigour. Then the difficulty began. How were such persons to be employed? If we were made wise by our experience of the stronger class, the answer was obvious. You must employ them in industries for which they are suited, which would consequently be profitable to the State. It was quite clear that the first condition had been rightly described by Capt. Du Cane that you could not employ prisoners in highly organised industry. You could not, for instance, establish a cotton factory in a prison; you could not use machinery or capital on a large scale, because such work could not be carried on without taking advantage of the labour of other sorts of people, and converting the State into a manufacturer. Other kinds of labour, which did not require machinery or capital, but were compatible with the physical powers of the prisoners to be employed, must be sought out. He had suggested to the inspector that he should go through the whole range of industries, and select those that could be carried on by an individual in his cell. In one of the prisons in India, where the most dreadful criminals were confined, they were employed in making by hand carpets such as were now seen in the shops of London, resembling Turkey carpets, and there were other branches of industry of that kind which could be utilised. If we had a great variety of employments for prisoners we should not commit the error of turning a great number of persons upon only one branch of an industry, which they could not follow when they left prison; by providing for them various branches of industry, we should open to them a career of usefulness which they could pursue out of prison under the same conditions as they pursued it in prison. By this means we should give them habits of industry which would not be destroyed when they left their place of incarceration. If we employed prisoners under conditions which they would not find to exist when they became free, all that we had built up while they were in prison must fall to the ground. That struck him as the practical result of useless prison industry, and it suggested the necessity of having an industry in prison which should be profitable to the man who pursued it, both in prison and out of prison, and which would, therefore, give him a chance of leading a respectable life. The practical application of this suggestion was full of difficulties, and required great skill and thought, and it was gratifying to find that our chief inspector of prisons was applying his mind to questions of this description, and when we saw such works as those around us (alluding to the specimens of prison labour exhibited in the room), he thought we should see there was great scope for that kind of work in gaol which heretofore had not been thought worthy of consideration. There was one other principle also deserving of attention—that, instead of making an occupation in prison repulsive to anyone ordered to follow it, it should be made attractive, that is to say, you should not absolutely disgust a prisoner with the industry which was meant to reform him, but interest the man himself in that which you compelled him to do. Considering that idea practically, there were certain natural conditions of mankind which you might invoke. Even the most abandoned were amenable to the sense of beauty in colour and form, and of art, and although we might see little merit in the work, yet still the manufacture even of a little piece of pavement went a long way towards humanising an abandoned character, and it tended to interest a person in his own pursuit, when he found he could produce a result so beautiful as that, after one or two months' learning. There were other employments, like the making of the mats they saw exhibited, and the species of Turkey carpet behind him. It was quite obvious that if a man after one or two months' practice could produce a carpet like that, he would be interested in his work. It was no longer an irksome task, like that of oakum picking. The prisoner's ideas of beauty might thus be invoked in aid of these industrial pursuits. Therefore he (the Chairman) thought those were principles which might be applied for the purpose of reclaiming abandoned and brutal minds, and interesting them in the pursuits of regular industry, in place of leaving them to return to a life of crime when their sentences expired. These were views which Captain Du Cane was endeavouring to carry out. We must all see that it was a proceeding to be carried on tentatively, by way of experiment, and, in the end, no doubt what might be usefully and profitably pursued would be discovered. As Captain Du Cane advanced, he would satisfy himself by results what class of employments could be carried on in prisons with advantage, and the more they were the better, because they would tend to diffuse the people when they emerged from gaol. What we wanted was to let them out of prison without any mark on them as belonging to the criminal class. He hoped the consideration of this question would not be lost sight of; and, whilst we carried out the principles that had been advocated of utilising prison labour, we should not lose sight of the punishment of the criminal. At the same time, we should not degrade labour by looking down upon it as but punishment, but rather as its alleviation. He (the Chairman) hoped, therefore, if the meeting appreciated the views of Captain Du Cane, they would concur in giving their cordial thanks for the interesting paper he had read.

The motion was carried, and the meeting separated.

ANNOUNCEMENTS BY THE COUNCIL.

CONVERSAZIONE.

The annual conversazione of the members will be held on the 16th June, at the South Kensington Museum. Cards of invitation will be issued in due course.

DRILL REVIEW.

The Council have the satisfaction of announcing that H.R.H. Prince Arthur has consented to review the boys from the district and other schools, in or near the metropolis, where drill forms part of the system of education. The review will take place in the Royal Horticultural Gardens at South Kensington, on Wednesday, the 14th of June. Further particulars will appear in future *Journals*.

CANTOR LECTURES.

The concluding lecture of the course on "Our Food-producing Ruminants, and on the Parasites which reside in them," was delivered by T. SPENCER COBBOLD, Esq., M.D., F.R.S., on Monday, the 15th inst.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The Exhibition will open daily at 10 a.m., when the public generally will be admitted, but a privileged admission, for study, may be obtained at the South Entrance, in the Exhibition-road, from 8 a.m., at a charge of double the ordinary fee for daily admission. Season-ticket holders will have this privilege free.

In last week's *Journal* was given the arrangements for the second exhibition in 1872. The following is a complete list of the proposed arrangements till 1880:—

1872.

Cotton.
Jewellery.
Musical Instruments.
Acoustical Experiments.
Paper, Stationery, Printing:—
  (*a*) Paper, Card, and Millboard.
  (*b*) Stationery.
  (*c*) Plate, letterpress, and other modes of printing.
Machinery for the group.
Raw materials for all the above-mentioned objects.

Any modifications in the year 1873 or the following years will be duly announced.

1873.

Silk and Velvet.
Steel, Cutlery, and Edge Tools:—
  (*a*) Steel Manufactures.
  (*b*) Cutlery and Edge Tools.

Surgical Instruments and Appliances.
Carriages not connected with Rail or Tram-roads.
Substances used as Food:—
  (a) Agricultural Products.
  (b) Drysaltery, Grocery, Preparations of Food.
  (c) Wines, Spirits, Beer, and other Drinks, and Tobacco.
  (d) Implements for Drinking and use of Tobacco of all kinds.
Cooking and its Science.
Machinery for the group.
Raw Materials for all the above-mentioned objects.

1874.

Lace, hand and machine made.
Civil Engineering, Architectural and Building Contrivances and Tests:—
  (a) Civil Engineering and Building Construction.
  (b) Sanitary Apparatus and Constructions.
  (c) Cement and Plaster work, &c.
Leather, including Saddlery and Harness:—
  (a) Leather, and manufactures of Leather.
  (b) Saddlery, Harness.
Artificial Illumination by all Methods, Gas and its Manufacture.
Bookbinding of all kind.
Machinery in general for the group.
Raw materials used for all the above-mentioned objects.

1875.

Woven, Spun, Felted, and Laid Fabrics (when shown as specimens of Printing or Dyeing).
Horological Instruments.
Brass and Copper Manufactures.
Hydraulics and Experiments. Supply of Water.
Machinery in general for the group.
Raw materials used for all the above-mentioned objects.

1876.

Works in Precious Metals and their imitations.
Photographic Apparatus and Photography.
Skins, Fur, Feathers, and Hair.
Agricultural Machinery and results.
Philosophical Instruments, and processes depending upon their use.
Uses of Electricity.
Machinery in general for the group.
Raw materials used for all the above-mentioned objects.

1877.

Furniture and Upholstery, including Paper Hangings and Papier-Mâché:—
  (a) Furniture and Upholstery.
  (b) Paper Hangings and General Decoration.
Health—Manufactures, &c., promoting, with experiments.
Machinery in general for the group.
Raw materials used for all the above-mentioned objects.

1878.

Tapestry, Embroidery and Needlework.
Glass:—
  (a) Stained Glass used in Buildings.
  (b) Glass for household purposes.
Military Engineering, Armour and Accoutrements, Ambulances, Ordnance and Small Arms:—
  (a) Clothing and Accoutrements.
  (b) Tents, Camp Equipages, and Military Engineering.
  (c) Arms, Ordnance, and Ammunition.
Naval Architecture—Ships' Tackle:—
  (a.) Ships for purposes of War and Commerce.
  (b.) Boats, Barges, and Vessels for commerce, amusement, &c.
  (c) Ships' Tackle, and Rigging.
  (d) Additional Clothing for the Navy.
Heating and Combustion, with experiments.
Machinery in general for the group.
Raw materials used for all the above-mentioned objects.

1879.

Matting of all kinds, Straw Manufactures.
Flax and Hemp.
Iron and General Hardware:—
  (a) Iron Manufactures.
  (b) Tin, Lead, Zinc, Pewter, and general Brazing.
Dressing Cases, Travelling Cases, &c.
Horticultural Machinery and Products.
Uses of Magnetism.
Machinery in general for the group.
Raw materials used for all the above-mentioned objects.

1880.

Chemical Substances and Products, and experiments, Pharmaceutical Processes:—
  (a) Chemical Products.
  (b) Medical and Pharmaceutical Products and Processes.
  (c) Oils, Fats, Wax.
Articles of Clothing:—
  (a) Hats and caps.
  (b) Bonnets and General Millinery.
  (c) Hosiery, Gloves, and Clothing in general.
  (d) Boots and Shoes.
Railway Plant, including Locomotive Engines and Carriages.
Machinery in general for the group.
Raw materials used for all the above-mentioned objects.

EDUCATIONAL NOTES.

School Boards and Inspected Schools.—A visit paid by certain members of the Nottingham Board to the St. Peter's National Schools at that place, produced a remonstrance from the rector of the parish, who complained of this "unauthorised inspection." This led to an application being made to the Education Department as to whether School Boards had the right to visit inspected schools, the reply of the Department being in the negative.

Science College at Newcastle-on-Tyne.—In reference to this institution, which has been more than once referred to in the *Journal*, it may be mentioned that the executive committee have issued a circular, in which, after describing the college as one "for the teaching of physical science, especially as applied to engineering, mining, manufactures, and agriculture," and as being likely to be of especial value to all persons intended for the profession of mining and engineering, they say:—"Such an institution (which it appears desirable to limit at its commencement to purely scientific objects) would offer instruction in the following branches of scientific knowledge. 1. Pure and applied mathematics. 2. Chemistry. 3. Experimental philosophy. 4. Geology, mineralogy, and biology. Professorships and lectureships will be founded on these subjects. It is proposed that the course of study shall last for two years, that it shall consist partly in attending lectures, and partly in the work of the laboratories, that there shall be examinations at the end of each year, conducted mainly by examiners from the Universities, and that at the final examination the successful students shall receive the title of Bachelor or Associate of Science of the University of Durham, or, upon certain further conditions, the degree of B.A. It is hoped that classes of evening lectures for those who are unable to attend during the day may soon be formed." The committee have since inserted advertisements in the principal journals, inviting applications for the professorships, which are arranged to be as follows:—A professorship of experimental physics, value £400 a-year, and two-thirds of the students' fees. A professorship of pure and applied mathematics, value £300 a-year, and two-thirds of the students' fees. A professorship of chymistry, value £300 a-year, and two-thirds of the students' fees. A professorship of geology and mineralogy, value £300 a-year, and two-thirds of the students' fees. The appointments to the first two professorships will be made by the Dean of Durham, to the others by the committee of the College of Physical Science at Newcastle, and the professors will be elected in the first instance for five years, but, if re-appointed, will hold their professorships for life. The appointments will be made on the 30th June, so that no time is to be lost, and it is hoped that the college will be able to begin its courses in October, which is the usual time for the commencement of winter lectures. Of the £30,000 required to create a capital fund, upwards of £17,000 has already been subscribed, and if the whole amount be collected, the endowment of £1,000 per annum from the University of Durham will be made a permanent one.

Influence of the Education Act on the Teachers.—Mr. Edwin Goadby, in a communication to the *School Board Chronicle*, says:—"As soon as the Act is in fair general operation, there will be a steady demand for teachers, a demand, possibly, much greater than the supply. This demand will, in the nature of things, produce many results. It will cause a redistribution of teachers, already experienced, and capable of adapting their experience to the new state of things. This, of itself, will be a great boon to the teachers, no less than to the taught. Most teachers are apt to settle down into a groove, and to restrain their native elasticity in proportion to the length of time they remain under one set of influences, or in superintendence of one class of children, either socially or locally. They will now have an opportunity of rising higher in their profession, not as doing higher work, but as doing it under higher responsibilities and better prospects. Those writers who have dwelt upon the incapacity of existing colleges and institutions to meet the demand sure to be created by extended schools have overlooked the redistribution already noticed, which seems to me one of the first and most certain effects of our national system. The larger schools will draw their teachers from experienced men, and the new teachers will take their places. Another consequence of the great demand will be that many able, thoughtful, and enthusiastic teachers, now vainly struggling to maintain themselves by private schools of a commercial character, will find it worth their while to enter into competition, and to be content with such an assured position as will be given them by the headship of a large elementary school established under the Act. Independently of these more or less certain results, we may expect that a better class of men and women will be anxious to qualify themselves for educational life. From the elementary they may hope to pass to the endowed schools, profiting by the transition, and carrying with them a facility for instruction derived from diversified experience. In order to accomplish all we have in view, the elevation of the professional class is essential, and we shall be greatly disappointed if it does not naturally follow from Mr. Forster's several educational reforms."

Use of the Bible in Education.—Dean Stanley, at the annual meeting of the British and Foreign School Society, said that while he did not desire to say anything in disparagement of catechisms and formularies, he wished to urge the reasons why the Bible appeared to him to be so very excellent a medium of religious instruction to the young. It possessed this great advantage over catechisms and formularies of all kinds: while the latter were not in themselves interesting forms of composition, the Bible was, by universal consent, one of the most interesting books—he might say the most interesting book—ever written, because it contained such a great variety of elements. The Bible appealed to our intellectual nature; but it appealed, in a much more persuasive and effective manner, to our moral and spiritual nature, and that was exactly the part of our nature to which catechisms and formularies did not appeal. The Bible, too, was very much more universally acknowledged as a means of religious instruction than any catechisms or formularies drawn up. The Bible repelled any attempt to turn it into a test. Any attempt whatever to make the acknowledgment of the Bible a test was sure to fail, firstly, because of the extreme variety of the elements contained in it; and secondly, because any test, any formal declaration of accepting the Bible, was perfectly unnecessary. Just as it would be ridiculous, in regard to literature, to insist that the plays of Shakespeare should be admired, so was it absurd to require any test that they admired and received the Bible. Of course they received it: it was the universal book which appealed to every heart, to every form of civilisation, and required no previous declaration that it must form a part in every form of education, in every Christian country, in every school for the humble child, as well as in the highest universities in the land.

OBITUARY.

Sir John Frederick William Herschel, F.R.S., &c., was the son of that eminent astronomer, Sir William Herschel, who just ninety years since discovered the Georgium Sidus, or Uranus, as it was afterwards called. His mother was Mary, daughter of Mr. Adee Baldwin, and he was himself born at Slough, Buckinghamshire, on the 7th of March, 1792. He received his early education privately, whence he passed to St. John's College, Cambridge, where he took his Bachelor's Degree in 1813, coming out as senior wrangler and first Smith's prizeman. In the same year he published his first work, "A Collection of Examples of the Application of the Calculus to Finite Differences." In 1819, he commenced a series of papers in the *Edinburgh Philosophical Journal* on miscellaneous subjects in physical science, and, in 1822, communicated to the Royal Society of Edinburgh a paper on the absorption of light by coloured media, which will be found in the ninth volume of the "Transactions" of that society. He spent a great part of the years 1821-1823, in conjunction with the late Sir James South, in making a number of observations on the distances and positions of numerous stars, a full account of which is to be seen in Part iii. of the "Philosophical Transactions" for 1824. In the following year he began to re-examine the numerous nebulæ and clusters of stars which had been discovered by his father. On this work he was employed for eight years, and its results will be found in the volume of the above-mentioned work for 1832. The catalogue includes upwards of 2,300 nebulæ, of which 525 were discovered by Sir John himself. These observations were made with an excellent Newtonian telescope, 20 feet in focal length and 18½ inches aperture; and "having obtained," to use his own words, "a sufficient mastery over the instrument," he conceived the idea of employing it in the survey of the southern heavens. Accordingly, he left England in November 1833, and reaching the Cape in January, 1834, fixed his residence in the neighbourhood of Table Bay. He there set up his instruments, and was shortly able to commence a regular course of "sweeping" of the southern heavens. His observations were continued till May, 1838, the whole of the expense attending them being borne by Herschel himself. The interest felt by the scientific world of Europe and America in the progress of his labours was very great, and, from time to time, curiosity was gratified by accounts of some of the observations conveyed to friends by letter; but it was not until 1847, some years after his return to England, that the collected digested results of his four years' residence at the Cape were published in regular form, when he published his volume entitled, "Results of Astronomical Observations made during

1834-38 at the Cape of Good Hope; being the completion of a Telescopic Survey of the Whole Surface of the Visible Heavens, commenced in 1825." Besides his astronomical labours at the Cape, he was always ready to give the colonial authorities his advice and aid on scientific and educational matters. It is to him that the Cape colonists are mainly indebted for the very perfect system of national education and public schools which they now enjoy, and which he was enabled to carry out through the sagacity and liberality of the late Sir George Napier, at that time Governor, and of his Colonial Secretary, Mr. Henry Montagu. It is worthy of remark, says a writer in the *English Cyclopædia*, that Herschel's residence at the Cape was productive of benefits, not only to astronomy, but also to meteorology. While occupied there, he suggested a plan of having meteorological observations made simultaneously at different places—a plan subsequently developed at greater length in his "Instructions for Making and Registering Meteorological Observations at Various Stations in Southern Africa," published under official military authority, in 1844. He had already received from the hands of King William IV. the Hanoverian Guelphic Order of Knighthood, and on his return to England, in 1838, he was received with every possible public honour. During his absence in the southern hemisphere, the Astronomical Society had voted to him their gold medal, in 1836. Two years later, on the occasion of the coronation of Queen Victoria, he was created a baronet. In 1839, he was made an honorary D.C.L. of Oxford University, and there was a proposal, which he declined, to elect him to succeed the late Duke of Sussex in the presidential chair of the Royal Society. In 1842, he was erected Lord Rector of Marischal College, Aberdeen. In 1848, he was President of the Royal Astronomical Society, and in the same year the society voted him a testimonial for his work on the southern hemisphere. The most important work of a literary kind was that entitled "Outlines of Astronomy" (enlarged from his former treatise in Lardner's "Cyclopædia"), which he published in 1849. In the same year, he edited a collection of papers by various authors, published by authority, and entitled "A Manual of Scientific Inquiry, prepared for the use of Her Majesty's Navy, and adapted for Travellers in general." In December, 1850, when the Mastership of the Mint was converted from a ministerial into a permanent office, it was conferred upon Sir John Herschel, and this post was retained by him till 1855, when he resigned it on account of ill-health, and Professor Graham, the eminent chemist, was appointed his successor. Sir John Herschel was the author of several articles on "Isoperimetrical Problems" and "Mathematics" in the *Edinburgh Encyclopædia*, and of "Meteorology" and "Physical Geography" in the *Encyclopædia Britannica* (the last two of which have been republished separately), and also of several articles on scientific subjects in the *Edinburgh* and *Quarterly Reviews*, which were collected and published in a separate form in 1857, together with some of his lectures and addresses delivered on public occasions. He besides occasionally contributed to *Good Words* some popular papers on the wonders of the universe; and, some two or three years ago, he gave to the world, in the pages of the *Cornhill Magazine*, a poetical version of part of the "Inferno" of Dante. He was also one of the too numerous translators of "Homer." Sir John Herschel was an honorary or corresponding member of the Academies of St. Petersburgh, Vienna, Göttingen, Turin, Bologna, Brussels Naples, Copenhagen, Stockholm, and of almost all other scientific associations in England and America. To his other honours was added that of Chevalier of the Prussian Order of Merit, founded by Frederick the Great, and given at the recommendation of the Academy of Sciences at Berlin. Few philosophers of an age which has proproduced a Faraday and Brewster have attained distinction equal to that which he earned for himself. His mathematical acquirements and his discoveries in astronomy, in optics, in chemistry, and in photography were all of a very high order, and, such as, aided by an admirable style, secured for him the widest reputation among men of science, both at home and abroad; while his numerous popular writings have contributed largely to the diffusion of a taste for science, and an acquaintance with its principles among our countrymen. Under one of the bye-laws of the Society, enabling the Council to admit a limited number of eminent persons as honorary life members of the Society, the Council, to mark their sense of Sir John's great services to science and its application to the arts, admitted him a member in 1856. He took much interest in its proceedings, at times contributing to the *Journal* and serving on its committees, including that for the promotion of a uniform musical pitch. He died on the 11th day of May, aged 79 years.

GENERAL NOTES.

Picric Powder.—The *Times*, of May 8th, says:—"Professor Abel, chemist to the War Department, Royal Arsenal, Woolwich, has, after a number of experiments, succeeded in perfecting the new explosive agent recently produced by him under the name of 'picric' powder, as a means for charging shells, which, though it is not so violent in action as gun-cotton, nitro-glycerine, or picrate of potash powders, is a much more powerful explosive agent than gunpowder, and has other properties, which appear to render it peculiarly adapted for use in shells. Its merits are that it may be readily and expeditiously prepared, and that it is remarkable for its safety as compared with all other explosive agents, being so much less sensitive to ignition by percussion than gunpowder. The President of the Committee of Explosives at Woolwich having pronounced the new powder worthy of further experiment, it will be tried under various conditions, in order to ascertain its suitability to the requirements of the service."

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

May 24.—*Derby Day.*—No Meeting.

May 31.—On "The Education of Women." By Mrs. Grey.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Institute of Surveyors, 8. Mr. E. I'Anson, "London; its Commercial Centres, and their Influence on the Value of Land."
Social Science Association, 8. Discussion to be opened by Mr. G. H. Hastings, "On the Public Prosecutor's Bill."
Royal United Service Institute, 8½. Captain G. H. Gardner, R.N., "On the Formation of Reserves of Officers and Seamen of the Royal Navy."
Victoria Institute (at Society of Arts), 8. Annual Meeting.
Royal Geographical, 1. Annual Meeting.
British Architects, 8.

Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Renewed discussion upon Mr. Jacob's paper "On the Treatment of Town Sewage."
Royal Institution, 3. Rev. Prof. Haughton, "Principle of Least Action in Nature."

Wed. ...Geological, 8.
Archæological Association, 8.
Royal Institution, 3. Professor Tyndall, "On Sound."
Linnæan, 3. Annual Meeting.

Thurs...Royal, 8½.
Antiquaries, 8½.
Philosophical Club, 6.

Fri.......Royal Institution, 9. Professor Rankine, "Sea Waves."
Quekett Club, 8.

Sat ......Royal Institution, 3. Mr. Norman Lockyer, "Instruments used in Modern Astronomy."
Royal Botanic, 3¾.
Royal School of Mines, 8. Dr. Spencer Cobbold, F.R.S., "Geology." (Swiney Course.)
Associated Arts Institute, 8¼. Mr. B. Montgomerie Ranking, "Chaucer considered as an Artist," and Annual Meeting.

Journal of the Society of Arts.

No. 966. Vol. XIX.

FRIDAY, MAY 26, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

CONVERSAZIONE.

The annual conversazione of the members will be held on the 16th June, at the South Kensington Museum. Cards of invitation have been issued.

DRILL REVIEW.

The Council have the satisfaction of announcing that H.R.H. Prince Arthur has consented to review the boys from the district and other schools, in or near the metropolis, where drill forms part of the system of education. The review will take place in the Royal Horticultural Gardens at South Kensington, on Wednesday, the 14th of June. Further particulars will appear in future *Journals*.

ALBERT MEDAL.

The Albert Gold Medal "for distinguished merit in promoting Arts, Manufactures, or Commerce," has this Session been awarded by the Council to Henry Cole, Esq., C.B.

CONFERENCE.

The Twentieth Annual Conference between the Council of the Society and the representatives of Institutions in Union, will take place at the Society's House, on Friday, the 16th June. The chair will be taken at 12 o'clock, by Lord Henry G. Lennox, M.P., Chairman of Council.

Secretaries of Institutions and Local Boards are requested to send, *immediately*, the names of the Representatives appointed to attend the Conference; and early notice should be given of any subjects which Institutions or Local Boards may desire their representatives to introduce to the notice of the Conference.

Secretaries of Institutions are requested to forward *at once*, by book post, copies of the last Annual Reports of their Institutions.

THE LIBRARY.

The following works have been presented to the Library :—

Proceedings of the Royal Institution of Great Britain. No. 54, vol. vi. Presented by the Institution.

A Memoir on Indian Surveys. Presented by the editor, C. R. Markham, Esq.

Report of the Howard Association. Presented by the Association.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The Exhibition will open daily at 10 a.m., when the public generally will be admitted, but a privileged admission, for study, may be obtained at the South Entrance, in the Exhibition-road, from 8 a.m., at a charge of double the ordinary fee for daily admission. Season-ticket holders will have this privilege free.

The number of visitors admitted to the Exhibition during the week ending May 19th was as follows:—Season tickets, 5,138; on payment of 2s. 6d., 3,157; on payment of 1s., 47,206; total, 55,501.

THE ROYAL MINT.

The first annual report of the Deputy Master of the Mint contains an historical account of the coinage and the Mint, in addition to the ordinary information respecting the changes that have taken place in the establishment during the year 1870. From this published matter, gathered from the best authorities, to whom ample reference is given in the margin, it appears that the right of coining, in this and other countries, has always been the privilege of the Sovereign. In former days, the Crown, besides settling the denominations and designs of coins, and giving them currency, also exercised the right of determining the standard of fineness, and it is remarkable that the Acts of Parliament which were passed from time to time on the subject of the coinage appear to refer almost entirely to abnormal conditions of the coinage which it was desirable to rectify by the supreme authority of the Legislature, while the actual proceedings of the Mint were regulated by "indentures" between the Crown and the Mint Master. The privilege of coining was frequently delegated to eminent subjects, such as the Archbishops of Canterbury and York, the Bishop of Durham, and the more dignified abbots; but the right of determining the standard, denomination, and design of the coins appears to have been in all cases reserved as the exclusive privilege of the Crown itself. Moreover, the Crown appears at all times to have exercised the right of giving currency in this country to the coins of foreign states, and of determining at what rates they should be received in payment.

It is interesting to notice what metals have been at different times used for coinage, and the changes which were from time to time made in the amount of base metal added to them in the process of coining. Under the Saxons and Danes, money appears to have been coined of silver and brass, but the brass money was subsequently rejected by the Normans, who used silver only. Gold money was not introduced until the reign of Henry III., and copper not until the year 1672. Before giving an account of the alterations which were from time to time made in the coinage, a digression is made relating to the mode of debasing the coinage. This occurred in three different ways. First, by diminishing the quantity and weight of the metal of a certain standard of which any coin of a given denomination is made; second, by raising the nominal value of coins of a given weight. and made of a metal of a certain standard, that is, by making them current or legal tender at a higher rate than that at which they passed before; third, by lowering the standard or fineness of the metal of which coins of a given weight and denomination are made, that is, by diminishing the quantity of pure metal, and proportionally increasing the quantity of alloy.

With the exception of a short period in the reigns of Henry VIII. and Edward VI., the silver coins were always debased in the manner first mentioned, while the gold coins were more frequently subjected to debasement by arbitrary elevations of their nominal value, in order that the relative value of the gold and silver coins might be maintained. The evils of such a system are apparent. In order that a temporary advantage might be secured, violent changes were made, which, in their consequences, impeded all commerce, and disturbed the whole system of coinage in the country. Before the introduction of British gold coins, in the reign of Henry III., gold pieces of about the value of 10s., coined at Constantinople, and known as byzants, circulated freely in England, and at a subsequent period, florences, so called because originally struck at Florence, were well known in England as well as other parts of Europe. From these coins is derived the name of florin, which, as a silver coin, is the money of account in South Germany to the present day. Several denominations of gold coins have at different times been issued. In the reign of Edward III. the noble, and in the reign of Edward IV. the angel and rose noble, or rial, were followed by the double rial or sovereign of Henry VII., which was to pass for 20 shillings, and by the laurel of James I., of which the current value was also to be 20 shillings. The latter coin was adopted by Charles II., at the Restoration, and was subsequently called a guinea. The present sovereign was issued by proclamation, dated 1st July, 1817, and weighed $\frac{20}{21}$ parts of the guinea.

The present standard of fineness for gold coin is 22 parts fine gold and two parts alloy. The gold coins struck by Henry III. were 24 carats fine, or pure gold, but their standard was changed by Edward III. to 23 carats, 3½ grains fine, with half a grain only of alloy, and was reduced by Henry VIII. to 20 carats of gold, and 4 of alloy. In the latter reign, however, crowns were also coined of the standard of 22 carats of gold and 2 of alloy, and after many changes this standard, known as "crown gold," was, in the reign of Charles II., finally adopted by Act of Parliament as the sole standard, and has so remained to the present day. For silver coin the present standard of fineness, namely, eleven ounces two pennyweights of silver and eighteen pennyweights of alloy, was probably first introduced by the Saxons, but it has been subject to many changes. Copper money was first coined by Charles II., in 1665, but no trace of the issue of such coins is found till 1672. "Tokens," both of copper and of brass, were circulated in the reign of James I., but their intrinsic value was so far below the nominal value at which they were issued that it was not considered advisable to recognise them as coins. Copper coins continued to be in circulation from the reign of Charles II., and a large re-coinage of that metal took place in 1797. No further change was made until the introduction of bronze money, in 1860. Tin was also used for coinage in 1680, when farthings were struck in that metal with a stud of copper let into the centre, and again in the reign of William and Mary, when both halfpence and farthings were issued in considerable quantities.

The mint appears, after the Norman conquest, to have been to some degree under the authority of the Barons of the Exchequer. Before that time, the "moneyers" whose names were inscribed on the coins, and who, as actually fabricating the money, were probably personally responsible for its accuracy, are the only mint officers of whom record is made. These persons, who were in the employment of the King, or of the eminent subjects to whom the privilege of coining was delegated, enjoyed at all times extraordinary privileges, but any dereliction of duty was, on the other hand, punished with the greatest severity. In early times there were mints at many of the principal towns of England and Ireland, such as Bristol, Hull, and Dublin, and there was also a Mint at Calais, and it is curious that, besides the Mint in the Tower of London, there was also one in Southwark. The Mint at Dublin was abolished in the year 1696, and that at Edinburgh in 1817, and since that time the entire coinage of the United Kingdom has been conducted by, or under the direction of, the Master of the Mint in London.

EDUCATIONAL NOTES.

The Royal Geographical Society's Prize.—This prize of £5, given annually by the above Society to the best candidate in the subject of geography at the Society of Arts Examinations, has this year been awarded to John Armstrong, aged 21, engineer's clerk, a member of the Carlisle Mechanics' Institution. Mr. Critchett, educational officer of the Society of Arts, attended the annual meeting of the Royal Geographical Society, held last Monday, and received the prize on behalf of the candidate. It may be mentioned that, in this and former years, Mr. Armstrong has obtained first-class certificates in arithmetic, mensuration, book-keeping, English history, domestic economy, and political economy, as well as the first prize of the Society of Arts in geography.

The London School Board and Endowments.—The following amended motion on this subject was passed at the last meeting of the Board:—"That a committee of the Board be appointed to ascertain what is already known regarding the existence, circumstances, and present extent of endowments and bequests held by parishes, corporations, or parties within the area under the control of this Board, and available for purposes of the general and technical education of the people, and to report to the Board thereon." In the first instance, a motion by Mr. Freeman, "That a deputation from this Board wait upon the Prime Minister to request that the Government will advise Her Majesty to issue a Royal Commission for inquiring and collecting evidence" respecting endowments, was brought forward, but the above amendment, having been proposed by Professor Huxley, and agreed to by Mr. Freeman, was carried *nem. con.*

The University Tests Bill.—It will be remembered that when this Bill was before the House of Lords, the clause enacting that tutors and some other college functionaries should make a declaration that they would teach nothing opposed to the Divine authority of the Old and New Testaments was carried by a small majority of five. This clause was considered in the House of Commons on Tuesday, and rejected without a division. Another of the Lords' amendments, the effect of which was to except the heads of colleges from the operation of the Bill, was negatived by 255 to 149; and the amendment which prevents colleges from altering the statutes as to clerical fellowships, &c., without reference to Parliament, was rejected without opposition; but there was a protracted conversation on the two following amendments, which require the existing colleges to provide religious education and religious worship, the latter to consist of an "adaptation" of "morning and evening prayer" of the Church of England. The government agreed to these clauses, and the House divided on both, the first being carried by 197 to 165, and the second by 229 to 99.

Endowments and the Education of the Poor.—In a communication addressed to the *School Board Chronicle*, Mr. Edwin Pears refers to the recent agitation provoked by the proceedings of the Endowed Schools Commission. He says that the only plausible foundation on which the attempted agitation is based is the charge that the commissioners propose to devote the endowed schools to the benefit mainly of the middle classes. "In so far as this charge can be made out, the outcry is a valid one. The middle classes are quite able to pay for the education of their own children. If it is right that they, as well as the poorer and wealthier classes, should receive State aid, let them receive it by all means. But do not let the State aid they receive be taken from endowments which were intended for the poor. Such a transfer has taken place already in many schools throughout England. The process looks like class robbery, and in such matters it is as important that a transaction should look honest as that it should be so. It is no answer to the charge—although it has often been put in as if it were—to say that the poor are now provided with education in another way. They have a right to say, and do say, 'These endowments were intended for our use.' Few will object to the main design of the Endowed Schools Commissioners. They propose, in accordance with the report of the commission, to form a great series of middle-class schools throughout the country on the framework supplied by the endowed schools. Nobody doubts that such schools are urgently needed. But it may well be asked whether all, or by far the largest portion, of the endowments ought not to be used for the purpose of providing higher education for the poor in such schools. The fees which are to be paid in the reformed schools are sufficiently high to make them self-supporting. Use the endowments in providing scholarships. In the interests of the poor, who, I repeat, have the first claim, the wisest use to which the bequests can be applied is to devote them to the encouragement of industry and merit."

Female Education in the Higher and in the Lower Ranks.—Mr. G. C. T. Bartley, in a paper on the education of girls, points out that in this respect—strange as it may seem—the condition of the upper and middle classes is worse than that of the industrial population. "It is almost true that the higher the social scale, the worse in quality is the course of education supplied to the daughters of a family. The instruction given at the present time to a girl in an elementary school, if insufficient, has generally about it something practical which middle-class girls' schools might often follow to advantage. As the School Boards gradually get into working order, it seems likely that this difference in quality will become greater and greater; and unless the middle-class schools for girls improve, it is to be hoped that such will be the case. As a general rule, parents try to educate their boys so that they may be best fitted to get their living as early and as readily as possible. Girls, on the other hand, are but too frequently brought up to be fashionable. Attractive accomplishments, however superficial, are more showy than solid merit; and no doubt mothers display a good deal of knowledge of the world when they calculate on such things setting their daughters off to the greatest advantage. The highest aim at hundreds of girls' schools is to impart a knowledge of music and French, often very superficial; and where Italian can be added, if only to a sufficient extent for a few songs, the school takes rank at once as a finishing establishment of a high order. Doubtless, all these subjects are desirable, and time may usually be made for them, but the evil is that they are inefficiently taught, and that they are not laid on a basis of sound instruction in elementary subjects. A large number of the girls brought up—they cannot be called educated—at what are looked upon as first-class schools would be completely unable to pass such an examination in arithmetic, reading, and needlework, as the majority of the girls at the Hanwell District Pauper School qualify in, as a matter of course, before they leave that institution."

CORRESPONDENCE.

TRADE HAND-BOOKS.

SIR,—I desire to bring to the notice of the Council of the Society of Arts the exertions made by a somewhat similar society at Darmstadt, to supply workmen with trade hand-books and drawing copies for trade schools.

The "Gewerb-Verein" at Darmstadt has, for many years past, employed gentlemen of eminent qualifications to prepare very full and complete treatises on the scientific principles, and particularly on the technical details, relating to the various handicrafts exercised in that state. For instance, in a work on cabinet-making, an account is given of all the different kinds of wood which are known to be of service, their respective characteristics, uses, and relative qualities or defects for each kind of operation, the preparation of such woods, &c. An immense body of useful information is thus brought together by the joint co-operation of scientific and practical men, which very few masters or workmen would obtain even in a life-time. These handbooks are profusely illustrated with admirable woodcuts, and furnished with very full tables of contents. Their reputation is so great that many thousand copies have been circulated throughout the Continent, and have been translated by the order of the governments of several foreign states.

The second branch of work which the "Gewerb-Verein" has taken up is the preparation of a very large number of drawing copies for the Trade Schools of the Grand Duchy, these being under the immediate supervision of the Society. In these schools there are, in addition to the kind of instruction given in our science and art schools, drawing lessons of a somewhat different character. These are especially designed to illustrate the different handicrafts, copies on a very large scale being prepared for the purpose. It is considered by employers, and the Society of Arts at Darmstadt, that apprentices and workmen of every trade derive great benefit from the practice of copying designs which illustrate the various kinds of work in which they are engaged, as well as the tools which they use. Thus, for instance, carpenters will be set to copy every description of joining and morticing, every kind of roof and staircase which is known; masons and bricklayers, every description of stone and brick work; locksmiths, to copy designs in their trade; ironworkers, in theirs; and so on. A lithographic press is kept constantly at work in producing these designs. Directly a new machine, or building, or piece of ironwork of novel construction or character is heard of in the Grand Duchy, or in any other state, a copy is procured, and working drawings prepared from it. The value of this kind of copying appears to be appreciated in other states of Germany, for the Gewerb-Verein is in frequent correspondence with those states, with a view of exchanging copies.

The opinion is that such drawing educates the eye and hand of the apprentice, and makes him better acquainted with the nature of his work, and with the instruments which he uses. I was informed that those who attended these schools (open on Sundays and on week-day evenings) were much sought for by masters, and that they made far more rapid progress in their work than others not so trained.

I annex to this letter lists of some of these trade handbooks, and of the drawing copies for trade schools. I have purchased a few specimens which I shall be glad to send for the inspection of the Council, if they desire it.

I have been induced to bring this subject before you because I believe that a similar work might be done in this country with advantage. At the offices of the Working Men's Club and Institute Union, we have had frequent meetings of workmen, who came to discuss the question of a technical and trade literature. They were unanimous in expressing the great disadvantages under which they had laboured in the time of their apprenticeship, for want of the means of acquiring systematic instruction in the principles and practice of their trades. They had been left to acquire that knowledge, as has been often said, by "rule of thumb," picking it up from the foremen, who were often unwilling and unable to instruct them properly. They stated they had frequently made inquiries for trade hand-books, but that no works now in print were such as met their requirements. They added, indeed, that the works of the present day were inferior to some published at the beginning of the century.

I would therefore respectfully suggest that a sub-committee should be formed, to take this subject into consideration, to collect works of the kind in this and foreign countries, and to report as to the best mode of supplying a complete set of hand-books for different trades.

As regards the preparation of drawings for night schools and trade schools, the opinions of teachers, manufacturers, and others possessing special knowledge of these questions, might be taken. The Society would then be in a position to determine whether it could itself undertake to produce such. The Gewerb-Verein at Darmstadt might be applied to for a complete set of this class of models. I found the secretary, Herr Fink, most willing to afford any aid or information to persons interested in the subject.

I know that it will be said that the "law of supply and demand" may fairly be looked to in these cases. My reply is, that it has not done so during many years that the want has been felt. The production of such works by the ordinary channel would in all probability be too uncertain in its financial results—looking at the class of persons who would be the only buyers—to warrant publishers in incurring the risk. I may add that the work at Darmstadt has not been wholly that of a private society, for its principal officers are appointed by the government, and a considerable portion of the expenses are provided from the State exchequer.—I am, &c., HODGSON PRATT.

8, Lancaster-terrace, Regent's-park, N.W.

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Designs for Joiners and Cabinet Makers. 3 parts.

THE RESOURCES OF INDIA.

SIR,—Mr. Hyde Clarke, at a meeting held in the rooms of the Society of Arts on the 24th March, 1871, made certain proposals for forming an association whose objects were the establishing of greater commercial intercourse between Great Britain and all accessible parts of Asia, the acquiring of more reliable information regarding the geography, geology, history, resources, and statistics of that vast and hitherto almost unknown portion of the earth's surface—objects worthy of the greatest attention, but so varied, so intricate, and so gigantic, as to induce a belief in their impracticability. If we consider the enormous territorial area of Asia, her huge population (some 600 millions), and their conflicting interests and creeds, or if we consider the various governments now existing, we shall find ourselves beset with insurmountable difficulties. If we look at natural obstacles, we find that Siberia is rendered almost inaccessible by her inhospitable climate, Tartary by her mountain ranges and her turbulent races, Arabia by her deserts. Again, in India (a dependency of Great Britain) we could introduce salutary laws, make roads, develop trade, and thus materially improve the social condition of the great masses under British rule. In countries like Persia or China (independent states), our utmost efforts could only produce commercial treaties—treaties that at best could only affect the few. Taking, therefore, into consideration the great natural obstructions, the treacherous habits of the Tartar and Chinese races, the absence of roads, and a host of other causes which no association could possibly overcome, I am of opinion that Mr. Hyde Clarke's plan must be abandoned or materially altered, or the labours of the Society must at first be restricted to certain defined and easily accessible portions of Asia, as, say, India and Burmah. Surely any corporation, however learned, however energetic it may be, will find enough to do in ameliorating the social condition of two hundred millions of souls.

In discussing a matter of any importance, it would, perhaps, be well to keep strictly to the subject, and avoid random remarks as much as possible. For instance, regarding increased commercial intercourse with India, would it not be wise to decide, first of all, what are India's capabilities and requirements,—to settle beyond doubt her place in the world? Is she to be pre-eminent for her agriculture or her manufactures? To answer these questions, it is necessary to examine briefly, but carefully, her history and geography. There is no doubt that, at one time of her existence, India must have enjoyed great prosperity; that the successive and successful attacks of the Tartar hordes gradually brought the vast continent to an unparalleled state of anarchy and ruin, for no one who has seen the splendid architectural remains, the ruined weirs and tanks (all works of Hindoo rulers), can ascribe her retrogression to any other cause; nor can any one who has read the native historical records[*] (still extant) of the country, doubt that under Moslem oppression, misrule, and fanaticism India was reduced to a condition that beggars description; life and property were insecure; village was in arms against village; gangs of robbers spread fear and terror everywhere; petty adventurers raised the standard of revolt against weak and cruel rulers; the Rohilla levied taxes on his own account; flourishing towns[†] were entirely abandoned by their industrious and thrifty occupants, whole districts were deserted; large areas of land were left untilled; thousands perished by the sword, or from the effects of hunger. Death or Islamism was the alternative offered by the truculent Mussulman. The religion of Allah was made the pretext for foul murder. This picture will convey to your mind but a faint idea of the fearful state of the peninsula at the time when certain obscure English merchants organised armies and took possession of the country. By their firmness, devotion, and constancy, order was again re-established, life and property were respected, roads were opened out, tanks and channels restored, and a fresh impetus was given to trade. In the course of time, it was deemed necessary to bring India under the more immediate control of Great Britain, and she has benefited by the change. Railways and irrigation works were (and are still being) opened out, thousands of miles of new roads are now in process of formation, greater attention is paid to the conservation of forests and fisheries, the mineral resources of the country is meeting with much consideration, and close intercourse between the governed and governing races is being established; but much remains still to be done, the agricultural resources of India will bear enormous development.

I admit that, unlike our zealous predecessors—the Moguls—we do not destroy beautiful temples,[*] nor do we take the lives of our subjects under the garb of religion,[†] but we are pursuing a policy to the full as destructive and fatal. We would (notwithstanding our boasted learning and superior institutions) do well to take a few lessons from former Hindoo rulers. They saw the importance of storing water, a circumstance amply attested by the numbers of ruined weirs and tanks[‡] to be found all over the country; they knew how to build them substantially, too. Seeing that the material prosperity of India depended on her agriculture, and that her agriculture depended on her oxen,[§] these Oriental sages wisely protected the cow, by hedging her round with a girdle of sanctity (by learned pundits the cow was pronounced to be a sacred animal:—"Use her milk and her dung; employ her progeny in ploughing your fields or treading out your corn; but her destruction must henceforth be a sacrilege in your eyes, orthodox Hindoo"), and India was saved. Compare this with our policy. We have gradually denuded many parts of the country of its timber, without making a corresponding provision for future generations. For years fuel has been so scarce that dung has had to take its place; the fields, in consequence, year by year get less manure, and, as might be expected, famines occur with startling rapidity. In every district there are thousands of acres of waste land which could be turned to account, yet annually we allow forty to fifty thousand coolies to emigrate. To the European settler we say—Approach not the land; to the coolie—Get you gone to other climes; to the ryot we say—Denude our forests, fell the trees, and supply all your wants, domestic or otherwise; these are your communal privileges.[||]

I will now turn to the geography of India. A glance at the map will show us that, excepting the Nerbudda, all our rivers rise in the extreme west, and flow eastwards; rising where the fall of rain is extreme,[¶] they water and render fertile the greatest possible extent of land, and, at the same time, have the easiest possible fall. I will not enter into details, but briefly observe that were any of these peculiar conditions altered or changed, no river in India would be in flood for more than fifteen days. A peculiar geological feature is worthy of notice here, as confirming the views of the early Hindoo rulers, as also those of many earnest, zealous, but, alas, unrewarded, Englishmen.[*]

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[*] Government are now collecting the native records of all Taluks, and translating them into English; they describe the most frightful state of anarchy.

[†] All over the Kurnool district this fact is apparent.

[*] The Moguls built all their forts with carved stones taken from Hindoo temples. In many of their musjids I have found stone pillars with idols carved on them

[†] The Hindoos under Tippoo's reign were circumcised wholesale, and a piece of beef was forced into their mouths; this ruler's name is held in execration to this day.

[‡] I have seen weirs in excellent preservation all over the Madras presidency.

[§] The natives admit this. It would be frightful to contemplate the state of India were this law not rigidly enforced.

[||] Communal rights interfere with progress in India. If a stranger wants land, he cannot have it if the ryots of the place object. The ryot has fuel for domestic purposes, wood for building, and for his ploughs free of charge.

[¶] On the west coast, rainfall is 120 to 150 inches per annum; in Central and Eastern India it is but 40 inches.

The surface soil is very porous, and is composed almost entirely of sand, but underlying this sand is a deep bed of clay. Eminent authorities have decided that if the sand were found without the clay, India would be a desert; if the clay occurred without the sand, India would be a pestilential swamp. Hence, therefore, we have a country whose geographical and geological features go to prove that she is eminently adapted for agricultural development; but if we compare the extent of the cultivated portions with the total area, we find that but little has been done in making India what she could become—the "granary of the world."[†] The first object of our rulers should be to develop or rather extend cultivation, by projecting works for irrigation purposes, by encouraging colonisation, by establishing model farms in every district, taking care to place competent men in charge of them. Their special attention should also be given to the breeding and improving of cattle,[‡] sheep, and poultry. Ryots should be made to plant trees[§] on the boundaries and divisions of their fields, and should be weaned from the pernicious practice, now so prevalent, of using dung as fuel. The fisheries deserve more attention than they receive. Schools should be established in every taluk, where the native youth could be taught farming and the mechanical arts. Exhibitions of cattle, poultry, grain, &c., should be held annually, and prizes distributed. India should be apportioned with especial regard to her national and climatic aspects; for instance, in Burmah, and on the western coasts, where the rainfall is heavy, numerous trees should be planted, and the existing forests preserved. Along the banks of all rivers, small or great, irrigation and cultivation should be encouraged; lands more remote should be especially reserved for dry crops, or sown with grass for the use of cattle and sheep; the custard apple and prickly pear, both fruit-yielding shrubs, thrive in the most rocky soils;[||] the cocoa-nut and palmyra grow luxuriantly on the sea coast.

India, so far as we know, is rich in mineral resources; coal, peat, iron, saltpetre, earth-oil, lime, granite, and marble are found in abundance; the diamond mines of Kurnool spread over an area of 6,000 square miles, and are still worked; gold and silver in small quantities is extracted from the soil; but India never will become celebrated for her manufactures; she cannot use water (except in her hill tracts) as a motive power; of her coal but little is known; but her great drawback lies in her population, who are physically unfit for any severe bodily exertion. If, therefore, British manufacturers would but carefully study the tastes, habits, prejudices, and wants of our subjects, they could, in exchange for raw material, supply the natives with brass, copper, and iron utensils, piece goods, and such articles as Orientals appreciate. Before leaving a subject on which I know opinions differ, I purpose placing the views of the Hindoo before you. In their symbolical way, they gave certain rank to their different classes; the Brahmin, who represented the intellect of the country, held the first place, and is seen proceeding out of the forehead of the god Brama; the Rajpoot or Viceloo, the rulers or royal classes, issued from his shoulders or arms, indicative of authority; the sudras, the peasants, and merchants came from the stomach (the whole trunk really) of the deity; to the mechanician, however, the feet of Brama were assigned, and this unfortunate class are much despised in India.[*] The above will show you how much importance native legislators placed on agriculture, and how little on manufactures (not that I believe they really despise this class of their subjects). No doubt they saw clearly that the one art could be enormously developed and the other could not.

In conclusion, I would observe that, in early ages, Arabia attained great commercial and agricultural prosperity; Egypt was so prolific that she supplied herself and the rest of the world during seven years of famine; Palestine is described in our Bibles as a "land flowing with milk and honey;" under the Roman Republic, Algiers was the granary of Europe; during her supremacy, Spain was celebrated as a great grain-producing kingdom. But what is the state of these countries now. In their day they were celebrated for their fine forests; now we find them nude of tree vegetation, and from their elevated stations they have sunk lower and lower in the scale of nations, till their existence is now hardly remembered, and India is following in their wake. The price of our food and labour have risen in a most appalling manner, still nothing (worthy of the name) is done to ameliorate matters; our lands lie waste, our fisheries are neglected, our jungles are thinned, our crops and our rains are not to be depended on. Surely the time has arrived for the establishment of an agricultural department; surely colonisation ought to be encouraged;[†] surely the valuable labour which annually leaves our shores for Ceylon, Mauritius, and other islands could be diverted from its present channels, and utilised in India. I append a statement, showing the return of the more valuable crops and oil-bearing trees of India:—

Name of Crop.	Yield per acre.	Value per acre.	Remarks.
Indigo	Not known.	£18 after all cost.	In Cuddapata.
Paddy	2½ candies.	£12 " "	Madras Presidency.
Coffee	Not known.	Not known.	" "
Tea	"	"	" "
Raggy	3 candies.	£3 after all cost.	
Cocoa nut	400 trees to the acre.	£13 " "	
Palmyra	" "	" " "	When full-grown, each tree sells for 2s.
Sugar-cane	Not known.	£15 after all cost.	
Chenna Cholum Cumboo	2 candies.	£3 " "	Madras Presidency.
Neem Mango Tamarind Date palm Jack	Not known.	From 2s. to 4s. per tree.	" "

I am, &c.,
R. Taylor, Captain.
30, Cave's-terrace, Shepherd's-bush.

INDIAN AGRICULTURE, &c.

Sir,—The following extract from a letter received from Mr. T. Login will be interesting to your readers. The letter of mine referred to was in the *Asiatic* of February 8th:—

"I was very glad to see your letters in the *Asiatic*, about my cotton experiments. My wheat experiments have given quite as remarkable results as the cotton. To think that one grain of wheat could produce 105 ears, each bearing about 40 grains, is, to say the least of it, remarkable. 105 × 40 = 4,200 grains. The average will, on all my experiments, be about two thousand-fold, which certainly is promising, and I believe the time is not far distant when you will see a vast advance in Indian agriculture. To attain this end, you must press the matter, urging it on as much as possible at home, and in time people will begin to attend. I have been doing my best, but it is rather up-hill work, as my experience of the last dozen years clearly shows; but I think that now, at last, people are beginning to believe me. A great deal, however, depends on your exertions at home.

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[*] Colonel Haly has for years advocated necessary reforms.

[†] The remark was made by the late Duke of Wellington.

[‡] Europeans would manage this better than natives.

[§] Were every ryot compelled to plant fruit or oil-bearing trees on the boundaries and divisions of his field, India would have twelve millions of additional trees, costing government nothing. The ryot should alone enjoy the produce from them.

[||] During the famine in Hyderabad, thousands of natives supported life on the fruit of this shrub. In Coimbatore, during the famine, thousands lived entirely on the fruit of the prickly pear.

[*] No artizan is allowed to ride through a village; till lately, they were not allowed to wear slippers. No priest attends at their marriages or deaths.

[†] A subject ably and earnestly recommended by Mr. Hyde Clarke and Col. Haly.

"I do not agree with you about the income-tax, and I think that direct taxation is not suitable to India yet. You must first teach them the value of truth, and that will be a long business."

In answer to Mr. Login's remarks on the income-tax for India, I would say there is no doubt that he is right in saying it is not palatable in India; what tax is palatable in India, or even anywhere? The unpleasant feeling arising out of paying a tax direct is, in my humble opinion, the best recommendation it could have, if justly levied, inasmuch as it will tend to draw the attention of the taxpayers to wasteful extravagance of the executive in time to enable them to raise their voices against it, and induce sounder legislation in the direction of reproductive expenditure, with a view to lighten the burden of taxation for all.—I am, &c.,

Thomas Briggs.

Mr. Thomas Login also writes from Umballah as follows, with regard to the labours of the India Committee of the Society:—"The discussion on cotton led me to inquire into the system of cultivation in Egypt when I passed through, and I tried an experiment here on a small scale, and the yield has been most satisfactory, as I have got over 300 lbs. for the acre, or nearly five times the average produce of India per acre; and would have had considerably more but for the very heavy rain early in the summer and the frost at the end of it. I have, however, every cause to be pleased with the result, and government will try it on a larger scale this year. I have also tried wheat on the same system (furrows 10 inches high and two feet apart, with a single seed at every 18 inches, on the top of the ridges), and it promises to give quite as good results. By last report I have received of this latter experiment, some of the seed have given off over 100 stalks. So, you see, that our interesting meetings have not been without good results. There have been inquiries as to the cause of the great sickness in the irrigated districts, and, from all I can learn, they have come to the very same conclusion as I came to in my paper.

"Umballah, February 14th, 1871."

COFFEE LEAVES.

Sir,—The conflict of opinion, in the pages of the *Journal*, upon this subject serves to show the desirableness of an authoritative determination of the real fitness of the cured leaf to take its place in the dietary of the people.

From what is stated, it appears that some prepared leaves received from Ceylon as recently as last year have been valued at 1s. 2d. per pound; and that the analyses of former samples give 1 to 1·15 per cent. of cafeine in the leaf, or thrice as much as in the berry, and twice as much as in the low grades of congou and hyson tea; whilst, in "Watt's Dictionary," i., 1,073, we read that the stimulating and invigorating action of coffee appears to depend both upon the empyreumatic oil and the cafeine, the retardation of tissue transformation chiefly on the empyreumatic oil, the cafeine acting in this manner only when it is present in considerable quantity."

The conclusion may therefore be urged that the leaves are of considerable value and importance, and the evidence of further test will probably be not disappointing. The more serious doubt seems to be, whether they can be made acceptable to the public taste as a beverage, the liquid, though fragrant and strong, being characterised as rather herby in flavour, or, more unfavourably, as like senna tea. No fond memories linger round a cup of the latter, that we should hesitate to re-echo the epithet of "utter nastiness" in application to it, or any counterfeit presentment. But it should not be taken for granted that the quality of coffee-tea is so bad, or that lack of practice in preparing and packing may not have to do with it.

The teamen express a desire to reserve the Society's medal for an essay on tea, and begrudge one for a sample of coffee leaves. But is this fair? They have their advantage in the pre-eminence of their favourite, and one would think that no such incentive was wanted to write its history. Although the popular impression is that everything is known about it, tea is a thing "of credit and renown," to illustrate which should be a pleasure of itself, and will always secure attention. But of coffee-leaves, their curing and manipulation, nothing comparatively is known, and information is not readily accessible. To give an honorable encouragement to experimental inquiry is therefore obviously to sustain and excite active interest in the pursuit of an object so neglected, not to say discredited.

The coffee-leaf is not advocated as a substitute for tea, but as ancillary to it. Its production in any quantity will, of course, depend upon a special cultivation, for both leaf and fruit cannot profitably be gathered from any plant, else why have not tea-leaves been imported as the good helpmate to coffee it is said they are? The annual forcings and young shoots "handled out" in the season on the coffee plantations offer a means ready to hand for experiment, and the intimation that the planters would rather see them utilised than cast aside suggest a way to work it out.

The opportunity for giving an impulse to the production of a new article of commerce, and for helping the poor and needy to a cheap and wholesome drink, if coffee leaves are found to be palatable when properly prepared, is open. To provide the large classes of the population concentrated in the towns, and by the census returns in in the papers steadily increasing, whose toil is more exhaustive of the nervous and vascular than of the muscular system, with an innocent stimulant to recruit their jaded energies, supplies the motive for moving in proof of the fact under contention.—I am, &c.

George Buchanan.

London, 15th May, 1871.

DECIMAL AND METRIC SYSTEMS OF WEIGHTS, MEASURES, AND MONEYS.

Sir,—My attention has been attracted to the letter of your correspondent, Mr. Frederick Hendriks, in your *Journal* of the 28th of April, pp. 491, 492. I am not about to ask your permission to enter into a controversy on the merits and demerits of the views which your correspondent so warmly espouses, having before my mind the objection inseparable from the decimal system comprehended in the word *repetend*. I content myself with saying that, when the very zealous advocates of this theory have succeeded in imposing it compulsorily on an unwilling and (if it please them) unenlightened people, their difficulties will commence, for they will find it to be impossible to inflict the penalties. It would be just as reasonable to pass a law to compel the English people to use none but the French language (as William the Conqueror and his successors did), and as futile. So long as there are various races and nations of human beings, so long will there be different languages. They may be gradually assimilated, but the genius, and the customs and habits of people, the growth of centuries, cannot be suddenly reduced to uniformity by compulsory laws; and money, weights, and measures, are ideas expressed in figures which must necessarily differ in different races and nations. Many theories can be made to appear to be very simple and very clear, so long as the mind is restricted to one particular point of view; but it is actual experience which tests their practicability, after all. The question, therefore, so far as it relates to weights and measures, will take care of itself when it comes into practice; but with regard to money, watchfulness is required, lest with the persevering aid of your correspondent, and his not-numerous but zealous coadjutors, our present Chancellor of the Exchequer should, by a sudden *coup*, do an infinity of mischief by attempting to prove practically that what is commonly called "clipping" the sovereign, if the operation be only carried out universally and transmuted into "seignorage," will not depreciate its value. I do not, however, propose to discuss this question either on the present occasion. My object is merely to direct attention to certain assertions with regard to matters of fact which are contained in your correspondent's letter, and to ask that they may be substantiated by some evidence, *ex. gr.* Mr. Hendriks says, page 491:—"Moreover, it is not only amongst our forty millions of French neighbours that its (the metric system) use is obligatory and its disuse penal by statute, but it is also amongst some 100 or 110 millions—(the enthusiast is not particular to a decimal or two of millions)—of souls of other nationalities, European and American." A little further on, Mr. Hendriks says:—"The United States are anxious to adopt the system, and so, too, are the Scandinavian nations." Now, it must strike the ordinary reader as somewhat inconsistent in the Americans, when they have already rendered the system obligatory, to be anxious to adopt it; and equally strange that the millions, both of Americans and Scandinavians, being so anxious, do not at once allay their anxiety. Who or what hinders them? I doubt the alleged facts, and ask for evidence in support of the assertions.

Again, referring to the question of seignorage, Mr. Hendriks says (page 492) that "the United States had again, in the past year, affirmed the principle of such a change." Now, if by this it is meant to be inferred that the United States did in the past, or in any preceding year, "affirm the desirability" of reducing their half eagle to the value of 25 French francs, by increasing their charge to the required extent for "mintage" or "seignorage," I venture to deny the alleged fact, and again ask for evidence in support of the assertion. Bills may have been introduced, and "reports" may have been made, but they have not been sanctioned either by the legislature or the people of the United States.

I think it will be admitted that, above all things, it is incumbent on scientific men to be precise and accurate in their statements of facts or data.

I had occasion, a few months since, to correct an assertion made by the same gentleman in your *Journal*, to the effect that the Association of Chambers of Commerce of the United Kingdom had approved Mr. Lowe's suggestion for depreciating the English sovereign one per cent. I have not observed that your correspondent has either admitted his error or supported his allegation by any evidence. I hope, on the present occasion, he will either substantiate his assertions or withdraw them, for it is of more than ordinary importance that a gentleman who states that he has been giving evidence before "the Paris Commission of 1870" should be accurate in his statements. I shall be glad to be informed where a copy of the report of the proceedings of this Paris Commission of 1870, and also of that of Mr. Fremantle, referred to by your correspondent, can be obtained. The proceedings of these foreign commissions should not be kept comparatively private. English interests may be deeply affected by such *ex-parte* "evidence" and "reports." For instance, Mr. Hendriks' remarks lead to the inference that himself and Mr. Fremantle coincide with Mr. Lowe in recommending the depreciation of our standard of value. The public have a right to know whether this be so or not.—I am, &c.,

Leonard Bruton.

Bristol, May 1st, 1871.

THE DUKE OF WELLINGTON ON THE ARCH AT HYDE-PARK-CORNER.

Sir,—The Prince Consort took exception to this colossal statue, placed the wrong way on the arch, and I believe I may venture to say that this was a point of art which rested in his Royal Highness's mind to rectify. A statue or group on a triumphal arch is, or should be, as it were, the genius of a procession passing under it, and therefore should be in a direction in which such a procession might pass, and not crosswise. Also, the colossal scale of the statue at Hyde-park-corner is quite out of proportion with the arch on which it stands. All this might be set right, if the equestrian Colossus were removed, and instead, on its pedestal, for instance, placed a smaller equestrian statue of the great Duke, flanked on either side respectively by walking figures of "Victory" and "Peace," altogether forming a simple but effective group, which should front across Piccadilly towards Hyde-park, while the entablature beneath, which at present looks bare, might be appropriately enhanced by a series of shield-like bronze medallions, presenting in relievo the portraits of the Duke's principal generals, as Hill, Beresford, Picton, Anglesey, and others. But what should be done with the great statue? At any rate, it does not look to advantage where it is, and dwarfs and deteriorates the arch it occupies.—I am, &c.

Epsilon.

May 22nd, 1871.

MUSIC OF ORNAMENTAL ART.

Sir,—Your correspondent of last week, on the subject "Music of Ornamental Art," claims originality for another correspondent on "Truth in Ornamental Art;" and Mr. Newton, in the issue of the week before last, mentions my letter on the same subject—in that of April 14th—in very favourable terms. But it is a misstatement—doubtless an accidental one—to say that I made any similar claim in reference to the analogy used in my letter, though I had neither then read the letter nor the passage referred to. I should never dream of claiming originality for making use of so very old a comparison as that of painting with music—that of architecture with music dates from before the time of Vitruvius. All that I sought to accomplish by the analogy was to help those who might be in a state of mental confusion about so very simple a subject as that of the theory of ornamental art, to a notion by which they could rearrange and bring their ideas into order. But the rendering of my letter, unfortunately, contains several mis-readings of my not very legible manuscript, otherwise I think it would be found that I am master of the analogy, and therefore accidentally anticipated the wishes of several of your correspondents.

Had I to propound the theory of ornament, I should take more direct means than analogies; indeed, I am always very reluctant to use this particular one, for fear it should be taken to imply more than intended, and so lend weight to such old-fashioned fallacies as those upheld by Hay and others. That all the arts have a common basis of identity, I have myself not the least doubt, and to point out this common basis has for many years occupied much of my time and thought, of which I hope my forthcoming work on "The Theory of Proportion as the Basis of all Formative Science" will give a good account. In this work, I believe, the great principle will be for the first time enunciated that quantity is the form of relativity, or, in other words, that all relation is fundamentally proportional, and this enables me to detect analogies, and some common principles existing in the arts.—I am, &c.,

W. Cave Thomas.

May 5th, 1871.

WORKMEN'S DWELLINGS.

Sir,—Upon looking into Dr. Stallard's calculations, I am sorry to find that the income of 2s. per week per man will not cover the expenditure.

I take, for instance, a plot of land in Southwark, which can now be purchased at 10s. per foot,

	£	s.	d.
The first outlay will be for 9,300 feet of land, at 10s.	4,650	0	0
Costs of conveyance, &c., say	30	0	0
Building (Dr. Stallard's estimate)	8,000	0	0
Total landlord's outlay	12,680	0	0

Tenant's capital account I take to be, as stated, at £400.

Income (Dr. Stallard's figures.)

	£	s.	d.
204 beds, at 2s. per week	1,060	16	0
16 beds, at 3s. per week	124	16	0
	1,185	12	0
Deduct 10 per cent. for expenditure	118	12	0
	1,067	0	0

Expenditure.

Rent of land—5 per cent. on an outlay of £4,680	234	0	0			
Building—6 per cent. on an outlay of £8,000	480	0	0			
				714	0	0
Interest on tenant's capital—20 per cent.				80	0	0
Rates and taxes in Southwark amount to 6s. in the £, and the rateable value of proposed building would be £500				150	0	0
Gas, coal, and water				100	0	0
Three servants, at £30				90	0	0
Soap and sundries				20	0	0
Newspapers				7	12	0
				1,161	12	0

The above shows a loss of £94 12s. per annum.—I am, &c.,

Robert Vigers.

4, Frederick-place, Old Jewry.

Sir,—In a late number, I observe a note from Mr. Cooke, inquiring whether the cottages erected from designs of the late Prince Consort are to be seen now. I believe the identical cottages, pulled down at the close of the Exhibition in 1851, and re-erected are still to be seen; they are used as lodges for the keepers of Kennington-park, and form a very ornamental feature in its arrangements. It is to be regretted that the idea carried out in these cottages (that the labouring man might not only have a home, but that it should be tasteful also) has not been in some way incorporated with recent designs for labourers' dwellings, I would allude more especially to the absence of any attempt at a central garden. This might easily have been carried out in the large spaces between blocks of buildings, and would have been a pleasing relief to the eye. By judicious arrangement this need not diminish the play-space for the children, and probably would have diminished the noise so much complained of in the large flagged yards. I should think the expense of a central garden need not add more than a penny per week to each room, and would serve as a means of educating the children to good order in our parks.—I am, &c.,

W. G. Trewby.

Park-road, New Wandsworth, May 6th, 1871.

EMPLOYMENT OF WOMEN.

Sir,—I regret to observe that in the report of the discussion on Miss Emily Faithfull's excellent paper on female employment, the name of Mr. Gillard was erroneously substituted for my own. I should have gone more fully into the matter before the meeting, but that I had hoped some ladies then present would have attempted to support the unquestionable, able, and eloquent arguments of the gifted lecturer. In now answering Miss Faithfull's scheme, and generally supporting her views, allow me again to repeat my former assertion, "that female employment, as indeed all other, is entirely a question of demand and supply; not a matter of philanthropy or feeling, but rather one of expediency, convenience, and economy. I do not believe, therefore, that the Postmaster-General was actuated by philanthropy in the cause of female employment when he engaged females in the telegraphic department, and instituted schools for their instruction, but rather "expediency" in getting the work done as well or better, and more economical, than male labour could be obtained; hence the preference. Two of my clerks and book-keepers are young ladies, who correspond and write well, are accurate in their accounts, perform their duties with admirable punctiliousness, have no families to support, are zealous and sober, and do not attend or gamble on race-courses. I get their labour at considerably less expense, which enables me to compete with my wealthier competitor. The mercer who excludes females from behind his counter, does so as a matter of expediency, in deference to his female customers, who prefer the polite and obliging attention of his male attendants. Again, the fashionable dealers in articles of jewellery, perfumery, and knick-knacks of a costly nature, employ the best looking (and none but the best looking) girls at their counters, who, by their personal attractions and pleasing manners, can drive better bargains with their rich old or young bachelors than male attendants could possibly accomplish; and I am not sure whether, on going to my barber, I should not rather prefer to have my grey locks clipped and arranged by the delicate manipulations of the female fingers, than submit to the clumsy operations of a German or French attendant, who bores me afterwards to purchase a pot of bear's-grease, or a pot of tooth-paste. I do not think that either the jeweller or fashionable hair-dresser study philanthropy in the matter, except in their own self-interest—expediency and economy.

That females are fit for any occupation history has amply proved. We have had, and have, sovereigns rule a powerful nation with wisdom and firmness. We have had leaders of armies of eminence and courage. Boadicea, who led her Britons against the Roman hosts; Kenan Hasplaar, who, at the head of 500 women, raised the siege of the city of Haarlem from under the iron grasp of the Duke of Alva; the Maid of Orleans, who repulsed the English army in France; and, more recently, the Maid of Saragossa, some sixty years back. We have had, and have, our female poets, authors, sculptors, painters, scientific travellers, preachers, and recently barristers in America, and doctors everywhere. No law excludes woman from any pursuit her capacity and genius leads her to adopt; and she is perfectly free, in her race with man, to work out her own destiny in the pursuit of any industrial occupation she is enabled to follow. She is also equally competent to set the proper value on her talents, from the lowest to the highest scale. In a general sense, the female, in her eager ambition of self-support, as a rule, is more energetic, more alert in her duties, scarcely given to vice, but, above all, her labour can be had cheaper than that of the male, who usually, besides his own indulgences, however temperate, has generally a wife and family to look to him as their sole bread-winner. Their general claim to employment is mostly temporary, and therefore could not materially affect that of men. When fate offers marriage to them their occupation ceases, their domestic duties commence, and man is the gainer with such a wife. Her sobered experience, her love of order and frugality, fits her at once to adorn his household, to educate his children (particularly daughters), in the useful arts and habits of industry, and which, from her own reality in life, she will inculcate in her daughters, in order hereafter, should the contingency occur of losing their natural protectors, they may follow in the same steps that their mother did before them.

Political economists may object to the displacement of industrial pursuit from one sex to the other. This is a fallacy; but what if it does? Is the liberty of the subject restricted to sex? Is the female of our present civilisation born with the badge of slavery stamped upon her? Or will the "social evil" be checked by the exclusion of females from the ambition of honourable self-support, if by sudden calamities she is helplessly thrown on a barren and pitiless world; or should she rather rush, as her only means, to the pitiful needle, which ultimately leaves her the choice of slow starvation, or the dread alternatives—the streets, the gaol, or the cold river-bed?

That which is required for the advancement of Miss Faithfull's scheme is a useful, healthy education. Let us hope the new School Board will provide this,—then training schools for the different industrial pursuits fitted for different capacities. I dare say Miss Faithfull did not find her female compositors ready made. I did not find my female illuminators or lithographers ready to earn bread; I had to train them. Law-writers, book-keepers, wood and glass-engravers, telegraphists, aye, and hair-cutters, all must be trained. There should be proper training schools to teach them. Miss Faithfull asks for government interference or assistance. With the increase of our armaments and additional income-tax to be inflicted, I would not advise Miss Faithfull to send a deputation of penniless girls to the Chancellor of the Exchequer for assistance in that direction for the present. No, she must seek aid from private sources. We who have aided our warlike neighbours with our hundreds of thousands to heal their sick and wounded, to raise the sickly famine which was destroying the fairest city in the world, to send seed to cultivate the blood-sodden soil again with fresh crops of corn, &c., and who, in return for our generosity and humanity, now at this very moment are in deadly strife, and destroying their future by civil war—surely we, who have done so much in so worthless a cause, may have a mite to spare to help Miss Faithfull in her humanising efforts to find the Englishwoman the means of self-support by honourable labour, and enable her to establish training schools throughout the length and breadth of the land, which, in the end, will be repaid by the increasing wealth of the whole country.—I am, &c., D. Laurent de Lara.

London, April 3rd, 1871.

MEETINGS.

Friendly Society Association.—A conference of this association was held on the 11th inst. in the Great Hall, by permission of the Council, under the presidency of Earl Nelson, who, in opening the proceedings, remarked that every friendly society required advice at different stages of its existence, and he should be glad to see the counsels of this association more generally followed. A paper recently issued by Mr. Tomkins showed that, so far from such societies dying soon, some had lived for fifty, sixty, and one hundred years, and were still flourishing; in others, the interest on the accumulated capital was sufficient to keep the members going for life without paying any subscriptions; but, as a rule, societies, from want of the requisite knowledge, had to call for a higher subscription than was necessary. He knew of two societies, where the one with the fewest members and largest funds coming in had the smallest surplus. He anticipated much good from the Friendly Society Commission, of which Sir Stafford Northcote was chairman, and himself a member. The Rev. J. Y. Stratton, of Ditton Rectory, Maidstone, the secretary, read a report, showing that the object of the association was the promotion of friendly and benefit societies suited to the industrial and labouring classes, by devising plans for the development of the principles of insurance societies; by the examination of rules of societies, and suggestions for their alteration or improvement; by the encouragement of the interchange of rights and privileges between the members of different societies; by consideration of the bearing of the Poor-laws on friendly societies; by the suggestion of legislative measures; and by acting as a court of reference or arbitration. It was intended to hold two conferences yearly, one in London and the other in the country. The next would be held in Basingstoke, in October. The association, however, needed more pecuniary support, as at present the funds were barely sufficient to meet the expense of printing and circulating the various papers furnished by gentlemen who made the subject their special study. Papers were read and discussed at the morning sitting "On the Deposit Principle applied to Friendly Societies," by the Hon. and Rev. S. Best, Abbotts Ann, Andover; and "On the Affiliated Orders, their Constitution and Management," by Mr. Francis G. P. Neison; and in the evening, "On Sickness Pay through the Post-office," by the Hon. Edward Stanhope. The Earl of Lichfield, the president of the association, was prevented attending by indisposition.

The Victoria Institute held its annual meeting on Monday evening, the 22nd inst., in the rooms of the Society of Arts, by permission of the Council. The Earl of Shaftesbury presided. The report was read by the hon. secretary, Captain F. Petrie. It announced a satisfactory advance in the objects of the institute during the past session, and a considerable addition of influential men to the number of its members. The death of Mr. James Reddie, the late hon. secretary, and one of the chief founders of the institute, was alluded to with regret. The Rev. Dr. Robins moved the adoption of the report, which Mr. Day seconded, and it was carried. Other formal and complimentary resolutions, thanking the council and honorary officers of the past, and appointing those of the current year, having been passed, the Rev. Dr. W. J. Irons read the annual address, which, after referring to the progress and the need of such a society, and its prospects in the immediate future, proceeded in a luminous and exhaustive argument to prove that true science was not antagonistic to, but confirmatory of, revealed religion. He especially referred to some of the theories recently put forward as to the origin of life and the antiquity of the human race, and concluded by calling attention to the importance of extending the operations of the institute. The Bishop of Gloucester and Bristol proposed a vote of thanks to Dr. Irons for his admirable address, and spoke of the value of such an institute, urging the great importance of all connected with it making the objects known, with a view to increasing its popularity. Admiral Halsted seconded this, and it was carried unanimously. A vote of thanks to the Chairman was then proposed by the Rev. J. B. Owen, seconded by Mr. C. Brooke, F.R.S., and carried. His Lordship having replied, the proceedings terminated.

GENERAL NOTES.

Education in India.—It is said in an official report on education that, throughout India, only 1,096,000 children attend schools, of whom 166,000 are taught English.

South Australian Savings Bank.—This institution was established in 1847. At the end of 1850, the depositors were 672, and ten years later increased to 2,567, and at the end of last year (1870) the number was 12,569. The value of the deposits have also increased in the same ratio. It appears, says the *South Australian Register*, that this progression was not merely proportionate to the increase of the population, but in excess of it. The following table shows the number of depositors every fifth year since 1850:—

	Population.	Depositors.	Per-centage.
1850	63,700 ..	672 ..	1·054
1855	96,982 ..	1,322 ..	1·363
1860	121,960 ..	2,567 ..	2·104
1865	156,605 ..	7,076 ..	4·518
1870	183,703 ..	12,569 ..	6·842

It appears from this table that the population trebled itself in twenty years, and that the depositors in the Savings Bank increased sixfold during that time in numerical proportion, and that the actual number of depositors was, at the end of 1870, eighteen times the number at the end of 1850. The amounts deposited have continued to augment in even a larger ratio, and with scarcely any exceptional cases of retrogression.

New Cement or Artificial Stone.—Many attempts have been made of late years to manufacture artificial stone, some of which have been attended with more or less success, as far as regards the production of large blocks, but have rarely succeeded for the purpose of moulding or making medallions and mosaics, or for emery-wheels, oil-stones, and articles of a similar character. In almost all cases, too, the agency of heat has been required for producing articles in artificial stone, and this has been found very objectionable, as well as expensive. Attention is called to some specimens of artificial stone in the shape of medallions, mosaics, emery-stones, oil-stones, imitation marble, &c., which have been produced in a simple manner, by moulding without the agency of heat, and which appear to partake in every respect of the nature of the stones they are intended to represent. These specimens are formed from natural materials, agglomerated by means of a cement, the invention of M. Sorel, a French chemist, well known in connection with the introduction into this country of the galvanised iron process. This new cement is formed of basic oxychloride of magnesium (carbonate of magnesia and chloride of magnesium), either pure or mixed with other substances. The cement may be made in two different ways, viz., either by diluting or tempering magnesia, which may be more or less hydrated and carbonated, with a solution of chloride of magnesium more or less concentrated; or by adding to the magnesia chloride of magnesium in a dry state, and employing water to form the cement. The cement thus produced is specially white and hard, and may with advantage be used in the place of some of the best cements. It may be made to take any colour, and be moulded like plaster. It possesses the same hardness, and will receive the same polish as marble, thus enabling it to be employed in the manufacture of artificial marble, mosaic pavements, and statuary. Imitation ivory can be made from it for making billiard balls and other similar articles, also medallions, buttons, &c. The agglomerative properties of the cement are of the highest degree, thus enabling the waste and otherwise worthless materials of quarries to be utilised; one part of the new cement will agglomerate thirty parts of sand, chalk, and other materials, the process being of a purely chemical nature. By this means, where building materials are not present, they can be made at a very low cost. Excellent millstones and grind-stones can be formed by agglomerating by this cement emery, sand-stone, and other hard materials. To those members who are interested in this subject, we would mention that specimens of articles produced from the new cement may be seen at the office of Messrs. Fontainemoreau and Co., No. 4, South-street, Finsbury, E.C., the agents of M. Sorel.

Experiments with Water.—A late number of Poggendorff's *Annalen* contains an account of an experiment made by E. Budde, to ascertain whether a Leindenfrost's drop with water could be produced at a less temperature than 100 C. The experiment was made by letting a drop of water fall upon a hot plate covered by a partially exhausted receiver, and it was found that the drop assumed the spheroidal condition at a temperature of 85 C., confirming the doctrine that the force which supports the drop obeys the laws of the pressure of vapours. The star shape assumed by the drop Berger was explained to be a phenomenon of vibration. If the drop is large it behaves like other vibrating bodies, and divides into aliquot parts, forming nodes or loops.

American Cars.—Two new palace cars, of the Pullman pattern, have, according to the *Detroit Post*, just been placed on the line of the Great Western Railway, to run between Detroit and the Suspension-bridge, starting from each end of the line every morning. Each car is sixty-two feet long, and is divided into five compartments; one large drawing-room, which will comfortably accommodate twenty persons; two staterooms, seated for six passengers each; and one room at each end of the car, which may be used as a smoking-room. The easy arm-chairs in the latter are cushioned and encased in Turkey morocco; the moveable chairs and settees in the drawing-room and state rooms are in like manner enveloped in velvet plush, while the interior woodwork of the car is finished with gilding and rosewood veneering, in the highest and most costly style of the art. The windows are of the clearest French plate-glass, 27 by 48 inches in size, and so numerous as to suggest a crystal palace. In addition to the usual devices for heating and ventilating, providing with water, lighting with gas, &c., the partitions are so arranged that they may be closed or withdrawn at pleasure, while persons may readily pass from end to end of the car without going through the central apartments, but through a side passage for that purpose. In short, with the exception of a cupola, wine-cellar, park, and kitchen garden, nothing seems to be wanting to make the car in reality as it is in name—a palace.

On Attraction Caused by Vibrations of the Air.—Professor Challis has communicated to the *Philosophical Magazine* a paper, in which he maintains that the condensation in waves propagated from a centre will vary inversely as the distance, and that the rate of diminution of the condensation or rarefaction with distance from the centre will be continually changed from the law of the inverse square of the distance to that of the simple inverse of the distance, provided there be alternate condensations and rarefactions, as seems to be inevitable; for it is contrary to known hydrodynamical laws to suppose the possibility of a solitary wave of condensation. The above-mentioned velocity gives rise to a continual flow from the rarified into the condensed parts, and just in the proportion required for altering the law of diminution with the distance from the inverse square to the simple inverse. Professor Challis believes that the attraction of magnetism is caused by vibration, to which he might have added the attraction of gravity—a doctrine long since propounded by Robert Hooke, and of which an account is given in his posthumous works. In the revolving grate erected by Boulton and Watt beneath a steam-boiler at the Bank of England, the coal was fed by a scoop moved by a cam, which advanced the scoop gradually over an orifice, carrying coal with it, and then suddenly drew back the scoop, when the coal, by its inertia, remaining behind it, fell into the fire. In this case we have a backward and forward motion causing bodies subjected to it to travel in a certain direction; and if we suppose a similar motion to exist in the particles of bodies, an attraction like that of gravity will be the result.

Richard Wright.—In 1768, the Society awarded a prize of £50 to Richard Wright, for a picture called "The Fishery," which was afterwards engraved by the celebrated engraver Woollett. The picture, somewhat destroyed by cleaning, and an impression of the engraving, are at the Society's House for a few days, and may be seen by any member on application.

Brimstone.—The following are the total exports of brimstone from Catania, Girgenti, Licata, and Terranova, during the past and five preceding years:—

	1865.	1866.	1867.
Great Britain......	578,331	801,369	811,107
France, North	56,021	54,694	43,051
,, South	414,152	441,555	528,391
Holland	88,115	112,371	106,119
Belgium	15,590	20,659	21,440
Germany	185,441	172,231	312,095
Russia	3,250	64,030	89,948
United States......	147,584	175,337	94,355
Spain, Greece, Turkey, &c., and Italy up to 1865	469,680	170,994	161,572
Italy	..	256,695	460,995
	1,958,164	2,269,935	2,629,073

	1868.	1869.	1870.
Great Britain......	666,154	708,472	781,051
France, North	62,828	17,351	6,681
,, South	490,065	432,311	326,654
Holland	79,739	84,573	61,372
Belgium	45,835	47,205	78,656
Germany	254,634	178,600	111,898
Russia	37,482	71,832	66,564
United States......	210,265	263,203	341,741
Spain, Greece, Turkey, &c.....	167,195	155,294	188,561
Italy	530,966	481,264	376,280
	2,545,163	2,440,105	2,339,458

Heating and Ventilating Railway Cars.—The *Journal of the Franklin Institute* places before its readers a system of heating and ventilating railway cars. The plan referred to is that of Dr. J. G. Allen, of Pennsylvania, and formed the subject of a report, adopted at a meeting of the Institute Committee on Science and the Arts. The heating is accomplished by a stove, of peculiar construction, placed beneath the platform at one or both ends of the car, which can be looked after by an attendant from the top. The products of combustion are carried off by an escape-pipe, terminating above the roof of the car; and the heated air, furnished by a cylindrical air-space about the fire-box, is led by tubes beneath the car, and supplied by openings at various points along its sides, slightly elevated above the flooring. The ventilation is effected entirely from the bottom. Openings are pierced in several places in the centre of the aisle, through which the air escapes, and is led off to a pipe terminating above the car in a cowl furnished with a flap valve, which, while the car is in motion, protects the passage from the descent of the air current. The suction established at the free end of the cowl by its rapid passage through the air, is relied upon to produce an effective circulation of the air within the car. The heated air, upon its entry along the sides, rises at once (by virtue of its inferior specific gravity) to the top of the car, and is gradually forced downwards—escaping finally, with the exhalations of the passengers, through the ventilators in the flooring. The plan of ventilating apartments from the bottom has been so thoroughly established as the most economical as well as healthful, that if the mechanical details of the plan here described are as correct as the principle whose requirements they claim to meet, it cannot fail to meet with warm approval.

New Naval Dry Dock at Malta.—One of the most important works of its kind executed for the British government has recently been completed and opened with great success at Malta. During many years past, great inconvenience has been felt because of there being no dry-dock accommodation in the Mediterranean where the largest class of men-of-war might be docked and repaired. The application of the screw-propeller to men-of-war of every description renders such accommodation most necessary. The new dock at Malta will be called the Somerset Dock. It is the largest naval dry-dock in the world, being 7 ft. deeper than the largest at Portsmouth. Its principal dimensions are as follows:—Depth of entrance and on floor, 34 ft.; width between the copings, 104 ft.; length on the floor, 430 ft.; width of entrance, 80 ft. This dock has been about four years in course of construction, but that is amply accounted for by the peculiarity of the ground. It required much time to be spent in clearing the site. The nature of the rock in which the dock is excavated also caused much difficulty in the work. The ground was full of faults and fissures, through which the sea-water rushed in torrents. Indeed, the "grumblers" began to think it would be necessary to pump the Mediterranean dry before the work could be finished; but eight powerful pumping-engines, working day and night, at last brought the water down. The unsound stone was removed, the joints and cracks were filled up, and the dock is now one of the driest ever constructed. The cost appears large (about £180,000), but it is not really so, considering the very large outlay that was necessary to clear the ground—in fact, the site had to be created, by the removal of immense masses of over-burden. At the entrance of the dock, a crane is fixed, calculated to lift 40 tons. The engine-house contains two engines, of 60 horse-power each, working three of Gwynne's centrifugal-pumps. These discharge three jets, each of which is 36 in. in diameter. It also contains a drainage-engine, of about 30-horse power, to keep the dock dry by means of a powerful hydraulic-pump, which also lifts the penstock and sluices. The well (about 50 ft. deep below the sea level) is 16 ft. in diameter, dug in the solid rock, as well as the tunnel, 6 ft. in diameter, connecting the well with the dock. The chamber to receive the caisson had to be built precisely under the salient angle of a bastion 60 ft. high.

ORDINARY MEETINGS OF THE SOCIETY.

Wednesday evenings at eight o'clock.

May 31.—On "The Education of Women." By Mrs. Grey. On this evening the Rev. Wm. Rogers will preside.

MEETINGS FOR THE ENSUING WEEK.

Mon. .. Royal United Service Institute, 8½. Mr. Andrew Murray, C.B., "On the Turbine Propeller."

Tues. ...Royal Institution, 3. Prof. Houghton, "Least Action in Nature."

Wed. ...**SOCIETY OF ARTS, 8.** Mrs. W. Grey, "On the Education of Women."

Thurs...Royal Institution, 3. Professor Tyndall, "On Sound."
Linnæan, 8. 1. Dr. Hance, "On Some Plants from Northern China." 2. Mr. Miers, "On South American *Hippocrateaceæ*.
Chemical, 8. Dr. Debus, "On Ozone."

Fri.......Royal Institution, 9. Professor Andrews, "Gaseous and Liquid States of Matter."
Geologists' Association, 8.
Philological, 8¼.
Archæological Institute, 4.
Royal Botanic, 4. Professor Bentley, "Economic Botany."
Architectural Association, 7½. Mr. R. Plumbe, "On the External Architectural Treatment of Portland Cement."

Sat ......Royal Institution, 3. Mr. Norman Lockyer, "Astronomy."

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FRIDAY, JUNE 2, 1871.

PROCEEDINGS OF THE SOCIETY.

TWENTY-FOURTH ORDINARY MEETING.

Wednesday, May 31st, 1871; the Rev. William Rogers, Vice-President of the Society, in the chair.

The following candidates were proposed for election as members of the Society:—

Moseley, James, David Moseley and Sons, Ardwick, Manchester.
Pope, Frederick, Donnington-on-Bain, Lincolnshire.

The following candidates were balloted for and duly elected members of the Society:—

Adron, Henry, 78, London-street, Greenwich, S.E.
Fielden, S., Centre-vale, Todmorden, Lancashire.

The Paper read was—

ON THE EDUCATION OF WOMEN.

By Mrs. Grey.

Some time ago, the *Pall Mall Gazette* said that "the world was vexing itself to distraction over woman's health, woman's rights, woman's wrongs, woman's work, and woman's education," and it is undoubtedly true that the women's question, as it is called, has assumed of late a very prominent place among those which occupy the attention of the public. A wit once remarked that the best way to get rid of a temptation was to yield to it; and I would suggest to those who are distracted by the various pleas advanced on behalf of women, that the best way to be rid of hearing of their wrongs would be to right them.

The grievance I have specially to call your attention to this evening is the low condition of women's education, the inadequate provision made for it out of the endowments of the country, and the difficulty of obtaining support from the general public for any scheme having for its object their higher education.

In what I have to say, I shall only touch very slightly on the classes which come under the Elementary Education Act, and for this reason, that in those classes girls do, on the whole, share all the educational advantages equally with the boys. They receive the same instruction, with the addition of sewing; they are examined by the same inspectors and by the same standards; their teachers undergo the same special training for their work, and receive the same certificates of efficiency. In their case, therefore, there is no special grievance to complain of. The inferiority of girls' schools of that class, and of the results obtained in them, is due, where it exists, to the general causes which affect women's education as a whole, causes, which I propose to point out further on, and which can be removed only by a change in the public opinion whence they spring. It is, then, to the education given to girls in all schools above the elementary schools, that I propose to dwell this evening. I shall leave theories aside, and bring before you facts resting upon authority which cannot be questioned; and the main source I have drawn upon is the volume before you, containing "Reports of the Schools Inquiry Commission on the Education of Girls," together with the evidence given before the Commissioners by ladies of tried ability and great experience in the education of their own sex. To these I have added extracts from the evidence given before the Commisioners by various gentlemen interested in education. The reports were collected and reprinted in the convenient shape you see here, with the sanction of her Majesty's Commissioners, by Miss Beale, who is at the head of a most successful educational institution for girls—the Ladies' College at Cheltenham—one of the very few proprietary schools for girls in the country; and Miss Beale has added to the volume a very valuable preface, giving the results of her own large experience, and adding all the weight of her testimony to the truth of the sad picture presented by the reports.

The Commissioners, in their General Report, sum up the result of the Assistant-Commissioners' inquiries in the following words:—"Want of thoroughness and foundation; want of system; slovenliness and showy superficiality; inattention to rudiments; undue time given to accomplishments, and those not taught intelligently, or in any scientific manner; want of organisation."

Mr. Norris's evidence, quoted in the above report as the most concise and accurate view of the state of girls' schools, is to this effect:—"We find, as a rule, a very small amount of professional skill, an inferior set of school books, a vast deal of dry, uninteresting task work, rules put into the memory with no explanation of their principles, no system of examination worthy of the name, a very false estimate of the relative value of the several kinds of acquirement, a reference to effect rather than solid worth, a tendency to fill or adorn rather than to strengthen the mind." Taking these points more in detail, I will try to reproduce, in slight but accurate outline, the picture given in this volume of the education by which the future wives and mothers of the lower and upper middle-classes of this country, and the large and ever-increasing number of single women who have to earn their own bread, and often the bread of others, are trained for their work in life. I must first, however, remind you that the standard of comparison by which the inspectors judged the education of girls was not any standard of ideal or theoretical perfection, but that of the education given to boys in the same grades of society, —an education which, according to Mr. Matthew Arnold, leaves our young men of the upper classes barbarians; of the middle class, Philistines; of the lower class, heathens. Without accepting this extreme view, it is abundantly evident, from the reports of the Schools Inquiry Commission, that the standard is not a high one, and that nothing can give so deplorable a measure of the low condition of girls' education as the fact that it is unanimously pronounced, on the best authority, to be very inferior to that of boys.

The only points on which this judgment is reversed in favour of the girls are reading and spelling. The reading is almost invariably spoken of as good. As regards religious knowledge, again, the evidence is not unfavourable, and it is worth noticing that the religious difficulty is even less felt in girls' schools than in boys' schools. The religious knowledge, however, for which the girls get credit seems to be little more than a tolerably accurate acquaintance with the facts of Scripture history and the outlines of the Christian faith, and cannot therefore rank high as an element of education. As regards the mere facts of history and geography the girls are sometimes better than the boys; but, with rare exceptions, the teaching is superficial, and from miserable catechisms or compendiums of knowledge, such as "Mangnall's Questions," and others of the same type.

With regard to grammar, Mr. Bryce's statement expresses the substance of all the reports on the subject. He says:—"In four-fifths of the schools, both higher and lower, English grammar means the committal to memory of Lindley Murray, or of some one of his less illustrious brethren, and it was surprising to see how little notion even intelligent teachers had of handling the subject in a rational way."

The arithmetic is even more unsatisfactory than the grammar. The Commissioners, in their general report, refer to it as the "weak point" in women teachers. Mr. Bryce says "the teaching in this subject is poor, slow, unintelligent; to speak more correctly, there is no teaching, only a languid working of sums." "I feel quite certain," says Mr. Fearon, "that if the girls in half a dozen of the best national schools, formerly under my inspection, were tried in elementary arithmetic against the young ladies of an equal age in half a dozen of the best schools that I examined, the national schools would produce better results." It would be tedious to multiply quotations all repeating the same testimony. I would only remark, that this arithmetical deficiency in girls' schools does not appear to be owing to any natural inaptitude, for where the teaching was good, the girls proved themselves equal and even superior to the boys.

Physical science has a place in girls' schools, but Mr. Bompas found it only "a subject for lectures." Mr. Giffard reports it "as read only from text-books;" and Mr. Fitch says that "it is nowhere taught systematically, and that it is commonly unintelligible." After mentioning that astronomy and the use of the globes, by some curious law, seem to be recognised as constituting the one department of science specially interesting to girls, he adds, "few things are sadder than to find how the sublimest of all physical sciences is vulgarised in ladies' schools."

Modern languages and music, to which, according to Mr. Fitch, one-third of a girl's school life is devoted, fare little better.

"In fashionable schools," says Mr. Bryce, "girls of good abilities, when they leave school at 17, can usually translate an ordinary author with some facility, and turn an easy phrase of English into French, which, if neither idiomatic nor accurate, is at least intelligible." . . . . "It is quite exceptional to find them able to do more than this, that is to say, to write a theme in French, or to show such a familiarity with words and phrases as would enable them to keep up a conversation for ten minutes."

Mr. Fearon says:—"Young ladies of 16 or 18, whose parents were paying from £100 to £150 a year for their education, were found ignorant of the inflections of the most common irregular verbs, and unable to turn a simple sentence into French without blunders."

The specimens given are almost incredible, and, for that reason, I should have been glad to quote them verbatim, but must refrain from want of time. Two of the assistant-commissioners class French with arithmetic as the weak points in the school teaching of girls, a result not a little astonishing, considering that it is one of the two subjects (music being the other) which are considered by parents all-important in a girl's education.

But though such stress is laid upon music, though commissioner after commissioner complains of the manner in which it interferes with other studies by the time it requires, and with the discipline of a school by the impossibility of teaching it in class, music is apparently no better taught, as a rule, than French.

Mr. Bryce says he was assured that the common way of teaching it was not "only unscientific but irrational and wasteful." The same opinion is given by other inspectors, yet Mr. Bryce adds:—"At present music occupies pretty nearly as much of a girl's life as classics do of a boy's."

Drawing, of course, is taught with an equal disregard to thoroughness, to scientific principles, and to the cultivation of artistic feeling and taste, and it has, besides, this disadvantage, that the common practice of masters in touching up their pupils' performances for exhibition at home fosters a habit of dishonesty, and that too prevalent tendency running through the whole of female education, the tendency to care more for appearance than reality, to seem rather than to be. I will now give you some of the general results of their inspection of girls' schools expressed by the different assistant-commissioners.

"It is no exaggeration to say," states Mr. Fitch, "that in the mass of girls' schools the intellectual aims are very low, and the attainments lower than the aims. The course of instruction is very narrow. It leaves many of the pupils' best faculties unused. . . If the reproach be just that women do not reason accurately, and that their knowledge, even when they possess it, is deficient in organic unity, in coherence, and in depth, there is no need to look for any recondite explanation of the fact. The state of the schools in which they are educated sufficiently explains it."

Mr. Stanton says:—"The ignorance in many of these lower and middle class schools was most profound, and I cannot but remember that I probably only saw the better specimens."

Mr. Gifford sums up the impressions he derived from his visits to girls' schools thus:—"That the mental training of the best girls' schools is unmistakably inferior to that of the best boys' schools; and the great and obvious feature of all girls' schools, except those of the very humblest, is the enormous preponderance given to accomplishments."

I might multiply these extracts to any extent, but, my time being limited, I will add only a few passages from the reports of Mr. Fearon and Mr. Gifford, whose districts, embracing London and its neighbourhood, and Surrey and Sussex, contained the highest grade girls' schools in the country. Mr. Fearon concludes, as regards schools of the first grade:—(1.) "The provision in London is most inadequate." (2.) "The cost of education is very high." (3.) "The buildings and premises of almost all these schools, whether day or boarding, is most unsatisfactory." "Except Queen's and Bedford Colleges, where gentlemen are employed in teaching, and at a very few private schools whose principals have determined to make a stand against the frivolous character of girls' education, the quality of the visiting teachers of language and science is very inferior in girls' schools of the first grade." Further on, after stating that he thought it advisable to pitch his standard in judging of the elementary work in secondary girls' schools not quite so high as he had been used to pitch it in reporting on elementary girls' schools, he says:—"I have no record of any class of girls about twelve years old, in any first grade school that I examined, reaching the standard of *good*."

I will complete this picture of the state of women's education by some extracts from the evidence given before the Schools Enquiry Commissioners. Mr. Sargant stated in his evidence—"That the education of girls in Birmingham, of what he terms the middle class, is disgracefully bad; that they are very much worse educated than their brothers—very much worse than those who go to any school under Her Majesty's Inspectors."

Mr. Roche, whose classes in Cadogan-gardens have been attended for years by girls of the higher classes, says—"The defects which I have observed in my pupils, as the result of their previous education, are, a want of grammatical knowledge, even in English, and an indistinct pronunciation of the mother-tongue. Everything is done by memory, with abominable books of exercises and keys for grammar, of questions and dry answers for history, geography, and astronomy. There is very little development of intellectual faculties."

Miss Emily Davies, now a member of the London School Board, and well known as having devoted herself to the cause of female education, says:—"I have come across the best school-mistresses. They always speak a great deal of the bad preparation of the girls who come to them. They say they are perfectly ignorant. Their ignorance is unfathomable."

Miss Beale, the editor of these reports, states of female education in the class of life to which her pupils belong, *i.e.*, of independent gentlemen and professional men, that "it is defective in an extraordinary degree. That it is worse than that received by persons of a much humbler condition at the national schools; and, in a note to page 198, she says:—"Some, who produced papers almost inconceivably bad, have, to my knowledge, spent many years at school. . . . . Evidence is afforded that there are expensive schools where pupils who have naturally fair abilities may remain for years without obtaining the rudiments of education. . . . . I mean, leave them incapable of writing, spelling, or composing fairly in their own langage; almost ignorant of French grammar, and scarcely able to work the simplest sum correctly."

Miss Wolstenholme, herself the mistress of a young ladies' school, says "that from what she hears, she should imagine that, in spite of external accomplishments, the girls of the middle-class really are not very much better educated than girls of the same age in the National Schools. They have external accomplishments, but no solid information."

Miss Buss, the principal of the North London Collegiate School for Girls, which she has raised to an endowed school by investing in trust for its benefit the earnings of her 20 years' work there, says, in answer to the question whether she thought that the girls who came there from the preparatory schools were in a better or worse state of instruction than boys similarly circumstanced, "I do not know about the boys, I know that the girls could not be worse prepared than they are."

Some tables which have been furnished to me by the head of a large secondary day-school, attended by daughters of tradesmen, clerks, and a few of independent means, give the following results of entrance examinations:—Of 26 girls, whose ages averaged 12½, the number of faults in an easy English dictation of ten lines were about nine to each girl. Out of ten questions in easy arithmetic given to each girl, there was an average of nine incorrect answers. The reading generally was bad. One pupil, not reckoned among the above, who was entered as the daughter of a gentlewoman, could not do anything. She had not been to school, and implied she had not learnt anything.

Mr. Carleton Tufnell, in answer to my request that he would give me the results of his experience, wrote me a letter, of which the following are extracts:—"Every teacher appointed to a school under the Poor-law Board must undergo an examination, and in this way I have come to know the sort of education which many of the women who apply for these situations have received. The examination is extremely slight. . . . . The questions are not at all more difficult than could be readily answered by any pupil in the first class of an ordinary village school. A first class in a really good village school would go far beyond them. . . . . The papers are sometimes so bad that we are only justified in passing the writers at all by the consideration that if we do not accept them we should get no candidates for the places at all. The candidates are always respectable women of the middle-class, and have sometimes been governesses in private families, yet their writing is often hardly intelligible, and deformed with such mistakes in spelling as would pluck them in any examination for the lowest Civil Service examination. Their Biblical knowledge is excessively meagre, and their arithmetic worst of all, generally not going further than the simple rules, and if they try a sum in multiplication of money, the working commonly shows fatal blunders. Sometimes, seeing that candidates know nothing of these elementary branches of education, I have asked what they do know, and what they have been accustomed to teach in private families. The answer is crochet, the piano, French, Italian. Of course, it is obvious that their knowledge of all these subjects must be extremely limited."

The evidence I have given applies mainly to the middle-class in its three strata, lower, middle, and upper; but I have reason to believe that in the higher classes, the gentry and aristocracy, who are mostly educated at home, although the instruction given may be better, and the standard of information somewhat higher, there is just as little systematic training of the intellectual powers, of reason and imagination, just as little appreciation of knowledge, of the higher forms of literature, or of real excellence in the pursuit of any art.

It should be noted that the education given to girls, the results of which I have just laid before you, is exceedingly expensive; the Commissioners in their general report, state that the cost of girls' schooling, where it varies from that of boys of the same class, varies on the side of more expense. Mr. Bryce says "that the charges in first-rate schools in Manchester seem moderate compared with those of the most fashionable London or Brighton schools, but they make a girl's education nearly twice as expensive as that far more solid and practically useful education which a boy receives." So that the practical British parent not only procures for his daughter a very bad article but pays very highly for it.

It would be gross unfairness to lay the blame of the miserably low standard of education given in girls' schools upon the mistresses. The number of proprietary or endowed schools for girls is very small. The immense majority are private schools, kept by ladies who must live by them, who cannot afford to refuse pupils on the ground of their insufficient preparation, and who must supply the kind of education the pupils' parents are willing to pay for. As Miss Buss says, in her evidence given before the Commissioners, "it is so entirely a matter of necessity for the mistress to live, that she is obliged to allow the children to do as they like, and the parents too." Miss Davies, after saying that many of those she had had to do with were intelligent and conscientious, added:—"They complain very much of their difficulties, and explained their difficulties to be that they have had very imperfect training themselves, and they are hampered by want of money. Very often, too, they are at the mercy of very ignorant parents."

This is the root of the whole matter; there is no demand for a better education for girls. "Although the world has existed several thousand years," says Mr. Bryce, "the notion that women have minds as cultivable and as well worth cultivating as men's minds is still regarded by the ordinary British parent as an offensive, not to say a revolutionary, paradox." The same commissioner says, "that he lost no opportunity of inquiring from schoolmistresses their experience in this matter. Their answer was invariably the same. Mothers are acutely sensitive to anything which may affect their daughter's social success, whether it be the 'selectness' of the school or its situation, or the fame of the music and dancing masters. They are profoundly indifferent to their diligence (as a moral quality), or to their progress in the more solid branches of an English education. If a girl begins to get interested in the school work, and is seen in the evening busy over her theme, her mother comes to me and says, 'Now, Miss, you must not make Augusta a blue.'"

It would be tedious, even if I had time, to repeat the opinion of each inspector. Suffice it to say that their testimony, and that of the ladies examined before the commissioners, is unanimous upon the point that the indifference of parents to the education of their daughters, beyond the conventional standard of the society they live in, and the accomplishments which may promote their success in it, is the real stumbling-block in the way of any improvement. This holds good even in the class who receive their education in the national schools.* If we seek for the cause of this indifference, we shall find it in that fatal view of education which regards only its money value, and estimates it solely as a means of "getting on." "The knowledge which will pay in the business or pursuits a lad is likely to enter is fully appreciated by the parents," says Mr. Fitch; "but the only business of life which they contemplate for their daughters is marriage, and they ask for an education which will fit her for this end. And the accomplishments which they value are those which promise rather to increase her attractiveness before marriage than her happiness or usefulness after that event." I could quote passage after passage to the same effect from these reports, and from every writer on female education, and I appeal to the experience of everyone present to confirm the accuracy of the statement. There is a pretty theory abroad, which is always brought forward when women's education is talked about, *i.e*, that they are educated to be wives and mothers. I do not know a more fallacious one. They are *not* educated to be wives, but to get husbands. They are *not* educated to be mothers; if they were, they would require and obtain the highest education that could be given, in order to fit them for the highest duties a human being can perform. They are *not* educated to be the mistresses of households; if they were, their judgment would be as sedulously trained, habits of method and accuracy as carefully formed, as they are now neglected. They would not give, as Mr. Bryce calculates, 5,520 hours of their school life to music against 640 to arithmetic; and social and political economy, which are scarcely thought of in their course of instruction now, would take the foremost place in it. What they are educated for is to come up to a certain conventional standard accepted in the class to which they belong, to adorn (if they can) the best parlour or the drawing-room, as it may be, to gratify a mother's vanity, to amuse a father's leisure hours, above all, to get married. And here I must mention the cruel result of this fixed idea in men's minds that their daughters are to be provided for by marriage. No other provision is made for them, nor are they trained or allowed to provide for themselves. From the highest ranks of the aristocracy down to the lowest stratum of the middle-class, the rule, which is best proved by the few exceptions to it, is that no adequate provision, if any, is made for daughters. £5,000, which invested in Consols would produce £150 per annum, is the ordinary fortune of a peer's or country gentleman's daughter, who has been bred up from her cradle in the lap of luxury. A solicitor in large practice told a friend of mine that he had constantly reason, in drawing up wills and settlements for rich and aristocratic clients, to ask the question, "Do you intend your daughters to live in lodgings with one servant?" Among the poorer gentry and the professional classes, no provision at all is or can be made for daughters, and the only thing which might be done for them, *i.e.*, to train them by education and habits to provide for themselves, is not done or even thought of. They are brought up to think it a degradation to gentlewomen to work for their bread, and when the time comes, as it too surely must come to large numbers, when they can get no bread but what they work for, they find themselves as utterly unfitted for the work as they were taught to believe the work was unfitted for them. The only occupation open to them is the very one for which they are least prepared, *i.e.*, that of a governess, which, for that reason, is overstocked with incompetent people; and even that involves some loss of caste. We hear much of the sanctity of marriage, of the happiness of domestic life. Is it the best way to preserve them to make the worldly and pecuniary motives for entering upon marriage so strong as to overpower all others? If the girl who sells herself for the comforts or luxuries of life turns out a wife who thinks more of the things she bargained for than the duties she accepted in return, they, at least, have no right to throw a stone at her whose customs reduce her to the alternative of marrying for a provision, or leading a life of poverty, so dull, so narrow, so colourless, so exiled from all she has been taught to value, that only the highest strain of moral courage is equal to accepting it voluntarily. It is easy to laugh at old maids, it is easy to praise them as the sisters of mercy of life, it is not easy to measure the amount of silent suffering, of slow wasting away of hope, of energy, of faculty, as the woman sees her youth passing away, the boundless horizon of earlier years narrowing more and more, middle age finding her as helplessly dependent in her father's house, as unable to gratify a single taste, to follow a single pursuit, which does not chime in with his fancies, as she was at 18, or left alone to struggle, untrained and unarmed, in the fierce battle of life for the very means of living. In the last report of the Society for the Employment of Women, it is stated that, according to the census of 1861, there were upwards of three millions of Englishwomen maintaining themselves by their own exertions, a number on which the census of 1871 will probably rather show an increase than a diminution; and allowing that a large per-centage of these belong to the wage-earning classes, there still remains a great proportion who belong to the classes above these. Difficult as it is to find remunerative employment for the daughters of barristers, lawyers, clergymen, and naval and military officers, it is even more difficult to find women in that class fit to do the work when found.

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* See Report of Committee of Council on Education for 1869-70. Mr. Alington's report, page 28.

Miss King, the secretary to the society, writes to me:—"I cannot state too strongly my conviction of the necessity of more systematic and methodical training for girls. . . . . By far the greater number of those who apply to me for work are over 25 years of age. Many have never held any responsible position at home or elsewhere, nor have had training for anything at all. The saddest cases we have to deal with are those of widows or deserted wives, who are left, with children dependent on them, utterly unprovided for." It may be seen from the last sentence that marriage is not always the provision it is supposed to be.

But it is not even on such grounds as these I ask for a higher education for women. I claim it, as the Bishop of Peterborough did the other day at the meeting for Hitchin College, on the ground that they are human beings. I wish it were as certain as the bishop held it to be, that however men might differ about other points, on this, that women are human beings, there could be no difference of opinion. I am afraid that, on the contrary, there is a very widely diffused belief, especially among average men, that women belong to a different species. If, indeed, the fact were seen and recognised that women are human beings, with precisely the same kind of faculties, affections, desires, wants as men, though there may be variations in degree, that their minds are governed by the same laws, and their characters susceptible of being moulded by the same influences, a great many obstacles in the way of their improvement would be at once removed. There would no longer be any need to consider what education was necessary for women, but, having ascertained what education is best for human beings, to develop them to the full measure of the stature of perfect humanity, it would follow that the same education that is best for men is best for women also. The only special function allotted by nature to women is motherhood; but, as Miss Davies says in her excellent little book, "Higher Education of Women," the education which produced the best wives and mothers, is likely to be the best possible education. . . . . Having made this admission, it is necessary to point out that an education of which the aim is thus limited is likely to fail in that aim;" and she goes on to show this by transferring the case to the education of men, "an education which produces the best husbands and fathers is likely to be in all respects the best, because the best man in any capacity must be the man who can measure most accurately the proportion of all his duties and claims, giving to each its due share of his time and energy. A man will not be the better husband and father for neglecting his obligations as a citizen, or as a man of business; nor will a woman be the better wife or mother through ignorance or disregard of other responsibilities." Let men and women, then, be educated as human beings. But let me guard here against the fatal confusion, so common in this country, between education and instruction or preparation for the special profession or work of life. It is owing to this confusion we hear of elementary education, consisting of the "three R's," of the necessity of technical education superseding classical, &c., &c., of women, or of the working classes being enough educated already, and being thus unfitted for the duties of their position.

But the true meaning of the word education is not instruction, technical or otherwise. It is intellectual, moral, and physical development, the development of a sound mind in a sound body, the training of reason to form just judgments, the discipline of the will and the affections to obey the supreme law of duty, the kindling and strengthening of the love of knowledge, of beauty, of goodness, till they become governing motives of action. This alone is truly education, to be begun in the first twenty years of life, to be carried on through time, and as I trust, through eternity; and this is the education which should be given, or at any rate aimed at, in the case of every human being. Once accept this view of education, and there is an end of all the distracting talk about this education being good for a man, that for a woman, this for working men, that for tradesmen or professional men, or men of fortune. The technical education may be different for all these, but the education of reason, and conscience, and will, and affections, must be the same for all; and the test to be applied to every proposed system will be this:—Does it tend to form a sound judgment, an enlightened conscience, a disciplined will, a heart loving whatever things are true, honest, just, pure, and lovely?

It would seem scarcely necessary that I should dwell on the social and national importance of the education of women, but the neglect of it would not be so general if that importance were fully recognised. If it be an indisputable axiom that as is the mother so will be the home training, and as is the home training so, in the vast majority of cases, will be the tone of mind and habits which the children take out with them into the world as men and women, then the opinion of Mr. Hare, quoted in the General Report of the Schools Inquiry Commission, to the effect that "an educated mother is of even more importance to the family than an educated father," is fully justified. I could quote passage after passage from these reports, shewing that it is to a higher tone of mind, a wider and more refined culture among the women of the middle class, that we must look to rescue the men from the narrowness of mind, the vulgarity, the absorption of energy and intelligence in money making alone, which threatens to lower the tone of national character, and to make us really what the First Napoleon accused us of being, "a nation of shopkeepers." In the higher classes, if, as doubtless is the case, the preference of idle and frivolous men for idle and frivolous women tends to keep down the tone of women's education, it is equally certain that the women re-act on the men, and the latter will do well to remember Mr. Stuart Mill's eloquent warning to them, that, in the present state of society, if they will not raise women to their level, the women will infallibly drag them down to theirs. Let me, finally, quote the testimony of a man of another country and another form of faith, Monseigneur Dupanloup, Bishop of Orleans, who, some years ago, struck with the evils arising from the deficient education of his countrywomen, wrote a little book entitled "Les Femmes Studieuses." In that book, after having shown what the education of Christian women, destined to be the companions and helpmates of men in earthly as in heavenly things, ought to be, he proceeds to describe what it is, and paints a picture of women's ignorance, idleness, and frivolity; of their corrupting influence on society, on their husbands, and their homes, not through vice, but through their narrowmindedness, their incapacity to comprehend any higher aims or feel any large sympathy, their intolerance of any life less idle than their own, which would be painful to read at any time, but is terribly painful now, when read by the light of the last year's events. When that book was written, France stood foremost among the nations, to all appearance great, strong, skilled in all the arts of peace and war. What is she now? In the hour of trial everything failed her—her manhood, her genius, above all, her long boasted military organisation; and when civil war broke out to complete the ruin begun by foreign invasion, the upper and middle classes in Paris, armed and organised though they were, made but one senseless attempt to meet the insurgents, and then fled from the city,—from the homes they should have defended,—or silently submitted to the tyranny of the minority they hated and despised. Looking back to the history of French society for many generations, as painted both in the lighter and more serious literature of France, I hold it not too much to say that one and not the least powerful cause which led to a national collapse, so unprecedented in its swiftness and completeness, may be found in the lowering influence incessantly exercised by the women on the men. What high sense of duty,—that salt of society without which it grows corrupt and worthless,—what noble ideal of patriotism and self-sacrifice, what comprehension even of the issues at stake, could be expected from the sons of such mothers, the husbands of such wives, as are pourtrayed with the intimate knowledge of a father confessor and a man of the world by Bishop Dupanloup?

I think I have now made good my assertions respecting the low state of women's education in this country. I turn now to the means of raising it from this condition, and to the main object which I had in view in bringing the subject before you, *i.e.*, the hope that this Society, which has already done so much for education, will take the matter up, and lend its powerful aid to the scheme I have to propose. There is, fortunately, almost complete unanimity of opinion amongst those who have most fully considered the subject, as to the remedies required. They are:—

1. The creation of a sounder public opinion respecting the need and obligation of educating women.
2. The re-distribution of educational endowments, so as to give a fair share of them to girls.
3. The improvement of the female teachers by their examination and registration according to fixed standards.

Allow me to say a few words on each of these points, and, first, as to the creation of a louder public opinion respecting the education of girls.

I have already laid before you a mass of evidence to prove that the great hindrance to improvement in girls' education is the total indifference to it of parents; an indifference bred by the tone of society which neither requires nor values in women the results of a good education; and the more than indifference, the very common dislike among men, young men especially, to a high standard of education for women. So long as parents look to marriage as the one provision for their daughters, the *summum bonum* to be obtained for them, so long will woman's education be adapted solely to please what are called marrying men. No woman can be more convinced than I am that a happy marriage is the *summum bonum* of a woman's life, but so it seems to me it is equally of a man's, and surely to the woman as the man it should not be an object to be striven for, but received as the supreme grace of fate when the right time and the right person come.

The reform of public opinion on this point would ensure every other reform. If ever it be possible to make cultivation, knowledge, and serious work the fashion for women, the battle would be virtually won. I remember at the time when all the feminine world walked in gigantic crinolines, that an examination of a National girls' school, in a somewhat remote country district, showed 40 of the girls to have crinolines and only one a pocket-handkerchief. That is about the proportion now between the girls who have a smattering of accomplishments and those who are really educated. Is it too Utopian to hope that a day may come when the proportion shall be reversed, and when it will be considered as disgraceful for a woman to be without preparation for the serious work of life as it would be now for any one above the gutter to be without a pocket-handkerchief.

With regard to the second remedy, the extension of endowments to girls, opinion is equally unanimous among all the authorities I have consulted. The necessity of institutions for girls, holding the same place in their education, as grammar schools, public schools, and the universities do in that of boys, is strongly insisted upon by the assistant commissioners in these reports.

Mr. Green says:—"The education of boys in England has only been saved from the abyss of triviality and vulgarity by the application, however clumsy, of endowments. For girls the same salvation can only be obtained in the same way." And Mr. Bryce places first among the remedies from the application of which an improvement in the education of girls may be hoped for, the establishment of schools for girls under public authority and supervision. Hitherto, however, the claims of girls have been almost entirely disregarded; the Schools Inquiry Commissioners state that it is evident that the endowments for the secondary education of girls bear but an infinitesimal proportion to the similar endowments for boys. They go on to say, "It is certainly a singular fact, and one not by any means admitting of easy explanation, that, with these few exceptions, no part of the large funds arising from endowments, and applicable to educational objects for the upper and middle classes, is now, or has been for a long time past, devoted to so important a purpose as the education of girls and young women." The fact seems scarcely so singular to women, to whom the difficulty of obtaining funds for any scheme destined to benefit them is but too familiar. The same difficulty of obtaining money for the better education of women stands in the way of the Hitchin College, the only institution yet offering to women the greatly needed and greatly desired advantages of a university education, and also of the North London Collegiate Schools, founded by the public spirit and self-sacrificing generosity of the principal, Miss Buss, whose noble act in endowing the schools has met with no adequate response. "It is a noteworthy fact," says Mr. Fitch, in a note appended to his report, "that in the City of London a new trust fund, of more than £60,000, has just been created for improving the education of boys, notwithstanding the existence of enormous unused endowments for precisely the same purpose. No part of this is available for girls. Merchants and bankers subscribe freely; even a joint-stock company contributes £1,000, on the express ground that a better race of clerks and "commercial" men is wanted to do the work of the City. But for those who are to be the wives of these men, whose influence will determine the characters which they form, and the lives they lead, no provision is even contemplated."

The last of these words are no longer true. Mr. Rogers is contemplating making a provision for the middle class girls of London; but as I understand that he can only get shillings for the girls where he got pounds for the boys, and has been unable yet to raise for them one-twentieth of the sum which was subscribed at once for their brothers, the scheme has not yet been carried into effect.

It is some comfort to find this matter thus strongly summed up in the Commissioners' Report:—"We conceive that, even were the bearing of the old deeds far more manifest than it is, the exclusion of girls from the benefit of educational endowments would be in the highest degree inexpedient and unjust; and we cannot believe that, in any comprehensive adjustment of these great questions, it will be defended or maintained."

It is cheering also to find that there is a disposition among the more enlightened of the community, including the Endowed Schools Commissioners themselves, to redress this grievance. Lord Lyttleton, in his speech at the Hitchin College meeting, invited pressure from without, as being the best help that could be given to the Commissioners towards carrying into practical effect their good intentions in this respect. It is such a pressure that I hope to see exercised by the Educational League I want your help to form; a pressure, which, I trust, will not be relaxed till we have obtained for girls as well as boys Professor Huxley's ladder from the gutter to the Universities, the steps of the ladder being precisely the same for both. There is much and very weighty evidence to show that it would be an advantage to both sexes, morally and intellectually, as well as an immense saving of money and teaching power, that they should climb it together from the infant school to college inclusive, learning by this common work for common aims to recognise their common human nature, to complement what in each is deficient, and thus to become the true helpmates which God created them to be. The time, however, may not be ripe for this yet. More experience of the working of mixed education may be required before any decisive steps can be taken towards promoting it. But the question of giving to girls their fair share of endowments is ripe for decision, and not a moment should be lost in bringing to bear upon it the utmost available force.

The third remedy I would urge will perhaps meet with readier acceptance than the former, *i.e.*, a system for the examination and registration of teachers according to fixed standards, which should create a body of teachers for secondary schools analogous to the certificated mistresses of elementary schools. I have not time to place before you the evidence I have collected from this book and other sources respecting the miserable incompetency of women teachers as a class, and it appears to me that the results of the teaching in girls' schools, as exhibited in these reports, are sufficient to establish the fact. Here, again, the larger portion of the blame should be laid on the system, not on the individuals. So long as public opinion decrees that the only genteel occupation for women shall be that of a governess, while it decrees also that it is ungenteel to take it up as a profession and prepare for it by thorough training, so long will its ranks be overcrowded with utterly incompetent persons, and the social status and emoluments of female teachers remain at their present low ebb. But with the growing demand for a better education for women there must be necessarily a growing demand for better teachers, and for some means of distinguishing the competent from the incompetent. This would be secured by the registration of teachers according to qualifications, tested either by the local examinations of the Universities or by the College of Preceptors, whose examinations are open to female as to male teachers, or by any other body duly appointed for the purpose. An association has been formed in London to carry this out, as far as practicable, by private enterprise. It may be that public opinion is not prepared to follow in this country to its full extent the system of Prussia, where no person can teach anything professionally without a certificate of competency from the authorities established under government for that purpose, but the nearer approach that can be made to it, by enlightening the public mind on the necessity of requiring some test of teaching capabilities, and by inducing those who intend to teach to qualify themselves to pass such a test, the better chance there will be of weeding out the present incompetent race of governesses, and replacing them by others trained to their work.

In this, as in the other directions I have indicated, much has been and is being done by associations both in

London as also in the provinces, especially the north and west of England. The University Local Examinations have done much to raise the quality of female education, by giving schools and teachers a standard to work up to. The Hitchin College carries the standard up to the point of a Cambridge degree. The courses of lectures for women provided in London and in the North of England, though they are, as Mr. Fitch said the other day, to be looked upon rather as stimulants than food, and can by no means take the place of thorough teaching, have stirred up an interest and created a desire for knowledge unknown before. Good and zealous work is going on, and beginning to bear fruit. But these efforts are little known or felt by the general public, and what I believe is still wanted, is some general organisation that should draw into union and co-operation all these separate movements, and give to them the strength which belongs to combined and systematic action.

This, then, is the scheme to which I trust this Society will lend its aid, *i.e.*, to form an Educational League, embracing all those who are actively interested in the cause, and having for its object to carry what I may call the three points of the educational charter of women:—

1. The equal right of women to the education recognised as the best for human beings.

2. The equal right of women to a share in the existing educational endowments of the country, and to be considered, no less than boys, in the creation of any new endowments.

3. The registration of teachers, with such other measures as may raise teaching to a profession as honourable and honoured for women as for men.

Such a League might be represented in London by a central committee, connected with local committees formed in every considerable country town. By common action from all these different centres, a body of evidence might be collected on every point connected with the better education of women of all classes, which would be of invaluable service in guiding the action both of school boards, and of the Endowed Schools Commissioners, as of all other bodies and individuals concerned in the education of girls; and by means of lectures, meetings, journalism, and social influence, an agitation might be set on foot and kept up active enough and penetrating enough to reach even the subsoil of the British mind, and to force upon it, not only the recognition of the fact which it now, according to Mr. Bryce, holds to be an obnoxious and revolutionary paradox, "That the minds of women are as cultivable, and as well worth cultivating as those of men," but that it is of vital national importance that the minds of those who now exercise an enormous indirect influence, and will, in all probability, soon exercise a large direct influence, on the destinies of the nation, should be cultivated to the full measure of their capabilities.

Since I first conceived this scheme, I have received assurances of sympathy and co-operation from many who may be considered as representative men and women, and whose names would be a sufficient pledge to the public for the character of the undertaking. I believe that I could have obtained many more if I had not been so heavily pressed for time; and I have no doubt that, should such a league as I have proposed be formed, it will soon number among its members most of those whose co-operation would be of any value.

I now leave the matter in your hands, and have only to thank you very earnestly for giving me this opportunity of laying it before you.

DISCUSSION.

Mr. G. C. T. Bartley said he fully agreed—having made the subject of education his occupation for a long time—with nearly everything said in the paper concerning the deficiency of the education given in girls' schools. He would give an instance of a case which came under his own notice. A little girl, who went to a superior kind of school, was repeating her lessons, and her father caught up the last expression, "Derby, on the Derwent," repeated several times. He found that Derby was on the Derwent; but, on asking her "What is Derby?" "Oh," said the little girl, "that is not in my lesson." "What is the Derwent?" said the father. "Oh, I was not taught that," said the child; and there was this little girl positively learning a string of names in that way, without knowing that Derby was a town and that the Derwent was a river. Mrs. Grey's remarks as to the difference between education and instruction was most admirable. People did not all appreciate that difference, he was sorry to say, and he might sum up the evils of female education in this country by saying that girls were never educated, but were only attempted to be instructed. He did not agree with Mrs. Grey, however, on the question of endowments, and thought that the middle and upper classes of this country need not trouble themselves at all about that part of the subject, being quite competent to look after their own children's education. With regard to the scheme of sending girls to universities, he did not think it at all necessary or advisable. He considered that the real education of a girl commenced when she left school. The work at school should be such that she ought then to be able to begin her own education; but generally she was as ignorant of how to set about her own education when she left as when she first went. Girls had more leisure than boys, and they should then begin to educate themselves at home.

Mr. Elliott said the subject had been perseveringly discussed for three-quarters of a century, but for all that there was very great misunderstanding of the real meaning of the word education. He was happy to say, however, that he concurred in nearly everything said by Mrs. Grey, whose mode of delivery and accurate pronounciation of her mother tongue were superior to the great majority of speakers, either male or female. In his opinion, the training of boys and girls ought to be entirely different, having to pursue two distinct paths in life; and there was as much difference between the brain organisation of a woman and that of a man as between silver and iron. Schools were desirable for boys, no doubt, because the chief function and business of the male animal was performed out of doors, and consisted in the acquisition of wealth, while that of a woman was quite different; and he believed it would be much better for girls not to go to school if it could be avoided. School was only desirable for girls in as far as they could not get the requisite training in any other way, but the proper place for the training of a girl was at home—at her mother's apron-strings, where she would learn those honourable household duties which belonged to her. The business of a man was to produce or collect wealth, while that of a woman was to look after its proper distribution, and her education ought to teach her how to economise and make the most of her income. If there were any accuracy in the statement that the average provision of ladies, even in the higher grades, was £150 a year, that of itself was sufficient proof of the necessity for teaching girls domestic economy, for that of the sternest kind would have to be exercised in order to obtain any of the comforts of life from such an income. A woman ought to be taught how to perform what he might call her professional duties at home, as well as her father, brother, or husband did his professional duties abroad. A school was well fitted to teach boys, but home training only could impart the requisite knowledge to the female sex. Some people thought that women had the same intellectual faculties as men, and that if they had the same education they would make the same progress in Greek, astronomy, and so forth. But the great mass of mankind had but an average amount of intellect, and no amount of cramming or forcing would increase it. It would be well, therefore, for people to relieve their minds of the idea of colleges, &c., for women, for this so-called higher education would only unfit them for their domestic duties. As French female education had been referred to, he would recommend any one who was interested in that branch of the subject to procure a little book by M. Souvestre, entitled, "Sous les genoux de l'Eglise," which treated it very ably, and of which he believed an English translation had been published.

Madame Roniger said she thought that persons were rather too much in the habit of casting reflections upon governesses and teachers, but she must say that, as far as her experience went, the parents were also in fault, for they did not work in concert with the heads of schools; and until teachers and governesses were more strongly supported by parents, there would always be a great deal to be wished for. If young ladies could be made to care less for parties and balls, and more for mental improvement, the governesses and schoolmistresses would be able to do better; but still they had a hard part to play, and it was not fair to lay all the shortcomings of their pupils to their charge. As to the advisability of young ladies devoting themselves to science, and to those paths of life which men had generally kept to themselves, that had not yet been tried. With regard to ladies studying medicine, Dr. Priestley had said that he could form no opinion as to the results of such an experiment, but had determined not to place any obstacle in the way, and he thought it was, at all events, well worthy of a fair trial. That, she thought, was a very manly, generous, and fair way of looking at the subject, and much better than throwing every difficulty in the way of women getting their own living, and perhaps assisting their families.

Miss Faithfull thought that Mr. Elliott differed from Mrs. Grey more in the mode of expression than in the matter itself, for, listening to the paper, it appeared to her that it by no means neglected the daily duties of women, but rather pressed forward, as all those who honestly advocated this movement would, the higher education of women, in order that they might best perform those domestic duties and motherly duties, which were the highest that could fall to their lot. She maintained those duties were performed best by the most intellectual women, and this had been her experience; she always found they were more successfully performed by intellectual women than by those who had less brains, and who cared less for intellectual pursuits. She thought Mrs. Grey, however, took a somewhat gloomy view of the present state of female education, in fact somewhat similar to that taken by the late Mr. Buckle, when he complained "of that system in which important things were carefully kept from them, and trivial things were carefully taught them, until their naturally nimble minds were irretrievably injured, and their good sense inevitably destroyed." Still the extracts which she had presented from the reports showed a very great deficiency in female education at the present time. It was quite true that the schools set up in London, Cheltenham, and elsewhere, together with the admission of women to the local university examinations, had done much for the cause of female education for the last few years, but they were only steps in the right direction, and their influence was necessarily limited. Mrs. Grey struck the right key-note in speaking of the registration of teachers. This was a subject which was peculiarly brought home to her, having an office for the employment of women, where she was constantly meeting with applicants of all ages, from 25 to 45, who came to her, saying that they were thrown upon their own resources, that they wanted to do something, that they had no particular bent, but thought they could teach. On being questioned, however, it appeared that they had no knowledge of teaching, and some did not even like it, but there was no other way open to them. It was, therefore, of the utmost importance that parents should require some certificate from the ladies to whom they entrusted their daughters, whether at home or at school, the same as they did with respect to their boys. This was the case on the Continent, and tended more than anything else to raise the status of teaching; and until such a system came into general use, the profession would be one to which incapacity would always appeal. It must not, however, be forgotten that good parents were wanted quite as much as good teachers. It was not at all right to blame mistresses of boarding schools altogether, because they were obliged to provide that teaching which was in demand. Mrs. Grey alluded to the North London Collegiate School, and as she did so, she (Miss Faithfull), remembering the large sum of £60,000 which Mr. Rogers had obtained for the Middle Class School for boys in a very short time, could not help thinking of Miss Buss and the noble enthusiasm which led her to convert her school into an endowed institution, so that it should be carried on regardless of her life, and that the modest demand she made of £1,000 was not even yet responded to. There was an old story, which she had often heard her father repeat with regard to sympathy, and persons being asked how much they would sympathise, and this she thought was very applicable to the present case. Many persons would say, when asked to join a league, they did not know how it would work, and had not confidence in its conductors, but she would take upon herself to say that, with such a school as the North London Collegiate School, it was one beyond all question. Out of 120 pupils sent up to the local university examination, 89 passed, 28 with honours; and in the last examination one of Miss Buss' pupils gained the highest honour in the first school, and one the Taylor's Scholarship. There was a cheerful side, however, to this question, and one young lady who had passed the Cambridge local examination in London had been offered £150 per annum, although she was but nineteen years of age, proving, therefore, that intellectual training was appreciated. In conclusion, she believed no education was worthy of the name which did not look far more to the training of the faculties and the awakening of thought than to the teaching of any facts whatever, and that she believed was the kernel of Mrs. Grey's paper.

Mr. Soper could not allow the proceedings to close without protesting against the position taken up by Mr. Elliott, which seemed to be that the object of a man's life was to make money, and that of a woman to spend it. He seemed to think that education ought to fit men for the battle of life, but that women were to be free from any battle at all, except in the kitchen. He, however, had a notion—though it might be a strange one—of the progress of humanity, and that we were born to something higher than either getting or spending money; and to fit anyone for the higher duties of life, whether man or woman, it was necessary that the whole mental, intellectual, and moral faculties should be developed, and to that end should be directed, at any rate, the education of the early years of life, and special or technical education should come after. It was often impossible to say of every young person what he was best fitted for, and very often, after spending years, men had to begin their professional education all over again. The same thing might easily happen with girls, especially if they were so placed as to be required to get their own living. The best general education was that which developed all the intellectual and moral powers, and this ought to be the same for both sexes, for there was no generic difference in their powers. From some experience in teaching, he could say that he had found no difference between the intellectual powers of boys and girls, at least not more than between those of the same sex. He had had to deal with boys more stupid than any girls, and with girls as competent to receive the highest training as any boy. With regard to endowments, he did not think they were the best thing for either boys or girls. He should much prefer to see the nation take the whole system of education into its own hands, and establish a complete system from the lowest to the highest, which should be open and free to all.

Mr. William Hawes said he thought that the meeting had been somewhat led away by Mrs. Grey's eloquence and beauty of language, and were too much disposed to keep arguing in the old groove, instead of considering how best the means of female education could be improved. Mrs. Grey recommended that an Education League should be formed, in the first place on the principle that girls had as good a right to a high-class education as boys. But was that disputed? It appeared to him a truism. In his view, an education league was required, not so much to assert abstract principles, about which in these days—among thinking men at any rate—there was little difference of opinion, as to show to all ladies of middle age in the present time how they could best promote the proper education of their own sex, their own daughters especially. There seemed to be two things mainly required; first, the improvement of the teachers themselves, which would only be ensured by a system of certificates; and secondly, that all classes should unite in so employing and encouraging these teachers, that society would feel the benefit of improved female education. Mrs. Grey also spoke of the large endowment funds which existed all over the country, and claimed that a certain proportion should be appropriated to the education of the girls, and he was happy to say that he believed that process was going on more rapidly than was supposed. He knew of two instances, one in Monmouthshire, and the other in Shropshire, in which the trustees were now considering how large a proportion of the funds at their disposal should be devoted to the education of girls; but the stimulus was still wanting which a league would supply. A central body in London would be able to put before the country the advantages to be derived from acting on one uniform principle, and to prevent in a great measure endowments being wasted or misappropriated. There were great evils in many cases attached to endowments, and the action of a central authority to see that they were properly applied would be very beneficial. The Chairman had almost shown that endowments were unnecessary, for he had established one of the largest schools in London, which was nearly if not quite self-supporting; but having got them, they should be turned to the best possible account. He hoped, therefore, that the league would be established, and he had no doubt that the Society would do what they could to aid, for, having been many years a member of the Council, he might take upon himself to say there was no suggestion of the kind which was not heartily supported, at any rate to the extent of being brought before the public in such a way as that it might be thoroughly canvassed, and the best means suggested for carrying out the object which they all had in view.

Mr. William Ellis had much pleasure in moving a cordial vote of thanks to Mrs. Grey, and in doing so he could not but express his cordial concurrence in the principles she had laid down. One thing particularly struck him in the paper, and that was the necessity which was spoken of for good parents as well as good teachers. Now, it appeared to him that teachers could not do better than keep constantly before them the question—How can these children be trained so that when they leave the school they shall grow up to become the good parents we hope for? Of course, time must elapse before the full fruits of having a generation of good parents would be seen, but he knew of no speedier process for bringing about the improvement of mankind. To this end, the children must be taught what they had to do in order to become good parents; and there was no difficulty in that if it were approached in the right way. They would soon understand that, in order to be good parents, they must be industrious, skilful, intelligent, sober, trustworthy, economical, and that in order to acquire these good qualities they must begin when young. This ought to be the fundamental part of education, but in addition to that, children ought to grow up thinking beings. For his own part, he had no objection to seeing perfect unity in the teaching of the two sexes, and had never been able to trace any inferiority on the one side or the other; indeed, when prizes were offered at the City of London Institute for the best examination papers on a course of lectures delivered by Professor Huxley, the highest honours were carried off by a young lady. It might or might not happen that the Universities would be open to women, but if not, he would give the ladies this consolation, that he did not think thoughtfulness, which, after all, was the great desideratum, was very much cultivated at such establishments. He believed that some ladies he had known, who had never been to a university, had quite as much capacity of thought, though perhaps they were not quite so familiar with the differential calculus and some other matters, as any persons who had. It was no use to develop the moral faculties without intellectual training also. There was no use in pity, unless you could give bread to the hungry, and hospital accommodation and skilful attendance to the sick and afflicted, and these things were only to be attained by industry, skill, and economy. We enjoyed them to some extent, because our forefathers had a certain measure of these good qualities, and we had not enough of them, because there was too much idleness, ignorance, drunkenness, and dishonesty.

The Chairman, in tendering the vote of thanks to Mrs. Grey, said he could not quite agree with one statement she had put forward, viz., that there was no demand on the part of parents for a higher kind of education; on the contrary, there was a wide-spread dissatisfaction with the present state of things. Being anxious to establish a girls' school in connection with the Boys' Middle Class School in London, they sent round a paper to the parents of the boys—who numbered about 1,100—asking their opinion, and they received answers and promises that the girls should be sent, if the school were opened, from about 500. He regretted he had not brought any of the answers which had been received, but they were very remarkable, as showing how very unfortunate many of the parents had been in trying to obtain a good education for their girls. It was not quite true that where pounds were subscribed for the boys' school there was a difficulty in getting shillings for the girls, for he believed the necessary funds would be forthcoming, but the real difficulty was in finding a suitable site, and also in getting good teachers. It was felt that a girls' school must be placed in a different kind of locality to that which would do for a boys' school, but he was now in a position to say that he believed one had been chosen, and that before long the school would be open. He should be sorry for the idea to get abroad that gentlemen in London were not as anxious for the education of girls as of boys; it was not money which caused the delay, but a feeling of delicacy, and the desire that the thing should be done in a proper manner. In conclusion, he hoped that at the next school board elections they would have the advantage of Mrs. Grey's assistance.

Mrs. Grey said she desired to express her thanks for the attention with which she had been heard, and the kind manner in which her views had been received. She was very much pleased to find that she had been in error in supposing that there was a difficulty in raising the requisite funds for the girls' middle-class school in London, but the mistake was very natural, considering the difficulty which women always did find in raising money. With regard to endowments, she only desired to add one word. She by no means intended that girls should be depending on such assistance for their education, but simply that they should have the same advantages from them as the other sex; in other words, that schools of the highest standard of education should be established, to which the private schools of the country should look up, in the same way as private schools for boys looked up to the public schools and universities. She did not want to see girls educated by charity, but to see a high standard set up, and fellowships and exhibitions established, which would be an inducement to girls to carry on their education. That was a thing which was much wanted—that girls should have some object to work for after leaving school.

FOOD COMMITTEE.

The Committee met on Wednesday at 2 o'clock; present, Benjamin Shaw, Esq., in the chair, Messrs. Hyde Clarke, E. B. Savile, J. T. Warr, and J. Yool. Mr. E. Jenkins attended.

The Committee had before them, for comparison, specimens of tin meats sent from the Admiralty stores, supplied as follows:—

Melbourne Meat Preserving Company.—Boiled beef and boiled mutton.
Ramornie Company.
Ballarat Company.
Marshall and Company (Aberdeen).
Meat preserved in the Deptford Victualling Yard.

The Committee had before them a specimen of "compressed pea soup," stated to contain 20 per cent. of meat, and that one pound of the material will make 20 pints of good pea soup. It is also stated that it will keep good any length of time.

The Committee also had before them a specimen of preserved beef suet, stated to be so prepared as to keep sweet for any length of time.

Particulars of price and method of preservation of these two latter articles had not yet been supplied. Inquiries on these points were directed to be made.

A joint of meat preserved by Mr. Slaggett's process (a second specimen), roasted ribs of beef, was tasted by the Committee.

ANNOUNCEMENTS BY THE COUNCIL.

DRILL REVIEW.

The Council have the satisfaction of announcing that H.R.H. Prince Arthur has consented to review the boys from the district and other schools, in or near the metropolis, where drill forms part of the system of education. The review will take place in the Royal Horticultural Gardens at South Kensington, on Wednesday, the 14th of June.

A subscription fund has been set on foot to defray the expenses of the transit of the boys to and from the gardens, and some refreshment for them. Members are earnestly invited to contribute to this fund, and subscriptions to it may be sent to the Secretary of the Society of Arts, John-street, Adelphi.

CONFERENCE.

The Twentieth Annual Conference between the Council of the Society and the representatives of Institutions in Union, will take place at the Society's House, on Friday, the 16th June. The chair will be taken at 12 o'clock, by Lord Henry G. Lennox, M.P., Chairman of Council.

Secretaries of Institutions and Local Boards are requested to send, *immediately*, the names of the Representatives appointed to attend; and also to give notice of any subjects which Institutions or Local Boards may desire to have discussed at the Conference.

Secretaries of Institutions are requested to forward *at once*, by book post, copies of the last Annual Reports of their Institutions.

Representatives of Institutions and Local Boards attending the Conference are invited to the Society's Conversazione, at the South Kensington Museum, in the evening of the same day (16th June), and will receive cards on application at the Society's House on the day of the Conference.

CONVERSAZIONE.

The annual conversazione of the members will be held on the 16th June, at the South Kensington Museum. Cards of invitation have been issued.

ALBERT MEDAL.

The Council have awarded the Albert Medal of the present session—

To Henry Cole, C.B., "for his important services in promoting Arts, Manufactures, and Commerce, especially in aiding the establishment and development of International Exhibitions, the Department of Science and Art, and the South Kensington Museum."

The following are the previous awards—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce, in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which, in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. (now Sir) W. Fothergill Cooke and Professor (now Sir) Charles Wheatstone, F.R.S., in "recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. (now Sir) Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

In 1870, to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The Exhibition is open daily at 10 a.m., when the public generally is admitted, but a privileged admission, for study, may be obtained at the South Entrance, in the Exhibition-road, from 8 a.m., at a charge of double the ordinary fee for daily admission. Season-ticket holders will have this privilege free.

The number of visitors admitted to the Exhibition, week ending May 27th, season tickets, 3,404; on payment of 2s. 6d., 4,063; on payment of 1s., 40,574—total, 48,041.

His Royal Highness the Prince Christian, K.G., presided, on the 26th May, at the Royal Albert Hall, over a meeting of the General Purposes Committee of the Annual International Exhibitions. There were present Sir Francis Sandford, Mr. Edgar Bowring, Mr. Cole, Dr. Lyon Playfair, Mr. Thring, and Lieut.-Col. Scott, R.E., Secretary.

His Royal Highness the Prince of Wales presided on the 30th May, at Marlborough-house, over a meeting of her Majesty's Commissioners for the Exhibition of 1851. There were present his Royal Highness the Prince Christian, his Serene Highness the Prince of Teck, the Duke of Buccleuch, the Lord Portman, the Right Hon. Sir Alexander Y. Spearman, Bart., Sir Francis R. Sandford, Mr. Edgar Bowring, Mr. Thomas Fairbairn, Dr. Lyon Playfair, Mr. Prestwich, Mr. Vignoles, and Lieut.-Colonel Scott, R.E., Secretary.

EXHIBITIONS.

National Exhibitions of Fine Art in Spain.—The *Gaceta de Madrid*, of the 6th April last, publishes a decree by his Majesty the King of Spain, approving the regulations drawn up in regard to the national exhibitions of fine arts, which are to be held biennially in Madrid. The rules are strict as respects the admission of works, which are ineligible if they have been shown previously in any exhibition in Spain. Following the plan adopted by her Majesty's Commissioners for the fine arts section in the present London Exhibition, objects not coming immediately under the classification of painting, sculpture, or architecture proper, will still be eligible for exhibition if their artistic merit be sufficiently high. Twenty-four prizes alone will be awarded, they will consist of diplomas, accompanied by medals; of the latter, the first-class will be gold, the second silver, and the third bronze. The first of this series of exhibitions will take place in October next.

SCHEME OF THE ROYAL SANITARY COMMISSION.

An important document, embodying in considerable detail the views of the Royal Sanitary Commission as to the best machinery by which "constant and universal supervision of the essentials of public health"—viz., the food, the water, and the air of the people—by competent persons can be efficiently and economically secured throughout the country, has just been made public. The document, entitled "Memorandum on Medical Officers of Public Health," reiterates in the first place the unanimous opinion of the commission that "every question affecting public health should be brought into relation with one central office, presided over by a Minister," and goes on to point out that every district in respect of its health should be "as closely connected with the said Department of Health as is every part of the country with the Home-office through the police and the magistrates, and as are the destitute with the Poor-law Board through the guardians, &c.;" and that every person should "henceforward be entitled in respect of his health to such reasonable public protection as he is in respect of his liberty and his property."

In order to secure this object, and to bring each district of the country into proper relation with the suggested central office, the commissioners believe that there should be six permanent departments in the latter under the Minister, for matters connected with the law of local government, engineering questions, registration and statistics, the relief of the poor, the medical care of the public health and the poor, and legislation bearing on the profession of medicine. The legal supervision of sanitary questions in districts themselves should be placed in the hands of the legal advisers, or of clerks conversant with sanitary law, of corporations or boards of guardians, statistical questions would be, as at present, taken in charge by the Registrar-General's staff, while special experts would be needed for the examination of chemical matters, and the existing officers in the engineering department of the Local Government Act-office and some few additional district inspectors would be made available for engineering questions. The medical supervision of the whole country would be accomplished by district officers and central inspectors of public health. The former are ready to hand in the existing staff of Poor-law medical officers, who are paid out of the public funds, and are thoroughly acquainted with the haunts of disease, the habits of the poor, and the general sanitary peculiarities of districts. These medical officers number 4,000, and are becoming every day more highly educated. They would be expected to furnish returns at stated times of sickness, to report on the sanitary condition of their districts, upon special causes of local ill-health, whether in food supply, dwellings, wages, drunkenness, or employment, and to make meteorological, and, perhaps, analytical observations, while they would be responsible to the central authority. The duties of the proposed central inspectors of public health, who would consist, if the suggestions of the Commission were adopted, of the existing Poor-law, lunacy, factory, Privy Council, and registration inspectors, with those attached to the Local Government Act, and some minor offices, would be not so much to carry out special as general supervision, and to decide when it was advisable to seek the assistance of experts, who would be attached to the central office for stated periods (five years), and be subject to re-election. It is assumed that the existing inspectorial staff, with two or three additions, working harmoniously under one chief, would be able "to thoroughly superintend the whole sanitary arrangements of the country, provided the 4,000 medical officers now engaged by the State for the medical care of the poor undertake public health functions and form a class of resident health officers." A central office, six departments, general and special inspectors, a few experts, and the local district officers, the whole under the control of a Minister of Health, is the scheme of the Sanitary Commissioners, who affirm that the plan would work well and economically, inasmuch as the action of the several departments would be mutually related and complete. A recommendation to establish laboratories for public analysis in such towns as Oxford, Cambridge, Leeds, Newcastle, Bristol, &c., to be supported by public grants, is also made, as also to bring the naval and military medical services in direct relation to the Central Health Office, which, lastly, would be able, by accumulating accurate data, to diffuse early, valuable, and trustworthy information touching the cause and the prevention of disease, and "would bring to light in every corner all that could be advanced as bearing on the physical condition of the masses of the people, while all crude theories or impracticable plans would instantly fade before the experience of the central office."

NEEDLES AND PINS.

By order of the Commissioners of Patents, a blue-book, giving abridgments of specifications relating to needles and pins, from the year 1755 to 1866, has been published. The following interesting facts are appended to the work by way of introduction:—

Pins formed of wire seem to have been unknown in England till about the middle of the 15th century, before which time they were larger than the present pin, and were made of box-wood, bone, ivory, and some few of silver. Metal pins had, however, long been matters of history. In the Egygtian tombs they are frequently found, and are much more elaborate and costly than those produced to suit modern requirements. They vary in length up to seven or eight inches, and are furnished sometimes with large gold heads, and sometimes with a band of gold around the upper end, those of the latter kind having probably been used for securing the hair. The ancient Mexicans were familiar with their use, but they also found a convenient substitute in the thorns of the agave. About the middle of the 15th century, metal pins were in use to a small extent in this country, and we hear of Catherine Howard importing them from France somewhere about the year 1540. The importation of pins really dates much further back, for in 1483 it was made the subject of a prohibitory statute. In 1543, another act, passed in the reign of Henry VIII., provided "that no person shall put to sale any pinnes but only such as shall be double-headed, and have the heads soldered fast to the shank of the pinnes, well smoothed, the shank well shapen, the points well and round, filed, cauted, and sharpened." Within three years from this date, the manufacture was so much improved that the enactment became of little value. It is very probable that the imported pins were the cause of this manifestation of government interference. The best pins were made of brass, but in France it had become very general to manufacture pins from iron wire, which, being blanched like the others, passed for brass. The pins so made were very defective, and in little time their use was confined to the Continent. The French especially could with difficulty be prevailed upon to discard them, and even as late as 1695, it is recorded that the seizure of some millions of the faulty pins, by order of the lieutenant of police, was confirmed by the Parliament, and the whole quantity was ordered to be burnt by the common executioner.

The manufacture of pins was started in Gloucestershire by John Tilsby, in 1626, and the business soon proved so prosperous that it gave employment to 1,500 persons. Ten years later, it was established in London. About the middle of the last century, wire-drawing and pin-making were commenced in Birmingham by the Rylands family, who carried out most successfully this branch of industry. So much of the business as related to pins was transferred, about the year 1785, by Mr. Samuel Rylands to his nephew, Mr. Thomas Phipson, and this manufacture has since been continued by the present firm of Thomas Phipson and Son.

The trade gradually improved, but without any remarkable impetus, until 1824, when Mr. Lemuel W. Wright, a native of Massachusetts, patented in this country an important machine of his own invention, which is often believed to have been the first ever contrived for making solid-headed pins. This is an error, as a glance at the abridgments referred to will show, for, nearly seven years earlier, Mr. Hunt had been at work on a machine for that purpose. Mr. Wright, however, introduced his machine to the public in London, where it was worked at a factory in Lambeth. The enterprise was not successful, and the company failed before the new pins could be brought into the market. The machinery was then transferred to Stroud, in Gloucestershire, the county where the trade had been originally introduced two centuries before, and here the manufacture was conducted by Messrs. D. F. Taylor and Co. The first solid-headed pins were sold by this firm in London somewhere about the year 1833.

The first efforts to establish a home trade in America appear to have been in 1775. In that year, the Convention of the Province of Carolina, with a view to the encouragement of the manufacture of pins and needles, offered "£50 for the first twenty-five dozen of the former, equal to British imported pins, costing 7s. 6d. a dozen; and to the manufacturer of the first 25,000 needles, sorted from one to twelve inclusive, and equal to needles from Great Britain of the price of 2s. 6d. sterling per thousand, the same reward, if made within twelve months." Who gained the prize we are not told, but it is probable that public attention was attracted to the desirability of establishing the trade, for, in the same year, 1775, we hear of a proposition by Leonard Chester, of Wethersfield, to erect a pin factory at that place. Some years later, Dr. Apollos Kinsley, of Connecticut, a man of much mechanical ingenuity, and the patentee of certain printing and brickmaking machines, invented a machine for making pins, but neither of these projects appears to have succeeded. Soon after the war of 1812, however, when, in consequence of the interruption to commerce, the value of a paper of pins was not less than one dollar, and these were of very inferior quality to those now worth only six cents., the manufacture was really undertaken. The first attempt was made by some Englishmen, at the old state prison, in what was then called Greenwich village, now a part of New York city. The enterprise was soon abandoned, and again undertaken with the same tools in 1820, at the Bellevue almshouse, but again without success. In 1832, Mr. John J. Howe, of New York, patented his machine for making pins with wire or "spun heads," like those imported from Europe; and in 1836 the Howe Manufacturing Company started at New York. Their operations were transferred to Birmingham, Connecticut, in 1838, and soon included the new process of making pins with solid heads, patented by Mr. Howe in 1840.

About the time that the Howe Company were removing to their new establishment at Birmingham, another factory was being established at Poughkeepsie, on the Hudson River, by Messrs. Slocum, Gellson, and Co., who adopted the processes invented by Mr. Samuel Slocum for producing the solid-headed pin. The interests of the latter firm were finally transferred to the American Pin Company at Waterbury, Connecticut, where the business has been carried on successfully for a number of years.

At the present time, the total weight of pins made in the United States is supposed to be from seven to ten tons per week.

Among uncivilised people, at very early periods, attempts were made to form needles or bodkins of bone and ivory. The use of needles were known to the ancient Egyptians, a few having been found in their tombs. These were of bronze and of large size, being from three to four inches in length; but Wilkinson states that such as were employed in fine work must have been of a very minute kind. Pliny mentions the use in his day of needles of bronze for sewing and knitting.

In 1370, needles were manufactured at Nuremburg.

There seems to be some doubt about the date of the introduction of the needle into this country. Stow tells us that needles were not sold in Cheapside till the reign of Queen Mary, and that they were then made by a Spanish negro, who refused to discover the secret of his art. Another authority (Wilke's "London Ency.") says hat they were first made in England by a native of India, in 1548, but the art was lost at his death. The "Encyclopédie des Gens du Monde," says that the first metallic needle factory in England was established in 1543. We may, however, be quite sure that the needle in its present form had been introduced into England prior to 1553, for we hear of its use by the Lady Elizabeth, at Woodstock in that year, and the result of her labours, the embroidered back of a book, is at present in the Bodleian Library at Oxford.

Whether or not the art of manufacturing needles was really lost at the death of the "native of India," it seems to be quite clear at all events that no extensive centre of manufacture had been established till 1650. In that year, Mr. Damer, an ancestor of the Milton family, settled at Long Crendon, in Buckinghamshire, Christopher Greening and his three children. This little family, doubtless assisted by the benevolence of their patron, set up a small needle factory, which if it do not exist at the present day, certainly was carried on until very recently. At present Worcestershire is the chief seat of the needle manufacture, but even in this case it is not at all clear when Redditch became the centre of the trade. There are slight indications, it is said, of Redditch needle-making for a period of nearly two centuries, but beyond that all is blank. There are no particular advantages offered by the situation other than that common to many other spots of being near to the seat of the iron trade.

It is unnecessary to enter into any particulars concerning the changes which have occurred in the needle manufacture, since the present series of abridgments embodies all the improvements of any importance. It may, however, be well to add the following descriptions of apparatus designed with the view of obviating the inconvenience caused by the dust generated in the grinding process. It is notorious that this fine mixture of metal and sandy particles is productive of serious consequences to the health of the workpeople, and, as far back as the year 1811, the Society of Arts bestirred itself to find a preventive. In that year the silver medal of the Society was voted to Mr. Thomas Wood, of Great Berkhampstead, for his improved grindstone for pointing needles. It was nothing more than an ordinary grindstone provided with a hood or case, in which was a pane of glass, to enable the operator to watch his work. The current of air formed by the motion of the stone was confined within the case, and carried with it the fine particles, which it deposited on the lower part of the inside of a wet cloth which formed the connexion between the sides and the case.

In 1813, the apparatus of Mr. George Prior, jun., of Otley, in Yorkshire, for the same purpose, obtained a premium of 25 guineas. In this apparatus the dust was removed by causing a current of "air to pass the top, sides, and bottom of the grindstone by a tube enclosing them, which tube was slit lengthwise on the sides, top, and bottom, opposite the workman; one end of the tube having a communication with a pair of bellows worked bya crank at the axis of the wheel" which turned the stone. The dust was blown into a receiver, from which a funnel or tube carried it into the outer air or into a chimney.

In 1815, Mr. Thomas Roberts, of Dumfries, proposed to remove the noxious dust by means of a "fly wheel or ventilator." This apparatus, for which the inventor received a reward of 10 guineas, simply consisted of a ventilating fan of the ordinary character.

The large gold medal of the Society was given, in 1822, to Mr. J. H. Abraham, of Sheffield, for his magnetic guard, intended to protect persons employed in pointing needles and other branches of dry grinding. The stone rotated through a slot in a canvas or wood screen, so that the jet of dust, after having been carried beyond the screen by the force of the grindstone, was prevented from returning. As an additional preventive, magnets were suspended over the stone, and the grinder was furnished with a gauze muzzle fitted with magnets, which collected the fine metallic dust from the atmosphere.

[The Society's efforts were not only not appreciated, but actually opposed, by the very persons they were intended to benefit. A commission was sent to Sheffield to introduce a respirator intended to prevent the inhalation of the dust raised by needle grinding, which was exceedingly hurtful to the workmen. The members of the commission were threatened with personal violence if they persisted in their labours, on the ground that the general use of such a respirator would lengthen the life of the workmen, and so tend to diminish the wages paid.—Ed.]

EDUCATIONAL NOTES.

Payment of Fees in Denominational Schools.—This is a question which is now being frequently discussed in various parts of the country, and in reference to which strong party feeling evidently exists. At the recent meeting of the Manchester Diocesan Board of Education, the Bishop of Manchester said:—"The question now raised was whether school boards should be allowed to pay the school fees of those indigent children whose parents, on conscientious grounds, preferred sending them to denominational schools. He really could not see grounds for this new agitation. Was it to be an accepted principle in England that no Englishman was to pay rates or taxes to any object of which he individually disapproved? If so, there might be a considerable number of the citizens of Manchester who objected to the large expenditure which the Corporation were incurring upon what would no doubt be a magnificent building, the new Town Hall. Or was religion to be the only subject which was to be excepted from the general law that the minority would submit to the verdict of the majority, till by lawful influences they could change the minority into a majority? It seemed that the question was now being fought upon an altogether different ground from that upon which it had been previously fought. Before, it was argued that the consciences of the children and of the parents should be respected; but now the question seemed to be that the consciences of the ratepayers should be respected. The only alternative was, that if they could not maintain denominational schools they would have schools in which no religion at all was taught. Seeing that by recent legislation the conscience of every parent and of every child was and must be respected in our schools, and seeing that the possibility of intolerance in the management was altogether removed, he humbly submitted that it was a fanatical agitation that was being raised against the payment of school fees in denominational schools." On the other side, the *Nottingham Express* observes:—"Now the Nottingham School Board is asked to use their prerogative and to pay the fees of poor children to whichever schools their parents please to send them. In the case of Roman Catholic children, it is certain their parents will please to select the Roman Catholic schools. In the case of the very poor, whom this matter affects, it is equally certain that very slight pressure will induce the parents to prefer denominational schools, which are, with the exception of the Wesleyan and Roman Catholic, all Episcopalian. Consequently, the public rates of the town will pay the fees of a large number of children in denominational schools; and as these fees will secure a corresponding increase of the large Government grant to the school, which is proportioned to the number of children in the school, all our denominational schools will receive from rates or Government grants a vastly greater amount of public money than they did previously. Let the School Board erect free schools for all children who cannot pay fees. This is the alternative which Mr. Forster has put into their hands. By adopting this course, the School Board will hold itself above sectarian divisions and spend the people's money themselves, under the authority which they derive from the people. To give that mon y to institutions which they do not control, which are under denominational management, and carried on for denominational uses, contravenes all modern ideas of equity and religious equality, and will awaken sectarian animosities which will only dishonour religion."

School Endowments.—In answer to a question in the House of Commons, Mr. W. E. Forster said that the Endowed Schools Commissioners treated every case according to its special merits, and in dealing with the annual income of elementary endowed schools they, in the first place, provided assistance towards the preparation of the requisite building, and after that it certainly was their aim that the income should be spent as much as possible for the benefit of the class that had attended the school, that was, for the benefit of the poor, but for a higher education. It was not the opinion of the Commissioners or of the government that it would be in accordance with the intentions of the founders or with the interests of education that, generally speaking, those endowments should be used simply for the relief of the rates and taxes; but there might be special circumstances, such as the poverty of a particular place, which would have to be taken into account, and every case would have to be considered on its own merits.

Female Education.—At a meeting held not many days ago at St. James's-hall, the Bishop of Peterborough, Mrs. Anderson, and other speakers advocated the expediency of establishing colleges for women. An able correspondent of the *School Board Chronicle* replies to some of the stock objections of those who look upon the movement as "an organised attempt to revolutionise our domestic life, and to sacrifice to a certain amount of intellectual culture those precious gifts of womanly excellence, the tender grace, the tranquil dignity, and the sweet gentleness, which have hitherto been the pride, the comfort, and the happiness of our English homes." He says:—"There is and there can be no connection in the way of cause and effect between a highly-cultivated intellect in a woman and the diminution of her womanly graces and virtues. On the contrary, the head that is full of light is more likely to see clearly and guide correctly the warmth and the purity of the heart than the head which is unenlightened. The woman whose views are enlarged by culture and by the wider range of experience afforded her by a collegiate career, is in a fairer way than others of her sex to liberate her mind from the narrowing influences and prepossessions which at times warp the judgment of the best of women, and cloud the happiness of their homes. It is notorious that high culture, with its discipline, has a marked tendency to regulate the temper, to improve the disposition, and to give a gentle tone to the manners. 'Emollit mores,' says Ovid, 'nec sinit esse feros.' Are we prepared to say, either that the intellectual culture which is found so profitable to the improvement of man's social ēthos—to its beauty and its sweetness—would not be equally profitable in a more congenial soil? What gymnastics do for the body, by adding grace and strength, that will intellectual culture do for the elevation and refinement of women's nature. Intellectual light, like physical light, we believe, kills more corruption than it engenders, and warms into life and loveliness, and gives colour, and sweetness, and perfection to growths which otherwise would have perished outright, or only have enjoyed a stunted existence." Treating the same subject from a more practical point of view, Mr. G. C. T. Bartley urges "the necessity for the complete abolition of all the superficial work now done in girls' schools. The endless piano playing, the smattering of French, Italian, drawing, the useless fancy work, and other elegant accomplishments, as they are usually taught, can be looked upon hardly as educational at all; but a girl trained in the elementary laws of physiology, natural history, and botany, in addition to being really grounded in the more ordinary subjects now so often but nominally taught at schools, would, at sixteen or seventeen years of age, be really in such a position that, come what might, she would be prepared for it. After leaving school, or giving up her private masters at home, she would be qualified to pursue her own education by herself; and this is a most important consideration. As at present brought up, very few girls ever think of doing this, nor are they competent to make the attempt, even if they have the inclination. The proper and efficient education of girls, it must be urged, is not only a matter of private importance, but it is really one which affects to a very great extent the national well-being of the country. Much has been done for boys of all ranks. The industrial classes of both sexes have also been provided for, under the recent Elementary Education Act. The girls of the middle and upper classes form the only section of the community which remains; and for these, at present, little improvement has been suggested. If the good results of the educational work of the last few years are not to be very much retarded, no time must be lost in awakening public opinion concerning the urgent importance of a completely new and improved system of providing for the efficient education of girls." It may be mentioned that two large schools for girls of the middle and lower middle class have been recently opened in Camden-town, and, in pursuance of a resolution passed at a meeting held some time since under the presidency of Lord Lyttelton, they have been established upon a public footing. The lower of them is intended to meet the educational wants of the neighbourhood for the same class as that contemplated by the well-known City of London School for boys. The upper school is meant for those whose parents can afford to pay for a higher and more expensive education. Both are under the patronage of the Archbishop of Canterbury and the Bishop of London, the latter of whom is the visitor of the trust; but the religious teaching is said to be quite unsectarian, and the schools are opened upon equal terms for girls, whatever the denomination of their parents. Already between 300 and 400 entries have been made.

Technical Instruction.—In an oration by Dr. John Mill, entitled "What is Industrial and Technical Education," the author says:—"More than half a century ago, in 1815, it occurred to some educationists on the Continent to establish trade schools. One of the first ever attempted was that of Aury, established by Father Philip, for the purpose of teaching the people engaged in the coasting trade something of the construction and management of their ships, and also the rudiments of nautical astronomy and navigation. The instruction thus imparted was found to be of so much importance to the sailors, fishermen, and shipwrights, that other trades naturally followed the example set them, and hence 'apprentice schools' grew up in most of the large towns in France. It was soon discovered that drawing and mathematics lay at the very base of any successful course of mechanical instruction, and that those acquirements were available, and were indeed indispensable, to the prosecution of almost every art and trade. The 'machine' and 'weaving schools' soon followed in the wake of the 'ship schools,' and not long after 'stone schools" were established among the quarrymen of Volvie. Sometimes the enlightened enterprise of some manufacturer, or the foresight and penetration of a great educator, founded the institution; with others, necessity may be said to have been the parent of invention. This was notably the case with the weaving schools of Belgium. A few years ago, some districts of that country were so impoverished as to be absolutely the most pauperised in Europe; and this state of things had been brought about by the people adhering to their old method of weaving, and producing articles no longer equal to those of the same description made in other countries. Almost in despair, a commission of inquiry was appointed to investigate the cause of the decay of their ancient trade. Perceiving the error into which they had fallen, the commissioners proceeded to England, procured improved looms, engaged the best teachers of the improved art of weaving that could be hired, and founded weaving schools, who soon produced pupils who rivalled the English workmen in their textile productions. As a natural consequence, their trade has regained its ancient prosperity, and pauperism has been almost exterminated from the district. In this way, almost unknown and quite unregarded, those industrial schools grew up on the Continent; and it was only when we saw their productions in the International Exhibitions, and found them pushing our own out of the markets of the world, that the thing was forced on our notice as a matter which could be no longer ignored." This work contains many very useful suggestions worthy the attention of educationists. Amongst other proposals, Dr. Mill thinks this country should have "sea schools" for teaching everything connected with navigation, thus helping to maintain our maritime supremacy. He proposes that government should establish training colleges for the masters in the technical schools, which should be established throughout the country, and that there should be a central university, which should direct the work of the training colleges and of the technical schools.

CORRESPONDENCE.

DECIMAL AND METRIC SYSTEM OF WEIGHTS, MEASURES, AND MONEY.

Sir, — Your correspondent, Mr. Leonard Bruton (*Journal*, May 26th, pp. 549-550) says he has "before his mind the objection inseparable from the decimal system comprehended in the word 'repetend.'" Such an objection as this can only arise from a peculiar mental idiosyncracy, an enthusiasm for fault-finding. But, as is the being of everything, such also is its truth; and as the properties of numbers, whether decimal or not, are essential and immutable in their being, objections to them cannot be well founded. And arithmetic alone, without the aid of metaphysics, might teach Mr. Bruton that his objection to repetends is not valid, as every repetend, or continually repeated part, of infinite decimal fractions, has a finite value, and can be most easily reduced, by one simple and general rule, to a finite value, in the form of a vulgar fraction.

Mr. Bruton, with his *noli leges Angliæ mutari* argument, appears insensible to the educational advantages of a decimal system. He would rather go on without so odious an innovation. The reforms suggested do not, it is true, directly, although they do indirectly, manure the money-tree, so they have not the same intrinsic attraction to certain class interests as attach to some other amendments of our social system, in matters that have become antiquated by the efflux of time. Yet, as a machinery for saving time and mental labour, and for sharpening the intelligence of all classes, the decimal system is especially worthy of the same recommendation to modern England as was given to the world, more than two thousand years ago, by that prince of philosophers who wrote thus of a system of arithmetic teaching principles rather than the parrot-like rules of the common way:—"It will be proper, then, Glauco, to establish by law the discipline (arithmetic), and to persuade those who are to manage the greatest affairs of the city to apply to computation and study it, not in a common way, but till by intelligence itself they arrive at the survey of the nature of numbers, not for the sake of buying nor of selling, as merchants and shopkeepers, but both for war and for facility in the energies of the soul itself, and its conversion from the whole of visible nature to truth and essence, or real being."

How delightfully ingenious it is of Mr. Bruton to be so solicitous lest the carelessness of an "enthusiast" should have disturbed statistical accuracy, and induced exaggeration in the figures of "100 or 110 millions of souls of other nationalities (than the French), European and American." If Mr. Bruton will take the trouble to collect for himself the total, at last enumeration, of the population of Italy, Spain, Portugal, Belgium, Netherlands, Greece, North and South Germany, the Brazils, Mexico, Chili, New Granada, and other South American countries—all of which have passed laws for rendering the use of the metric system obligatory—he will find about 120 millions to whom repeating decimals are neither a snare nor a delusion. Mr. Bruton's allegation that it was inconsistent, in the first place, to say that so many Europeans and Americans rendered the system obligatory, and then to go on to say that the United States are anxious to adopt it, is quite a mare's nest of his own discovery, for surely the 30 million inhabitants of Mexico, the Brazils, and of the Chilian and other South American republics are as much Americans as the inhabitants of the United States.

Mr. Bruton objects to the statement (see page 492) that "the United States had again, in the past year, affirmed the principle of such a charge" (not "change," as misprinted in his quotation). If Mr. Bruton cares to refer to my paper on "International Coinage and Seignorage" (pp. 142—8 of Minutes of Evidence taken before the Royal Commission of 1868), he will find it explained that the United States law imposed on all bullion a tax of ½ per cent. and a coinage charge of ½ per cent., and that there was reason to believe that the delay in delivery of coin from the mint in exchange for bullion was considerable, so that 1¼ per cent. was about the average total seignorage allowing for interest on such delay, and that the adjustment of this to a total of one per cent., and to a provision of immediate delivery of coin for bullion (as proposed for general international use) would not present any great difficulty. In the past year (1870), the government at Washington had before them a report to the Treasury Department, relative to a revision of the laws pertaining to the coinage of the United States, from Mr. J. J. Knox, of the office of Comptroller of the Currency, who proposed the abolition of the coinage charge, on the ground that it seemed to him that it should be the policy of government to hinder rather than to encourage the export of bullion, the existing laws (according to Mr. Knox) having the effect of inducing bankers to ship bullion, as a commodity for the purpose of making sterling exchange. The advisability of introducing a Bill to repeal the mint charge was considered by Congress, and it was submitted by Mr. Knox to the Secretary of the United States Treasury, that it "would prepare the way for a more intelligent consideration and eventual adoption of a judicious system of international coinage." Congress, as it appears to me, did right in not altering the law imposing a seignorage, but it is agreeable to find that there are friends of free mintage, like Mr. J. J. Knox, who are free from prejudices against international coinage. A select committee of the Senate of the Dominion of Canada was also appointed last year, consisting of the Hon. T. Ryan and ten other members, on the subject of a uniform international decimal system of measures, weights, and coins, and their report not only deals intelligently and without narrow apprehensions of the coinage scheme of Mr. Lowe, but also (the repetend of Mr. Bruton to the contrary notwithstanding) calls the attention of the House of Representatives to the importance of causing the metric system to be taught in all schools over which they have control, directly or indirectly, as simple, easy to be learned, and not readily forgotten, young men instructed in it thus acquiring additional facility in understanding the trade with countries where this system prevails exclusively.

As Mr. Bruton enjoins upon me either to support by any evidence or to admit my error "that the Association of Chambers of Commerce of the United Kingdom had approved Mr. Lowe's suggestion for depreciating the English sovereign one per cent.," I beg to observe that I do not admit that there ever has been such a suggestion, either on the part of the Chancellor of the Exchequer or of myself and others who recommended a seignorage to the notice of the Royal Commission. There has been no such suggestion as would really depreciate the coin, either by one per cent., or by anything at all per cent. I believe, with McCulloch and other economists who have considered the question before and after him, that when a seignorage is first imposed in a country having a free mintage, it is necessary for the State to diminish the weight of pure gold in the coin to the extent of the seignorage imposed, otherwise the gold coinage would be over-appreciated and other commodities depreciated, which would be just as bad, both in effect and in principle, as the converse, so dreaded by Mr. Bruton, of depreciation of the currency, and over-appreciation of other commodities. This principle admitted, the doctrine of limits comes prudently into play to restrict the seignorage within such bounds as would provide, now and hereafter, a fair charge for first mintage of the bullion, and for a sustentation fund to enable the state to keep up the periodical re-integration of the coin at its legal tender weight at each future remelting and re-coinage. All states entering into an international convention, and undertaking such duties as the foregoing in connexion with the coinage of their own mints, are entitled to the *quid pro quo* of a fixed seignorage from those who bring bullion to be exchanged for coin. Calculations and estimates that 1 per cent would be a fair charge for all countries to adopt in such a convention, provided identical mint regulations as regards immediate delivery of coin in exchange for bullion were also generally introduced, were prepared by me and Colonel Smith, F.R.S., jointly, dated 3rd March, 1869, and were submitted to the Treasury, and, at a subsequent period, to the French Government Commission.

But to return to Mr. Bruton's interpellations about the Chambers of Commerce. He appears to harp upon the string of public report that gave last year an uncertain note as to the comparative unanimity or the contrary of their opinion. The Chamber of Little Pedlington may, in such matters, have as great a voice in voting as the Chamber of Magnopolis. Individually, I look only to the Reports of Selected Committees of Reference in such matters, and I accept them as the fairest indication of well-considered opinions. It appears that, at a meeting of the Associated Chambers, held at Birmingham, 16th and 17th November, 1869, it was unanimously resolved to refer the subject of International Coinage to Messrs. Lloyd, Akroyd, M.P., Whitwell, M.P., Behrens, and Field—all of them representing most important constituencies in the Associated Chambers. These gentlemen unanimously agreed to a report, in January, 1870, which is an elaborate document recommending the adoption of the Chancellor of the Exchequer's plan for reducing the sovereign to the extent that would make it equal in value to 25 francs exactly, combined with the principle of seignorage to counterbalance the effect of the reduction. The Associated Chambers met in London, in February, 1870, and this report was considered. The newspapers, on or about the 23rd to 25th of that month, led the public (including myself) to suppose that a deputation should wait upon Mr. Lowe, and urge him to carry out the recommendations of the report, and a brief report of the waiting of the deputation on the Chancellor of the Exchequer did appear in the newspapers. As I was on the point of accepting the invitation of the French government to give evidence before their Commission, a copy of the report from the referees of the Associated Chambers was placed in my hands, and it was not until many months afterwards that the fact became known to me that Mr. Leonard Bruton, on behalf of the Bristol Chamber, had carried an amendment, at the meeting of the Associated Chambers, in favour of their body confining their recommendation to the Chancellor of the Exchequer to a suggestion that he (Mr. Lowe) should promote another International Conference, a fact which, although Mr. Bruton thinks much of it, was a simple suggestion for shelving the matter by delay, and which gave advice that Mr. Lowe declined to take.

The French Minister of Agriculture and Commerce, at the meeting of the Commission on 10th March, 1870, asked me if I could give them a copy of the report, and it was translated into French, and appended to the evidence, under the signature of the referees of the Associated Chambers; and, without compromising Mr. Bruton, I do not understand what he means by saying in his letter to you "that the proceedings of these foreign commissions should not be kept comparatively private." The report, with the evidence, at great length, of all the witnesses, was printed, and on the point of publication, when the war broke out. Both the *Journal Officiel* and the *Moniteur*, and other newspapers, gave analysed reports of the evidence.

Mr. Bruton says that "English interests may be deeply affected by such *ex-parte* "evidence" and "reports." This is not offensive to me personally, as I did not volunteer to go to Paris; but the remark is, to say the least, ungenerous to the French government, who, in 1870, frankly and fairly sought and invited the evidence of persons from various countries, and holding the most opposite views and opinions. The interests of the Bank of France were most powerfully and ably represented, through the examination of its Governor, M. Rouland, and of three of its regents, Baron de Rothschild, the Marquis de Plœc, and M. de Waru. M. Rouland's very lengthy speeches were reported at great length in the *procès verbal*, and M. Wolowski's, on the same side, were separately reprinted in a pamphlet form.

As so many of the French government offices were burned down in the fearful conflagration that has just occurred, I am unable to enlighten Mr. Bruton as to the chances of a copy of the report being procurable at all. I have now endeavoured to answer his leading questions as categorically as due regard for the limited space for correspondence in the *Journal* will allow.—I am, &c., FREDERICK HENDRIKS.

Kensington, May 29, 1871.

CONVICT LABOUR.

SIR,—There is one reason in favour of Captain Ducane's views which has not been brought forward, and which, so far as regards the politico-economical bearing, demands attention.

In consequence of the Poor-law system, the population of this country must be fed. The population has a standard power of labour in a prosperous year. The full power, or standard power (less loafers, &c.), is exacted. In a year of crisis the standard power is not applied, manufacturing production falls off, and the population cannot, under any circumstances, be employed in such way. There is consequently, periodically, a large amount of surplus labour, which is lost, and were there the requisite organisation, it would be evidently desirable to employ such surplus labour on public works, which, though not directly profitable, are essential for the development of the country.

In such bad years we ought to be able to carry out harbour works, fortifications, sea and river dykes, road improvements, and other works. This, however, is at present hopeless, from want of good organisation; nor can we even expect that the legislature will, in such times of crisis, favour companies which are engaged in reproductive works. On the contrary, they are in such periods discouraged.

Unprofitable prison-labour we have ever present, and it is desirable it should be turned to account in some such way as Captain Ducane proposes. The work should be such as is useful to the nation, though not necessarily yielding a dividend or profit. Fortifications afford one mode, but the supply of small fishing and trading harbours, for the development of our fisheries and coasting trade, is also another mode, and there are many examples of such local works.

A small fishing community is otherwise occupied than in constructing a harbour, and the Scotch Fisheries' Board has been very usefully employed in supplying such harbours. Then, when a slate or stone quarry might be opened on the coast, to give employment to local labour, it cannot be done, because a harbour, at the cost of £2,000, £3,000, or £5,000 is required, and the promoters have not the capital for that, and barely enough for their mining venture. There are many such works available for prison labour, if there were the requisite organisation.—I am, &c.,

Hyde Clarke.

32, St. George's-square, S.W., May 24, 1871.

GENERAL NOTES.

Euphrates Route to India.—Mr. W. P. Andrew has published a pamphlet on this subject, consisting chiefly of letters addressed by him, during the past year, to the Grand Vizier, to the Secretary of State for India, to the Under Secretary of State for Foreign Affairs, to the Postmaster-General, to the Under Secretary of State for War, and to Sir Henry Elliott, our Ambassador at Constantinople, showing that the line is intended to be carried eventually from Constantinople to Bussorah, though at the outset it would only be carried from Seleucia, or some other part of the Mediterranean, to Bussorah, which portion, supplemented by lines of steamers at both ends, would suffice to open a new line of communication between Europe and India.

Pianoforte Action.—At the evening meeting on Wednesday last, the 31st May, an improved action was shown, the invention of Mr. W. G. Eavestaff, of 60, Great Russell-street, which he terms a "vertical repeater check action." The action is a simple vertical movement guided in a direct line to the hammer butt, exactly as it is propelled by the key when in motion; and, from the check working with the escapement, the hammer is checked, and the repetition of the blow allowed with a rapidity not hitherto attained. As a certain amount of resistance must be offered by the weights necessary to cause the key and parts of the action to return rapidly to their positions, the utmost any mechanism can do is to communicate to the hammer butt, without loss, the preponderance of force given by the finger to the key. The best action for grand pianofortes approximate to this, but those applied to upright instruments have hitherto been very deficient, and good pianists generally decline to perform difficult music on such instruments, knowing from experience, that in power of blow, expression, and repetition, they fail to answer the requirements of the player. Vertical actions vary much with change of weather, and it has been considered by makers and the profession that no upright action would ever be produced equal to a good horizontal one—but this the inventor considers based only on the fact that such has hitherto been the case. In this action, from the weight of the guide or motive conductor, and the arrangement of the centres of the guide, there can be but little tendency to become sluggish or alter in a moist atmosphere. Any note can, if required, be unscrewed and another substituted without difficulty; it can also be produced at as low a price as any check action yet made, and is applicable, without any loss of power, to any height of instrument. The arrangement by which the improvement is effected cannot be made intelligible by verbal description, but members can see a full-sized working model at the Society's house.

Tramways in London.—The report upon this subject, laid before Parliament by the Board of Trade, states that no sooner had the Tramways Act of 1870 passed, than schemes were proposed for tramways extending over upwards of 100 miles in different parts of the metropolis. The Board consulted the local authority, the Metropolitan Board of Works, which, after a lengthened and most careful inquiry, sanctioned 31 of these schemes. But when the promoters proceeded to apply for the consent of the road authorities—namely, the vestries and district Boards—they found much difference of opinion. Many refused their consent altogether; others assented, some upon conditions; others considered the tramway question not yet ripe for a decision. The vestry of St. George's, Hanover-square, considered that the tramways should be made by the Metropolitan Board of Works, a duty which that Board has hitherto declined to accept. In a later communication, this vestry proposes that a clause shall be inserted in each of the provisional orders made by the Board of Trade, binding the companies to sell the undertakings at a certain price within a given period to the Metropolitan Board. The City authorities require that the City Sewers Commission shall, at the expense of the promoters, construct all tramways to be made in the City, and have power (after 18 months) to require their removal, on one month's notice, if found inconvenient to the public. Most of the promoters, under the circumstances, have lodged Bills in Parliament for authorising their proposed lines. The government of the metropolis is at present in a chaotic state. The Board of Trade report that no general scheme which can be proposed is likely to receive the assent of all the authorities. As a general rule, the inhabitants of crowded thoroughfares object to tramways opposite their doors; others are in favour of anything which will facilitate communication. The police report that the tramways already made facilitate traffic, and cause no obstruction, except at a terminus, as at the foot of Westminster-bridge. But they have not yet been tried in the more crowded streets; that experiment has yet to be made. Under the circumstances, the Board of Trade are unable to lay before Parliament a complete and perfect scheme for tramways in the metropolis. They submit provisional orders for such of the schemes, approved by the Metropolitan Board, as have received the requisite assent from the road authorities, embracing as much as possible of a complete plan, leaving it to Parliament to deal with the plan as a whole. It appears that the report of the Metropolitan Board of Works was made upon the schemes submitted to them by private parties; and a report by Captain Tyler, one of the inspecting officers of the Board of Trade, points out that the proposed lines present some striking instances of communication not provided for, and gaps to be filled up by omnibus. He observes that the tramway cars will be an undoubted convenience to travellers, but their monopoly must be an obstruction more or less to other traffic, especially in narrow streets, and during repairs to the road. He thinks this last a very important matter. He observes that inequalities arise between the rails and the road paving, and he suggests that some new material should be tried, such as the Val de Travers asphalte. It is more durable and more easily repaired than paving-stone, but may possibly be found too slippery in certain states of the weather. The absence of dust and the absence of noise are advantages of such a material. But then, he adds, if so clean and even a surface can be obtained and maintained, the question arises whether special rails for the wheels of cars are required at all. Looking still further a-head, he thinks it probable that the introduction and extension of the rail system in and around London will lead, sooner or later, to the employment of other than horse power for the movement of vehicles, at least in the suburbs. This may seem a matter for posterity, but he thinks it right that the contingency should be borne in mind in considering the arrangements now proposed.

Captain Tyler, reporting at the end of March, summed up the list of metropolitan tramway schemes thus:—Open, or nearly ready to open, 12 miles; authorised and partly constructed, 31 miles; the additional lines for which powers are sought extend over 105 miles of streets, and involve, probably, an actual capital expenditure of nearly a million of money.

Trade with Central Asia.—It is worthy of record that at length the Indian government has appointed a special officer to encourage the trade between India and Thibet, through the English settlement of Darjeeling.

Population of London, 1871.—The Registrar-General states that, up to the present date, the population has, since the year 1861, been estimated for all purposes. Ten years have elapsed since the last enumeration, and during those years the metropolis has seen many changes; that it was still increasing was evident; but no space remained open for new houses in the central parishes; merchants, traders, and professional men had left their mansions in the cities of London and Westminster to reside beyond the boundaries; and many dwellings demolished to make room for railways and public works. The births have exceeded the deaths year by year, but the increase of London has been kept up by immigration from the English counties, from Wales, from Scotland, from Ireland, and from foreign parts; had that tide of immigration been retarded, or had it rolled on in an increasing flood? Looking at the infinite variety of causes of disturbance, it might appear at first sight impossible to calculate years beforehand the inhabitants of London. The population in the year 1861 was 2,803,989; what was the increase? Some estimate was indispensable; otherwise the rates of mortality could not be determined; accordingly, an estimated population of London for the middle of the year 1871 was published in the first weekly table of January last. We have no longer to rely on that estimate. The superintendent registrars and registrars have, by great zeal, now furnished the actual numbers of people enumerated in the metropolis on April 3rd, and although the returns have yet to be revised at the central office, it is thought right to publish their first results, in order to show how far they agree with the estimates on which the rates of mortality are calculated. Population of London estimated in the weekly tables for middle of year 1871, 3,258,469; population enumerated as living at midnight on Sunday, 2nd April, 3,251,804. Calculated for that Saturday night, the estimate by the same method is 3,247,631, which differs only 4,173 from the enumerated population. This slight difference will not affect the rates of mortality, which, as given for all London since 1861, may be considered correct. The nature of the calculation will be explained in the census report. It will be sufficient to state here that it was made on the hypothesis that the population of London increased at a decreasing rate; both the rate of increase and its rate of decrease having been deduced from the numbers returned at the three previous enumerations. The population of three and a quarter millions lives on both sides of the Thames—extending along its banks from Woolwich up to Hammersmith, and across its stream from Norwood to Hampstead—over 122 square miles; an area rather greater than a square of 11 miles square mile, and, as only a certain number of people live to the side. On an average, there are 2,669 persons to a on a given area, it became evident that the usual hypothesis of increase in a geometrical progression would no longer apply to the growth of London, and in consequence the series was calculated in 1855 which has since been used in the weekly tables, and of which the number cited above is one. The closeness of the estimate is another example of the constancy of the laws which rule human life and determine English progress. The increase of the population in the ten years, 1861-71, was 447,815. Not many cities in the world have a population equal to this increase of the metropolis of the British Empire in ten years.

Coal in Austria.—The production of coal in Austria increases yearly, but it is far from being sufficient for the requirements of the country. In 1869, it amounted (exclusively of Hungary) to 62,064,188 cwt. of mineral coal, and 55,939,050 cwt. of wood coal. The greater part of this came from Bohemia, which produced 35,000,000 cwt. of mineral coal, and 30,000,000 cwt. of wood coal.

Australian Silk.—The Acclimatisation Society of Sydney have received some silkworm eggs from Japan, and is willing to distribute a portion of the same to other societies, also to private individuals, who can satisfy the society that they have a sufficient quantity of mulberry leaf of their own growing to sustain the worms properly. It is hoped that the attention of colonists will be given to propagating the mulberry.

Revenue and Expenditure of South Australia.—The revenue for 1870, as compared with that of 1869, shows a falling off of £122,672. The expenditure, on the other hand, was £64,517 less than that of 1869. Among the items of expenditure, charitable institutions are set down at £55,444; police, gaols, and prisons, £46,925; and education, at £22,895, making the startling total of £125,264 as the outlay occasioned for the relief of poverty and the repression of crime in this small community. The postal service, in 1870, cost £56,132, as against a revenue of £30,398; and telegraphs show an outlay of £12,275, and a return of £10,517. Water-works show an expenditure of £5,683, and have brought in £20,917, leaving over £15,000 to be set against the interest on the funded debt. The most startling results are shown by railways, which have cost £104,525 in the course of the year, and only brought in £70,595. The return gives no clue as to whether any portion of this heavy outlay was for permanent improvements; it distinguishes in no way between outlay of capital and current expenditure; but, if it be assumed that the whole £104,000 has gone in the latter, it follows the colony loses some £34,000 a-year by working the railways, without calculating the outlay for interest on loans. From first to last, the principal and interest expended on railways amount to over £1,800,000, and it appears that the return for this heavy outlay is a loss of £30,000 for the privilege of holding and working the lines. The expenditure upon public works during the year has been £109,221, and upon roads and bridges £27,820.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal Institution, 2. General Monthly Meeting.
Royal United Service Institute, 8½. Mr. J. K. Laughton, "On Ocean Currents."
Royal Colonial Society, 8½.
Victoria Institute, 8.
Entomological, 7.
British Architects, 8.
Society of Engineers, 7½. Mr. Charles Turner, "The Timbering of Trenches and Tunnels, applicable to Sewerage or Railway Works."

Tues. ...Civil Engineers, 9. The President's Annual Conversazione.
Royal Institution, 3. Prof. Haughton, "Least Action in Nature."
Zoological, 9.

Wed. ...Geological, 8.
Microscopical, 8.
Royal Society of Literature, 4¼.
Obstetrical, 8.
London Institution, 2. Distribution of Prizes and Certificates by the President, Mr. Thomas Baring, M.P.

Thurs...Antiquaries, 8½.
Royal Society Club, 6.
Mathematical, 8.
Royal Institution, 3. Professor Tyndall, "On Sound."

Fri.......Astronomical, 8.
Royal Institution, 9. Professor Tyndall, "Dust and Smoke."
Quekett Club, 8.
Royal Botanic, 4. Professor Bentley, "Economic Botany."

Sat......Royal Institution, 3. Mr. Norman Lockyer, "On Astronomy."

Journal of the Society of Arts.

No. 968. Vol. XIX.

FRIDAY, JUNE 9, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

DRILL REVIEW.

The Council have the satisfaction of announcing that H.R.H. Prince Arthur has consented to review the boys from the District and other schools, in or near the metropolis, where drill forms part of the system of education. The review will take place in the Royal Horticultural Gardens at South Kensington, on Thursday, the 22nd of June.*

The price of admission to the gardens to see the review will be one shilling.

There will be a limited number of reserved seats near the Saluting-Post, the price of which will be five shillings, including admission to the gardens, and to the performance of the united Bands in the Royal Albert Hall after the review. As there are only a few of these seats for disposal, early application should be made.

A subscription fund has been set on foot to defray the expenses of the transit of the boys to and from the gardens, and some refreshment for them. Members are earnestly invited to contribute to this fund, and subscriptions to it may be sent to the Secretary of the Society of Arts, John-street, Adelphi.

SUBSCRIPTIONS RECEIVED.

	£	*s.*	*d.*
James Austin....	1	0	0
B. W. Bartram ..	1	1	0
Sir W. H. Bodkin	1	0	0
Wm. Botly	0	5	0
A. Cassels	0	10	0
A. S. Cole	0	10	0
Henry Cole	2	0	0
Sir Daniel Cooper, Bart. (will increase if needed)	1	0	0
Rev. B. M. Cowie	1	1	0
J. A. Crookenden.	0	10	6
John E. Evans ..	0	10	0
W. H. Fell......	1	1	0
F. Filliter.......	1	1	0
J. A. Franklin ..	0	10	0
T. N. Hooper....	1	1	0
Chas. Horne (will give 10s. more if required)	0	10	0
Dr. Albert Horwitz..........	0	5	0
Maj. E. W. Mathew	0	10	0
R. Nicol	1	1	0
James Noble	1	1	0
Philip Sancton ..	1	0	0
W. H. Tanquerary	0	10	6
Charles Telford..	1	0	0
E. C. Tufnell....	5	0	0
Z. Watkins......	0	5	0
C. Williams	1	1	0
W. B. Wrightson	1	0	0
	£26	4	0

CONFERENCE.

The Twentieth Annual Conference between the Council of the Society and the representatives of Institutions in Union, will take place at the Society's House, on Friday, the 16th June. The chair will be taken at 12 o'clock, by Lord Henry G. Lennox, M.P., Chairman of Council.

The Council will lay before the Conference the Report of the Proceedings of the Union for the past year, and the Results of the Examinations.

The following subjects have been suggested for discussion at the Conference:—

1. The Society of Arts Examinations:—Whether any, and what, modifications in them would be desirable?
2. Whether the Council should not be asked to confer the title of Associate of the Society of Arts on students who have distinguished themselves at the Society's Examinations, the qualification to be defined by the Council?
3. The best means of organising Instruction in Mechanics' Institutions, in view of the results expected after the Education Act has been some years in operation, particularly by establishing advanced classes, as elementary adult teaching will be no longer necessary.
4. How far can Institutions be made available for improving Female Education?
5. The especial advantages of using Illustrations in Lectures on History and kindred subjects, as means of fixing the attention of the pupils.
6. How far Institutions can aid in organizing systematic visits to the Educational Section of the International Exhibition of 1871 and subsequent years.
7. How far can Institutions encourage Instruction in Music by establishing Local Scholarships, to be open to public competition, and held in a National Training School for Music?

Secretaries of Institutions and Local Boards are requested to send, *immediately*, the names of the Representatives appointed to attend; and also to give notice of any other subjects which Institutions or Local Boards may desire to have discussed at the Conference.

Secretaries of Institutions are requested to forward *at once*, by book post, copies of the last Annual Reports of their Institutions.

Representatives of Institutions and Local Boards attending the Conference are invited to the Society's Conversazione, at the South Kensington Museum, in the evening of the same day (16th June), and will receive cards on application at the Society's House on the day of the Conference.

On the following morning (Saturday, the 17th inst.), should a sufficient number of representatives give their names to the Secretary, arrangements will be made for a visit to the Educational Section of the International Exhibition.

CONVERSAZIONE.

The annual conversazione of the members will be held on the 16th June, at the South Kensington Museum. Their Royal Highnesses the Prince and Princess of Wales have intimated their intention to be present.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

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* Unavoidably postponed from the 14th, as announced in the last *Journal.*

FINAL EXAMINATION, 1871.

PRIZES AND CERTIFICATES AWARDED TO CANDIDATES.

PRIZES.

His Royal Highness the Prince Consort's Prize of Twenty-Five Guineas to

No. 305—Thomas Dawe, aged 20, Devonport Mechanics' Institution, clerk, who has obtained the following First-class Certificates :—

1868. Arithmetic—First-class Certificate.
,, Navigation and Nautical Astronomy—First-class Certificate, with First Prize.
,, Mensuration—First-class Certificate.

1869. Book-keeping—First-class Certificate.
,, Algebra—First-class Certificate.

1870. Metric System—First-class Certificate, with First Prize.
,, Domestic Economy—First-class Certificate, with First Prize.

1871. Logic—First-class Certificate, with First Prize.
,, English History—First-class Certificate, with First Prize.
,, Political Economy—First-class Certificate, with Second Prize.
,, Geography—First-class Certificate.

The Council Prize (for Female Candidates) of Ten Guineas

Has not been awarded this year, as no candidate qualified to receive prizes has fulfilled the required conditions.

Arithmetic	1st Prize	£5	To No. 96—John Whitaker, 19, Bacup Mech. Inst., clerk
	2nd Prize	3	,, 1042—William P. Yates, 18, Manchester Mech. Inst., draughtsman (proposed)
			*No Prize for Females awarded.**
Metric System	1st Prize	5	,, 1289—Thomas R. Clarke, 19, Salford W. Men's College, salesman
	2nd Prize	3	,, 849—Henry Beer, 20, Birkbeck Lit. and Sci. Inst., clerk
			*No Prize for Females awarded.**
Bookkeeping	1st Prize	5	,, 955—William Salter, 26, Royal Polytechnic Inst., engraver
	2nd Prize	3	,, 307—Edward J. Gill, 21, Devonport Mech. Inst., clerk
			*No Prize for Females awarded.**
Mensuration	1st Prize	5	,, 1359—Joseph Dixon, jun., 20, Walsall Church Inst., saddler's ironmonger's apprentice
	2nd Prize	3	,, 1194—George Butler, 19, Pembroke Dock Mech. Inst., shipwright (apprentice)
Floriculture	1st Prize	5	,, 1138—Robert Inglis, 26, Newcastle-on-Tyne Excelsior Temperance Class, gardener
			No Second Prize awarded.†
Fruit and Vegetable Culture	1st Prize	5	,, 1138—Robert Inglis, 26, Newcastle-on-Tyne Excelsior Temperance Class, gardener
	2nd Prize	3	,, 1225—Walter Davis, 23, Richmond Parochial Library, gardener
Domestic Economy	1st Prize	5	,, 297—Joseph T. Treleaven, 21, Devonport Mech. Inst., shipwright
	2nd Prize	3	,, 647—John Kidney, 21, Leeds Mech. Inst., solicitor's clerk
	Female Prize	2	,, 83—Isabella Maden, 22, Bacup Mech. Inst. (no occupation stated)
Political Economy	1st Prize	5	,, 427—John McAlpine, 20, Glasgow Athenæum, warehouseman
	2nd Prize	3	,, 305—Thomas Dawe, 20, Devonport Mech. Inst., clerk
Geography	1st Prize	5	,, 257—John Armstrong, 21, Carlisle Mech. Inst., engineer's clerk
	2nd Prize	3	,, 826—James E. Cox, 27, Birkbeck Lit. and Sci. Inst., accountant
			*No Prize for Females awarded.**
English History	1st Prize	5	,, 305—Thomas Dawe, 20, Devonport Mech. Inst., clerk
	2nd Prize	3	,, 199—William C. Beanland, 16, Bradford Mech. Inst., manufacturer's apprentice
			*No Prize for Females awarded.**

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* No Female Candidate qualified to receive Prizes obtained a First-class Certificate in any of these subjects.

† No other First-class Certificates were given in this subject.

English Language..	1st Prize....	£5	To No. 423—Robert McH. Mellis, jun., 20, Glasgow Athenæum, in civil service
	2nd Prize ..	3	,, 1247—William Pollitt, 19, Salford W. Men's College, clerk
			*No Prize for Females awarded.**
Logic	1st Prize....	5	,, 305—Thomas Dawe, 20, Devonport Mech. Inst., clerk
	2nd Prize ..	3	,, 1072—Thomas J. Shiel, 21, Manchester Mech. Inst., book-keeper
Latin	1st Prize....	5	,, 1247—William Pollitt, 19, Salford W. Men's College, clerk
			No Second Prize awarded.†
French	1st Prize....	5	,, 438—James Wilson, 22, Glasgow Athenæum, clerk
	2nd Prize ..	3	,, 884—Francis G. Crutch, 25, City of London College, clerk
	Female Prize	2	,, 38—Mary J. Wilson, 20, Aberdeen Mech. Inst. (no occupation stated)
German	1st Prize....	5	,, 119—Edward Edmonds, 20, Birmingham and Mid. Inst., electro depositor
	2nd Prize ..	3	,, 22—James Tait, 29, Aberdeen Mech. Inst., clerk
			*No Prize for Females awarded.**
Italian...........			*No Prizes awarded in this subject.*‡
Spanish	1st Prize....	5	,, 953—William H. Willoughby, 29, City of London College, shopman
	2nd Prize ..	3	,, 439—Robert K. Strang, 20, Glasgow Athenæum, clerk
			*No Prize for Females awarded.**
Theory of Music ..	1st Prize....	5	,, 762—William C. Harris, 34, Beauvoir College, clerk
	2nd Prize ..	3	,, 347—William B. Barr, 19, Glasgow Andersonian University Popular Evening Classes, warehouseman
			No Prize for Females awarded.†
Elementary Musical Composition (Tonic Sol-fa System)....	1st Prize....	5	,, 1212—Alexander L. Vingoe, 19, Penzance, pupil teacher
	2nd Prize ..	3	,, 748—William G. McNaught, 22, Beauvoir College, clerk
			*No Prize for Females awarded.**

The Prizes offered by Mr. T. Twining, a Vice-President of the Society, in Domestic Economy, have been awarded as follows :—

Third Prize of £2........	To No. 786—William Burgoyne, 24, Birkbeck Lit. and Sci. Inst., clerk
Prize of Books, value £1..	,, 584—William Stephenson, 26, Hull Young People's Christian and Lit. Inst., tobacco manufacturer's assistant
,, ,,	,, 826—James E. Cox, 27, Birkbeck Lit. and Sci. Inst., accountant
,, ,,	,, 1097—Alexander Gibson, 17, Manchester Mech. Inst., draughtsman

The Prizes offered by Mrs. Harry Chester, in Political Economy have been awarded as follows :—

Third Prize of £2........	To No. 257—John Armstrong, 21, Carlisle Mech. Inst., engineer's clerk
Prize of Books, value £1..	,, 769—John K. Page, 25, Birkbeck Lit. and Sci. Inst., clerk
,, ,,	,, 776—George W. Foote, 21, Birkbeck Lit. and Sci. Inst., clerk
,, ,,	,, 875—William J. Bishop, 23, City of London College, foreign correspondent

The Royal Horticultural Society's Prizes have been awarded as follows :—

Floriculture	1st Prize....	£5	To No. 1138—Robert Inglis, 26, Newcastle-on-Tyne Excelsior Temperance Class, gardener
	2nd Prize ..	3	,, 1357—Robert Fuller, 18, Wakefield Mech. Inst., gardener
Fruit and Vegetable Culture	1st Prize....	5	,, 1138—Robert Inglis, 26, Newcastle-on-Tyne Excelsior Temperance Class, gardener
	2nd Prize ..	3	,, 1225—Walter Davis, 23, Richmond Parochial Library, gardener

The Prize of £5 offered by the Royal Geographical Society has been awarded to—

No. 257—John Armstrong, 21, Carlisle Mech. Inst., engineer's clerk

The Prizes offered by the Proprietors of the *Gardeners' Chronicle* have not been awarded, no Candidate having fulfilled the required conditions.

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* No Female Candidate qualified to receive Prizes obtained a First-class Certificate in any of these subjects.

† No other First-class Certificates were given in this subject.

‡ No First-class Certificates were given in this subject.

The Prizes offered by the Council for Writing from Dictation have been awarded as follows:—

1st Prize of £3 to No. 780—Flegg, Robert, 20, Birkbeck Lit. and Sci. Inst., clerk
2nd ,, 2 ,, 1373—Clough, John, 16, York Inst., law stationer's clerk
3rd ,, 1 ,, 702—Gough, James, 24, Leeds Young Men's Chr. Assoc., painter

The Prizes offered by Mr. Henry Cole, C.B., a Vice-President of the Society, for Writing and Manuscript Printing, have been awarded as follows:—

1st Prize of £3 to No. 1320—Skeats, Frank George, 25, Southampton Ath., clerk
2nd ,, 2 ,, 652—Wardle, James W., 21, Leeds Mech. Inst., engineer
3rd ,, 1 ,, 773—Young, William E., 24, Birkbeck Lit. and Sci. Inst., engineer

The Prizes offered by the Council for the four best specimens of Handwriting, as shown in any of the papers worked in any subject, have been awarded as follows:—

1st Prize of £5 to No. 991—Hendré, Francis H., 21, St. Stephen's Evening Sch., Westminster, clerk
2nd ,, 3 ,, 798—Rymer, Edward D. F., 19, Birkbeck Lit. and Sci. Inst., law clerk
3rd ,, 2 ,, 861—Thomson, James H., 16, Birkbeck Lit. and Sci. Inst., clerk
4th ,, 1 ,, 688—Andrews, Richard, 29, Leeds Young Men's Chr. Assoc., clerk

VIVA-VOCE EXAMINATION IN MODERN LANGUAGES.

The vivâ-voce examination in Modern Languages, as proposed in the memorandum furnished by Mr. Hyde Clarke, a Treasurer to the Society, has been held by only one Local Board, viz., that of the Birmingham and Midland Institute, in Spanish, the Examiners reporting the result as follows:—

Richard G. Greening, 20, merchant's clerk, "good."

CERTIFICATES.

The following is an Alphabetical List of the Candidates who have obtained Certificates.

The number following the name gives the age of the Candidate.

(1st) after a subject signifies a First-class Certificate.
(2d) ,, ,, Second-class ,,
(3d) ,, ,, Third-class ,,

The occupations stated are either present or proposed.

868—Abell, Edward G., 22, City of Lond. Coll., blacksmith—Bkpg (1st); Met. Syst. (3d)
869—Abrahams, Moses, 19, City of Lond. Coll., clerk—Fch. (3d)
549—Ackroyd, Herbert, 19, Halifax W.M. Coll., clerk—Bkpg. (3d)
533—Ackroyd, William, 19, Halifax M.I., book-keeper—Eng. Lang. (3d)
659—Acomb, Leonard, 21, Leeds M.I., clerk—Fch. (3d)
1243—Adams, Jessie E., 16, Rugby, at school—Eng. Hist. (2d); Eng. Lang. (3d)
1244—Adams, Marion, 18, Rugby, governess—Eng. Hist. (2d); Fch. (1st)
1205—Adams, William, 19, Pembroke Dock M.I., shipwright (apprentice)—Arith. (2d); Mens. (2d)
870—Adcock, John H., 23, City of Lond. Coll., teacher—Pol. Econ. (1st)
744—Adcock, Thomas, 23, Leicester W.M. Coll., baker—German (3d); Fch. (2d)
207—Affleck, William N., 17, Bradford M.I., clerk—Eng. Hist. (3d)
102—Agnew, Alexander, 22, Belfast People's L.I., clerk—Arith. (3d); Bkpg (1st); Eng. Lang. (3d)
494—Aitken, John, 19, Glasgow M.I., clerk—Latin (3d)
527—Aitkin, Ewing, 17, Glasgow M.I., clerk—Bkpg. (2d)
871—Alexander, William M., 31, City of Lond. Coll., architect's assistant—Arith. (3d); Bkpg. (2d); Mens. (2d)
344—Allan, David S., 30, Glasgow Anderson. Univ. Pop. Evg. Classes, tailor—Mus. Comp. (2d)
405*-Allan, James, 26, Glasgow And. Univ. Pop. Evg. Classes, teacher—Latin (3d)
850—Allen, William A., 17, Birkbeck L. and S.I., pupil-teacher—Geog. (3d)
1280—Almgill, Robert, 20, Salford W.M. Coll., salesman—Bkpg. (3d)
308—Alton, George B., 16, Devonport M.I., engineer student—Arith. (1st); Latin (2d)
1394—Amos, Robert, 18, Hulme W.M.I., clerk—Mens. (3d)
513—Anderson, William, 22, Glasgow M.I., clerk—Mus. Comp. (2d)
1056—Anderton, Thomas, jun., 18, Manchester M.I., tin-plate worker—Arith. (3d); Eng. Hist. (2d)
460—Andrew, Archibald, 20, Glasgow I., teacher—Arith. (1st)
110—Andrew, James, 24, Belfast People's L.I., clerk—Bkpg. (1st)
342—Andrew, Noah, 17, Freetown (Glossop) I., book-keeper—Arith. (2d)
688—Andrews, Richard, 29, Leeds Y.M. Chr. Assoc., clerk—Fourth prize of £1 for Handwriting
775—Angel, Mary D., 19, Birkbeck L. and S.I., governess—Eng. Lang. (3d)
1383—Apperley, William H., 18, Hulme W.M.I., clerk—Bkpg. (2d)
345—Archibald, William R., 18, Glasgow And. Univ. Pop. Evg. Classes, assistant chemist—Arith. (2d)
721—Armitage, Benjamin, 20, Leeds Y.M. Chr. Assoc., book-keeper—Bkpg. (3d); Arith. (3d)
639—Armstrong, Edward O., 23, Leeds Ch. I., book-keeper—Bkpg. (2d)
2587—Armstrong, John, 21, Carlisle M.I., engineer's clerk—Pol. Econ. (1st), with the third prize of

£2; Geog. (1st), with the first prize of £5, and the Royal Geographical Society's prize of £5.

60—Armstrong, John S., 30, Aldershot, gunner—Arith. (3d); Eng. Hist. (2d); Eng. Lang. (3d)

75—Armstrong, Thomas S., 17, Ashford M.I., railway clerk—Arith. (1st)

1319—Arnold, Frederick J., 16, Southampton Ath., clerk on ordnance survey—Arith. (1st)

1164—Ashton, Alfred, 17, Oldham Lyceum, warehouseman—Bkpg. (3d)

736—Atkins, William T., 21, Leicester W.M. Coll., warehouseman—Eng. Lang. (3d); Arith. (3d)

245—Atkinson, Robert L., 17, Carlisle M.I., clerk—Arith. (1st)

286—Atkinson, Roger, 19, Crewe M.I., fitter—Arith. (3d)

1074—Auglin, Samuel, 23, Manchester M.I., engineer—Arith. (2d); Mens. (1st)

407—Auld, Alexander K., 19, Glasgow Ath., assistant-salesman—Bkpg. (3d)

161—Bagshaw, Henry, 23, Bolton Ch. I., book-keeper—Arith. (1st); Bkpg. (3d)

45—Bailey, Herbert, 17, Accrington M.I., clerk—Eng. Hist. (3d)

346—Baird, James S., 20, Glasgow Anderson. Univ. Pop. Ev. Classes, clerk—Pol. Econ. (2d)

330—Baird, Mary S. C., 21, Edinburgh Watt I., governess—Fch. (3d)

630—Baker, Henry F., 20, Ipswich M.I., clerk—Th. of Mus. (2d)

1342—Baker, Orlando, 36, Swindon M.I., clerk—Mus. Comp. (3d); Th. of Mus. (1st)

111—Ball, John, 23, Birm. and Mid. I., warehouseman—Eng. Lang. (3d)

303—Ball, William, 20, Devonport M.I., smith (apprentice)—Mens. (1st)

323—Ballantyne, James, 29, Edinburgh Watt I., factory worker—Mus. Comp. (2d)

1023—Bamber, John, 20, Manchester M.I., timekeeper—Arith. (3d)

1095—Bamforth, William, 19, Manchester M.I., clerk—Bkpg. (3d)

1107—Barber, Arthur H., 18, Manchester M.I., clerk—Eng. Hist. (2d)

806—Barber, Thomas A., 22, Birkbeck L. and S.I., clerk—Fch. (3d)

1282—Bardsley, George R., 16, Salford W.M. Coll., entering clerk—Arith (3d)

78—Barnet, James S., 17, Ashford M.I., pupil-teacher—Arith. (1st)

347—Barr, William B., 19, Glasgow Anderson. Univ. Pop. Evg. Classes, warehouseman—Mus. Comp. (3d); Th. of Mus. (1st), with the second prize of £3

1334—Barratt, Samuel, 19, Stockport Sunday Sch. Imp. Soc., assistant teacher—Arith (1st); Met. Syst. (1st); Geog. (2d)

836—Barrett, Eugene V., 26, Birkbeck Lit. and S.I., clerk—Logic (1st)

1365—Barrett, Jabez C., 27, Ilchester (no occupation stated)—Mus. Comp. (1st)

1166—Barrett, Joseph, 17, Oldham Lyceum, warehouseman—Bkpg. (3d)

619—Barrett, William, 19, Ipswich M.I., clerk—Bkpg. (2d)

825—Barrett, William J. D., 31, Birkbeck Lit. and S.I., clerk—Bkpg. (2d)

550*-Barrowby, Charles E., 18, Halifax W.M. Coll., assistant teacher—Arith (2d)

1086—Barry, Thomas, 18, Manchester M.I., clerk,—Bkpg. (1st); Fch. (3d)

972—Barthes, George, 17, Royal Polyt. I., bank clerk—German (3d)

451—Barton, Peter G. 18, Glasgow I., clerk—Arith. (2d); Bkpg. (2d)

293—Bates, Alfred W., 19, Milford Evg. Sch., Derby, clerk—Bkpg. (2d)

1283—Battersby, Robert, 19, Salford W.M. Coll., clerk—Bkpg. (2d)

1124—Baxter, John, 16, Mossley M.I., tailor—Bkpg. (3d)

349—Baxter, Peter H., 39, Glasgow Anderson. Univ. Pop. Evg. Classes, jeweller's assistant—Mus. Comp. (3d); Th. of Mus. (1st)

301—Bayley, John, 34, Devonport M.I., waiter, H.M. Dockyard—Mens. (1st)

873—Bayley, Travers W., 18, City of Lond. Coll., clerk—Fch. (3d)

199—Beanland, William C., 16, Bradford M.I., manufacturer's apprentice—Eng. Hist. (1st), with the second prize of £3

802—Beattie, Thomas W., 17, Birkbeck L. and S.I., clerk—Fch. (3d)

627—Beaumont, Arthur W., 17, Ipswich M.I., clerk—Bkpg. (2d)

1099—Beckett, George E., 19, Manchester M.I., clerk—Arith. (2d)

1096—Beckett, William F., 21, Manchester M.I., clerk—Fch. (3d)

646—Beecroft, Edmund, 16, Leeds Ch. I., teacher—Geog. (3d)

849—Beer, Henry, 20, Birkbeck L. and S.I., clerk—Bkpg. (1st); Met. Syst. (1st), with the second prize of £3

105—Bennett, Edward, 24, Belfast People's L.I., clerk—Bkpg. (3d)

699—Bentley, William, 21, Leeds Y.M. Chr. Assoc., mechanical draughtsman—Mens. (2d)

1120—Berry, Thomas, 23, Mossley M.I., self-actor minder—Bkpg. (2d)

76—Best, William H., 18, Ashford M.I., railway clerk—Arith. (2d)

975—Bettger, Alfred, 23, Roy. Polyt. I., clerk—Fch. (3d)

1240—Biggs, Annie M., 17, Rugby, at school—Eng. Lang. (3d)

874—Bilson, Francis C., 20, City of Lond. Coll., clerk—Bkpg. (1st)

431—Binnie, William, 18, Glasgow Ath., clerk—Bkpg. (3d); Arith. (3d)

1147—Birch, James N., 18, Newton-heath, All Saints' No. 2 Sci. Class, hydraulic worker—Arith. (3d)

1057—Birchby, William N., 18, Manchester M.I., clerk—Bkpg. (2d)

875—Bishop, William J., 23, City of Lond. Coll., foreign correspondent—Mus. Comp. (2d); Italian (2d); Pol. Econ. (1st); with a Prize of Books to the value of £1.

312—Bissell, Mary, 23, Dudley M.I., schoolmistress—Th. of Mus. (2d)

609—Bixby, Robert, 34, Ipswich M.I., engineer's clerk—Eng. Lang. (3d)

350—Black, John, 17, Glasgow Anderson. Univ. Pop. Evg. Classes, draper—Th. of Mus. (1st)

1071—Blackstock, William, 31, Manchester M.I., clerk—Th. of Mus. (2d)

843—Blackwell, John W., 21, Birkbeck L. and S.I., farmer—Eng. Lang. (2d)

352—Blair, James, 23, Glasgow Anderson. Univ. Pop. Evg. Classes, clerk—Mus. Comp. (2d)

1284—Blake, James H., 17, Salford W.M. Coll., clerk—Bkpg. (2d)

497—Blane, James, 22, Glasgow M.I., clerk—Span. (2d)

112—Blaze, Thomas, 19, Birm. and Mid. I., pupil-teacher—Arith. (1st); Met. Sys. (3d); Geog. (3d)

1068—Bloome, Frederick, 25, Manchester M.I., stock-keeper—Bkpg. (2d)

954*—Blyth, Thomas A., 27, City of Lond. Coll., schoolmaster—Arith. (2d); Eng. Hist. (3d); Eng. Lang. (2d)

1216—Boase, Julia, 31, Penzance, (no occupation stated)—Th. of Mus. (1st)

1236—Bold, Clara, 18, Rugby, at school—Eng. Lang. (3d)

727—Bolton, Arthur, 16, Leeds Y.M. Chr. Assoc., clerk—Eng. Hist. (3d); Eng. Lang. (2d)

296—Bond, Samuel J., 21, Devonport M.I., engineer student—Mens. (1st)
746—Bond, William, 35, Beauvoir Coll., schoolmaster—Mus. Comp. (1st)
755—Bonner, William H., 18, Beauvoir Coll., clerk—Th. of Mus. (2d)
980*-Boon, Edwin J., 25, Royal Polyt. I., teacher—Arith. (3d); Dom. Econ. (1st); Eng. Lang. (3d); Geog (3d)
1054—Booth, James, 17, Manchester M.I., clerk—Arith. (3d)
1034—Booth, John O., 20, Manchester M.I., attorney's clerk—Bkpg. (2d)
1218—Borlase, Kate, 21, Penzance, (no occupation stated)—Mus. Com. (1st)
1218—Borlase, Maria, 19, Penzance, (no occupation stated)—Mus. Comp. (1st)
324—Boyack, John C., 17, Edinburgh Watt I., pupil teacher—Arith. (3d); Eng. Hist. (3d); Eng. Lang. (3d)
523—Boyle, Robert, 24, Glasgow M.I., clerk—Bkpg. (2d)
1089—Bradley, John, 21, Manchester M.I., warehouseman—Arith. (1st); Eng. Hist. (2d)
152—Bradley, Thomas, 23, Bollington Useful Knowledge Society, cotton-piecer—Eng. Lang. (3d)
1382—Brazendale, Edward, 29, Hulme W.M.I., engineer—Bkpg. (3d)
113—Breakspear, John T., 16, Birm. and Midl. I., pupil teacher—Th. of Mus. (1st)
683—Broadbent, James, 29, Leeds Y.M. Chr. Assoc., salesman—Eng. Lang. (3d); Dom. Econ. (1st)
248—Broatch, David, 18, Carlisle M.I., banker's clerk—Arith. (1st)
1014—Brock, Robert, 17, Liverpool I., clerk—Bkpg. (3d)
853—Brook, Edwin, 16, Birkbeck L. and S.I., clerk—Arith. (1st)
9—Brook, James, 33, Aberdeen M.I., mason—Eng. Lang. (3d)
1047—Broster, George A. B., 20, Manchester M.I., clerk—Arith. (2d); Eng. Lang. (3d)
877—Brotherton, Joseph, 26, City of Lond. Coll., assistant master—Arith. (1st)
4—Brown, Alexander, 18, Aberdeen M.I., joiner—Arith. (3d)
353—Brown, George M., 17, Glasgow Anderson. Univ. Pop. Evg. Classes, warehouseman—Th. of Mus. (3d)
1347—Brown, James, 28, Swindon M.I., clerk—Th. of Mus. (3d)
1288—Brown, Peter, 32, Salford W.M. Coll., clerk—Bkpg. (2d)
1036—Brown, Thomas H., 17, Manchester M.I., apprentice in shipping house—Bkpg. (2d)
1160—Brown, William A., 18, Oldham Lyceum, bookkeeper—Arith. (2d)
860—Browne, James S., 17, Birkbeck L. and S.I., banker's clerk—Eng. Hist. (2d)
266—Browne, Leonard G., 19, Cheltenham W.M. Club, engineer—Eng. Hist. (3d)
772—Browning, Alfred J., 21, Birkbeck L. and S.I., clerk—Fch. (3d)
855—Browning, Charles J., 19, Birkbeck L. and S.I., clerk—Arith. (3d)
103—Brownlee, William J., 19, Belfast People's L.I., clerk—Bkpg. (2d)
16—Bruce, Arthur C., 16, Aberdeen M.I., pupil teacher—Arith. (2d); Eng. Lang. (2d)
816—Bruce, Frank, 19, Birkbeck L. and S.I., clerk—Arith (3d); Bkpg. (2d)
1176—Buchanan, David, 24, Paisley Artisans' I., clerk—Bkpg. (2d)
453—Buchanan, William, 21, Glasgow I., clerk—Bkpg. (3d)
1092—Bullough, Thomas, 20, Manchester M.I., pattern card maker—Dom. Econ. (3d); Eng. Lang. (3d); Geog. (3d)
1228—Burgin, Benjamin, 24, Rotherham M.I., Britannia metal stamper—Mus. Comp. (2d); Th. of Mus. (2d)
786—Burgoyne, William, 24, Birkbeck L. and S.I., clerk—Dom. Econ. (1st), with the third prize of £2
876—Burke, Charles, 21, City of Lond. Coll., clerk—German (2d)
234—Burns, William G., 23, Carlisle M.I., french polisher—Arith. (3d)
1207—Burrows, John, 25, Penzance, organist and teacher of music—Mus. Comp. (1st)
306—Burt, Harry, 17, Devonport M.I., engineer student Arith. (2d); Mens. (2d)
317—Burton, Ella, 25, Edinburgh Watt I., teacher—Eng. Hist. (3d); Eng. Lang. (2d)
1194—Butler, George, 19, Pembroke Dock M.I., shipwright (apprentice)—Mens. (1st), with second prize of £3
1187—Butler, Henry T., 17, Parsonstown Y.M. Chr. Assoc., clerk—Arith (1st)
594—Butler, John F., 18, Hull Y. People's Chr. and L.I., clerk—Bkpg. (1st)
608—Butler, Joseph R., 30, Ipswich M.I., foreman of saw-mills—Arith. (3d)
490—Butler, Robert, 23, Glasgow M.I., engineer—Met. Syst. (2d)
830—Byatt, John, 16, Birkbeck L. and S.I., clerk—Arith. (1st); Geog. (3d)

11—Calder, David, 17, Aberdeen M.I., clerk—Arith. (3d)
114—Callaway, William F., 37, Birm. and Midl. I., Independent minister—Mus. Comp. (2d)
62—Calvert, John, 30, Aldershot, soldier—Eng. Hist. (2d); Geog. (2d)
506—Campbell, Daniel, 22, Glasgow M.I., clerk—Mus. Comp. (3d); Th. of Mus. (3d)
878—Campbell, John, 26, City of Lond. Coll., clerk—German (1st); Polit. Econ. (2d)
354—Campbell, Timothy L., 28, Glasgow Anderson. Univ. Pop. Evg. Classes, japanner—Mus. Comp. (2d)
1238—Cardiff, Jane, 18, Rugby, at school—Eng. Hist. (3d); Eng. Lang. (3d)
441—Carmichael, Robert R., 18, Glasgow Ath., muslin salesman—Eng. Lang. (3d)
1395—Carney, John, 28, Hulme W.M.I., maker-up—Arith. (1st); Bkpg. (3d)
144—Carter, William, 21, Blackburn Sci. Sch., pupil teacher—Met. Syst. (1st)
587—Chadwick, George, 20, Hull Y. People's Chr. and L.I., clerk—Bkpg. (2d)
1123—Chadwick, Joseph, 19, Mossley M.I., clerk—Bkpg. (3d)
846—Chamberlayne, Arthur R., 17, Birkbeck L. and S.I., clerk—Eng. Lang. (2d)
880—Champion, Horace E., 17, City of Lond. Coll., clerk—Bkpg. (3d)
803—Chapman, Annie, 35, Birkbeck L. and S.I., teacher—Fch. (2d)
617—Chapman, Robert, 17, Ipswich M.I., pupil teacher—Arith. (1st)
819—Chatterley, Robert J., 24, Birkbeck L. and S.I., warehouseman—Arith. (1st); Met. Syst. (3d)
208—Cheadle, Alfred S., 17, Bradford M.I., warehouseman—Eng. Hist. (3d); Fch. (3d)
328—Chisholm, James, 28, Edinburgh Watt I., clerk—Th. of Mus. (3d)
356—Chisholm, James, 35, Glasgow Anderson. Univ. Pop. Evg. Classes, bookseller's assistant—Mus. Comp. (2d); Th. of Mus. (1st)
857—Chombers, Harry, 22, Birkbeck L. and S.I., clerk—Bkpg. (1st)
1322—Christian, Gilbert A., 16, St. Martin's Sch. of Art, Stamford, pupil teacher—Arith. (1st); Mens. (3d); Geog. (2d)

595—Clark, Edwin, 24, Hull Y. People's Chr. and L.I., clerk—Bkpg. (2d)

1311—Clark, Herbert E., 19, Messrs. Chance's Library, Smethwick, pupil teacher—Arith. (2d); Fch. (3d)

357—Clark, James, 25, Glasgow Anderson. Univ. Pop. Evg. Classes, managing clerk—Th. of Mus. (1st)

310—Clark, Robert G., 32, Devonport M.I., shipwright—Eng. Lang. (2d); Geog. (3d)

1290—Clarke, Albert, 18, Salford W.M. Coll., house decorator—Bkpg. (2d)

881—Clarke, Ebenezer, 20, City of Lond. Coll., clerk—Pol. Econ. (3d)

1289—Clarke, Thomas R., 19, Salford W.M. Coll., salesman—Met. Syst. (1st), with 1st prize of £5; Bkpg. (3d)

1087—Clarkson, Henry H., 20, Manchester M.I., bookseller's assistant—Geog. (3d)

1078—Clarkson, Robert, 23, Manchester M.I., bookkeeper—Bkpg. (2d)

882—Clatworthy, Abraham, 23, City of Lond. Coll., in Civil Service—Arith. (3d); Geog. (3d)

570—Clay, John, 17, Hebden-bridge M.I., warehouseman—Arith. (3d); Eng. Lang. (3d)

551—Clegg, Jonah, 21, Halifax W.M. Coll., maker-up—Arith. (2d)

499—Clerk, Dugald, 17, Glasgow M.I., clerk—Arith. (2d)

1103—Clift, Charles E., 20, Manchester M.I., telegraph clerk—Geog. (2d)

1373—Clough, John, 16, York I., law-stationer's clerk—Arith. (1st); and the Second Prize of £2 in Writing from Dictation.

1210—Cock, Ellen, 24, Penzance, governess—Th. of Mus. (2d)

358—Cockran, John, 34, Glasgow Anderson. Univ. Pop. Evg. Classes, warehouseman—Music Comp. (2d)

544—Cockroft, Sam., 18, Halifax M.I., printer—Eng. Lang. (3d)

302—Cocks, Frederick A., 20, Devonport M.I., engineer student—Mens. (2d)

626—Cole, Charles G., 16, Ipswich M.I., solicitor's clerk—Bkpg. (2d)

1291—Collinge, Harriett, 16, Salford W.M. Coll., pupil teacher—Arith. (3d)

146—Colman, John, 32, Blackburn Sci. Sch., national school master—Th. of Mus. (3d)

511—Connell, William K., 29, Glasgow M.I., clerk—Span. (1st)

1214—Cook, Albert A., 17, Penzance, auctioneer's clerk—Bkpg. (2d)

1245—Cooper, Chas. E., 17, Salford W.M. Coll. (no occupation stated)—Arith. (3d)

1303—Corner, John, 16, Salford W.M. Coll., stationer's apprentice—Arith. (3d)

591—Corner, Robert, 20, Hull Y. People's Chr. and L.I., clerk—Bkpg. (1st)

1069—Cottrill, Jonathan, 16, Manchester M.I., clerk—Bkpg. (2d)

1227—Coward, Henry, 21, Rotherham M.I., spring knife cutter—Mus. Comp. (1st); Th. of Mus. (2d)

1132—Cowell, Charles, 22, Newcastle-on-Tyne Ch. I., clerk—Arith. (2d); Bkpg. (2d)

1417—Cowen, George, 17, Manchester M.I., joiner—Arith. (2d)

826—Cox, James E. 27, Birkbeck L. and S.I., accountant—Dom. Econ. (1st), with a prize of books to the value of £1; Met. Syst. (1st); Geog. (1st), with the second prize of £3

1196—Cozens, James, 17, Pembroke Dock M.I., shipwright (apprentice)—Arith. (2d)

359—Cranston, David, 22, Glasgow Anderson. Univ. Pop. Evg. Classes, engineer—Arith. (2d); Dom. Econ. (1st); Mens. (3d)

1354—Crisp, George Y., 34, Wakefield M.I., mat-maker—Arith. (2d)

974—Crocker, Charles J., 17, Roy. Polyt. I., pupil teacher—Arith. (2d); Eng. Hist. (3d); Geog. (3d)

300—Crocker, John, 19, Devonport M.I., engineer student—Mens. (1st)

598—Crofts, Arthur E. H., 21, Hull Y. People's Chr. and L.I., clerk—Bkpg. (2d)

115—Croghan, William J., 17, Birm. and Midl. I., chemist—Arith. (2d)

580—Crook, Benjamin, 20, Huddersfield M.I., articled clerk—Fch. (3d)

509—Crookston, Andrew W., 20, Glasgow M.I., civil engineer—Arith. (2d); Mens. (2d)

116—Cross, William J., 18, Birm. and Midl. I., guncase maker—Latin (2d)

884—Crutch, Francis G., 25, City of Lond. Coll., clerk—Fch. (1st), with the second prize of £3

486—Crum, Robert, 16, Glasgow M.I., clerk—Bkpg. (3d)

756—Cullingford, James N., 24, Beauvoir Coll., teacher—Mus. Comp. (1st)

360—Cunningham, Andrew, 19, Glasgow Anderson. Univ. Pop. Evg. Classes, grocer—Arith. (3d)

416—Cunningham, John R., jun., 22, Glasgow Ath., clerk—Eng. Hist. (2d); Eng. Lang. (2d)

1139—Cuthbertson, John, 18, Newcastle-on-Tyne Excelsior Temperance Class, clerk—Eng. Lang. (3d)

885—Dallow, Edward, 28, City of Lond Coll., reporter—Bkpg. (2d); Polit. Econ. (2d)

886—Dalton, Alfred, 24, City of London Coll., clerk—Arith. (2d); Bkpg. (2d)

754—Dash, Samuel, 24, Beauvoir Coll., warehouseman—Th. of Mus. (2d)

793—Dashwood, Horace, 19, Birkbeck Lit. and S.I., clerk—Fch. (3d)

361—Davidson, Alexander, 20, Glasgow Anderson. Univ. Pop. Evg. Classes, clerk—Mus. Comp. (2d); Th. of Mus. (2d)

31—Davidson, James, 23, Aberdeen M.I., clerk—Eng. Lang. (3d)

1200—Davies, Joseph, 16, Pembroke Dock M.I., shipwright (apprentice)—Arith. (2d)

1055—Davies, Thomas A., 17, Manchester M.I., assistant Government collector—Bkpg. (2d)

1059—Davies, Thomas W., 17, Manchester M.I., clerk—(proposed)—Arith. (1st); Bkpg. (1st); Eng. Lang. (2d)

1419—Davies, William W., 24, Manchester M.I., clerk—Arith. (2d); Eng. Hist. (2d)

799—Davis, Charles, 18, Birkbeck L. and S.I., woollen warehouseman—Fch. (3d)

888—Davis, Edward J., 21, City of Lond. Coll., clerk—Polit. Econ. (1st)

889—Davis, Frederick, 17, City of London Coll., ship caulker—Bkpg. (3d)

1225—Davis, Walter, 23, Richmond Parochial Library, gardener—Fruit and Veg. Cult. (1st), with second prize of £3, and the Royal Horticultural Society's prize of £3

973—Davis, William J., 20, Highgate L.I., Civil Service—Arith. (1st)

305—Dawe, Thomas, 20, Devonport M.I., clerk—Logic (1st), with the first prize of £5; Eng. Hist. (1st), with the first prize of £5; Pol. Econ. (1st), with the second prize of £3; Geog. (1st), also the Prince Consort's Prize of 25 guineas

1045—Dawson, Charles, 19, Manchester M.I., clerk—Bkpg. (1st)

1390—Dawson, William, 22, Hulme W.M.I., clerk—Arith. (2d)

601—Day, Charles W., 17, Hull People's Chr. and L.I., solicitor's clerk—Bkpg. (3d)

455—Dean, John, 28, Glasgow I., wine-merchant's assistant—Bkpg. (3d)

1241—Demmler, Sophie E., 20, Rugby (no occupation stated)—Eng. Hist. (2d); Eng. Lang. (2d)

997—Dickson, Humphrey C., 17, Liverpool I., clerk—Mens. (2d); Geog. (3d)

864—Dieck, Henry, 32, Birkbeck L. and S.I., clerk—Bkpg. (1st)
890—Dimmock, Henry, 25, City of Lond. Coll., joiner—Bkpg. (2d)
1318—Dixon, John H., 18, Southampton Ath., clerk on Ordnance Survey—Arith (1st)
1359—Dixon, Joseph, jun., 20, Walsall Ch. I., saddler's ironmonger's apprentice—Mens. (1st), with the first prize of £5
1242—Dixon, Susan, 18, Rugby, at school—Arith. (2d); Eng. Hist. (2d); Eng. Lang. (2d)
891—Dobell, Douglas D., 26, City of Lon. Coll., assistant surveyor of taxes—Pol. Econ. (2d)
243—Dobinson, Daniel, 19, Carlisle M.I., teacher—Arith. (2d)
1075—Dodgson, William, 25, Manchester M.I., civil engineer—Mens. (2d)
362—Douglas, John, 21, Glasgow Anderson. Univ. Pop. Evg. Classes, warehouseman—Th. of Mus. (3d)
471—Downie, Walter, 18, Glasgow M.I., tailor—Eng. Lang. (3d)
999—Dowson, John, 24, Liverpool I., clerk—Arith. (3d); Mens. (3d)
629—Drummond, Frank C., 16, Ipswich M.I., clerk—Eng. Hist. (2d)
426—Drummond, Hugh M., 16, Glasgow Ath., engineer—Fch. (2d)
757—Duckett, Thomas, 33, Beauvoir Coll., builder—Mus. Comp. (1st)
162—Duckworth, Walter, 24, Bolton Ch. I., clerk—Eng. Hist. (3d); Geog. (3d)
892—Dukes, Ernest A., 18, City Lond. Coll., clerk—Bkpg (2d)
500—Dunlop, James, 19, Glasgow M.I., engineer—Arith. (2d); Mens. (3d)
1331—Dutton, George D., 19, Stockport Sund. Sch. Imp. Soc., skipmaker—Arith. (3d)
440—Dykes, James, 19, Glasgow Ath., warehouseman—Eng. Lang. (3d)
579—Dyson, William H., 29, Huddersfield M.I., book-keeper—Italian (3d)

1278—Earl, Arthur, 16, Salford W.M. Coll., clerk—Arith. (1st)
34—Easton, David, 21, Aberdeen M.I., clerk—Fch. (2d)
553—Eastwood, Edward, 18, Halifax W.M. Coll., clerk—Bkpg. (3d)
1091—Eccles, William E., 17, Manchester M.I., salesman—Bkpg. (3d)
119—Edmonds, Edward, 20, Birm. and Mid. I., electro-depositor—German (1st), with 1st prize of £5; Fch. (2d)
1133—Edwards, Alfred, 17, Newcastle-on-Tyne Excelsior Temperance Class, clerk—Eng. Lang. (2d)
1011—Edwards, Joseph, 22, Liverpool I., clerk—Bkpg. (3d)
1021—Egan, William M., 18, Liverpool I., clerk—Bkpg. (2d)
894—Elliott, William S., 36, City of Lond. Coll., clerk—Bkpg. (1st)
895—Ellison, Joshua, 21, City of Lond. Coll., teacher—Arith. (3d); Mensur. (3d); Geog. (1st)
732—Elsworth, William, 18, Leeds Y.M. Chr. Assoc. lithographic printer—Eng. Hist. (3d)
160—Entwisle, Ethelbert, 19, Bolton Ch. I., millwright—Arith. (1st); Eng. Hist. (3d); Fch. (2d)
1203—Evans, David, 16, Pembroke Dock M.I., shipwright (apprentice)—Arith. (1st)
625—Evans, Frederic G., 19, Ipswich M.I., pupil-teacher—Bkpg. (2d)
169—Evans, John, 22, Bolton Ch. I., book and store-keeper—Arith. (2d); Bkpg. (3d)
1015—Evans, John, 16, Liverpool I., in an office—Bkpg. (3d)
1016—Evans, Richard, jun., 17, Liverpool I., in an office—Bkpg. (2d)
1197—Eynon, Thomas, 18, Pembroke Dock M.I., shipwright (apprentice)—Mens. (3d)

168—Fallows, Thomas H., 22, Bolton Ch. I., cotton doubler—Fch. (3d)
167—Fallows, William, 24, Bolton Ch. I., clerk—Fch. (3d)
1406—Faloon, Thomas, 23, Lurgan M.I., assistant in linen trade—Bkpg. (2d)
1276—Farnworth, Joshua H., 17, Salford W.M. Coll., warehouseman—Arith. (3d)
664—Fawcett, Alfred, 22, Leeds Y.M. Ch. Assoc., mechanic—Arith. (3d)
817—Feddon, John, 24, Birkbeck L. and S.I., clerk—Arith. (1st); Bkpg. (1st)
42—Fenton, Henry, 37, Accrington M.I., warehouseman—Arith. (1st)
464—Fergus, James, 16, Glasgow M.I., draughtsman—Arith. (1st); Bkpg. (2d)
244—Ferguson, William, 19, Carlisle M.I., clerk—Arith. (1st)
214—Fielding, John, 23, Bradford M.I., clerk—Arith. (2d); Bkpg. (2d); Met. Syst. (2d)
365—Fingland, Samuel, 24, Glasgow Anderson. Univ. Pop. Evg. Classes, warehouseman—Mus. Comp. (1st); Theory of Mus. (1st)
318—Finlay, David G., 17, Edinburgh Watt I., pupil teacher—Arith. (3d); Eng. Lang. (3d)
839—Fish, Robert, 23, Birkbeck L. and S.I., civil service clerk—Logic (3d)
814—Fish, William D., 18, Birkbeck L. and S.I., civil service clerk—Arith. (1st); Bkpg. (2nd); Eng. Lang. (3d); Geog. (2d)
120—Fisher, James P., 20, Birm. and Midl. I., clerk—Latin (3d)
618—Fisk, Frederick C., 20, Ipswich M.I., attorney's clerk—Bkpg. (3d)
854—Fitch, Aubrey, 18, Birkbeck L. and S.I., clerk—Arith. (3d)
1386—Flanagan, Henry, 25, Hulme W.M.I., warehouseman—Bkpg. (3d)
780—Flegg, Robert, 20, Birkbeck L. and S.I., clerk—Arith. (2d); Eng. Hist. (2d); Geog. (2d); 1st Prize of £3 in Writing from Dictation.
459—Fleming, William M., 20, Glasgow I., clerk—Eng. Lang. (3d)
765—Fletcher, Frederick W., 22, Beauvoir Coll., jeweller—Th. of Mus. (1st)
173—Fletcher, Jonas, 19, Bolton Ch. I., clerk—Fch. (3d)
776—Foote, George W., 21, Birkbeck L. and S.I., clerk—Pol. Econ. (1st); with a Prize of books to the value of £1.
366—Forrest, John, 21, Glasgow Anderson Univ. Pop. Evg. Classes, clerk—Th. of Mus. (2d)
476—Forsyth, James H., 18, Glasgow M.I., clerk—Eng. Lang. (3d)
510—Forsyth, John, 16, Glasgow M.I., pupil-teacher—Arith. (1st)
971—Fossey, Mary, 23, Royal Polytechnic I., governess—German (2d)
834—Foulger, James, 41, Birkbeck L. and S.I., buhl-cutter—Logic (3d)
69—Fox, John, 19, Ashford M.I., turner's apprentice—Arith. (2d)
1310—Frankland, William C., 19, Scarboro' M.I., clerk Arith. (1st)
463—Fraser, Hugh C., 20, Glasgow M.I., clerk—Arith. (2d); Bkpg. (2d)
327—Frazer, James H., 18, Edinburgh Watt I., engraver on wood—Arith. (1st)
1231—Freeman, Arthur, 20, Rugby, builder's clerk—Arith. (2d)
957—Frisby, George, 17, R. Polytechnic I., clerk—Arith. (2d); Bkpg. (2d); Eng. Lang. (2d)
981—Fulks, George J., 16, St. Stephen's Evg. School, Westminster, pupil teacher—Arith. (1st); Eng. Hist. (2d); Mens. (3d); Geog. (3d)

1357—Fuller, Robert, 18, Wakefield M.I., gardener—Floriculture (2d), with the Royal Horticultural Society's prize of £3.

437—Fyfe, Leander M., 16, Glasgow Ath., pupil-teacher—Arith. (3d); Eng. Lang. (1st); Geog. (2d)

867*-Gallatly, John, 23, Birkbeck L. and S.I., clerk—Com. Germ. (1st)

367—Galloway, Henry, 25, Glasgow Anderson. Univ. Pop. Evg. Classes, pattern book-maker—Mus. Comp. (3d); Th. of Music (2d)

743—Gamble, Edward D., 43, Leicester W.M. Coll., warehouseman—Germ. (3d)

226—Gannaway, Alfred C., 17, South Bromley Classes, draughtsman—Arith. (2d)

663—Garbutt, John, 32, Leeds Y.M. Chr. Assoc., joiner—Dom. Econ. (3d)

537—Gardam, William, 19, Halifax M.I., clerk—Arith. (3d); Eng. Lang. (3d)

121—Garland, Thomas A., 20, Birm. and Midl. I., clerk—Span. (2d)

701—Garnett, Robert, 26, Leeds Y.M. Chr. Assoc., clerk Bkpg. (2d)

621—Garnham, James, 16, Ipswich M.I., clerk—Bkpg. (3d)

898—Garratt, Thomas, 17, City of Lond. Coll., (no occupation stated)—Bkpg. (3d)

897—Garrett, George W., 28, City of Lond. Coll., book-keeper—Pol. Econ. (3d)

555—Gaskell, Levi, 21, Halifax W.M.C., warp dresser—Bkpg. (3d)

189—Gass, John B., 16, Bolton M.I., clerk—Arith. (2d); Eng. Lang. (2d)

899—Gates, William H., 23, City of Lond. Coll., clerk—Arith. (1st)

368—Gavin, James A., 26, Glasgow Anderson. Univ. Pop. Evg. Classes, clerk—Th. of Mus. (2d)

457—Geddes, John, 31, Glasgow I., teacher—Logic (2d); Fch. (3d); Latin (2d)

1191—George, John, 16, Pembroke Dock M.I., shipwright (apprentice)—Arith. (1st)

900—Gibb, George. 20, City of Lond. Coll., clerk—Bkpg. (2d)

1097—Gibson, Alexander, 17, Manchester M.I., draughtsman—Logic (3d); Dom. Econ. (1st), with a Prize of Books to the value of £1; Mens. (1st); Geog. (2d)

307—Gill, Edward J., 21, Devonport M. I., clerk—Bkpg. (1st), with the second prize of £3

322—Gillespie, David, 30, Edinburgh Watt I., clerk—Bkpg. (2d)

719—Gillgrass, William H., 18, Leeds Y.M. Chris. Assoc., pupil teacher—Eng. Hist. (3d); Geog. (2d); Eng. Lang. (3d)

901—Glenn. Walter W., 20, City of Lond. Coll., clerk—Bkpg. (3d)

642—Gordon, John, 16, Leeds Ch. I., clerk—Eng. Lang. (2d)

812—Gooch, Charles J., 22, Birkbeck L. and S.I., clerk—Bkpg. (2d)

448—Goodlet, Robert, 21, Glasgow I., clerk—Eng. Lang. (3d)

1067—Goodwin. Charles, 18, Manchester M.I., clerk—Bkpg. (2d)

702—Gough. James, 24, Leeds Y.M. Chris. Assoc., painter—The third Prize of £1 for Writing from Dictation

187—Goulding, Samuel, 25, Bolton M.I., cloth finisher—Bkpg. (3d)

369—Gow. Adam L., 22, Glasgow Anderson. Univ. Pop. Evg. Classes, iron founder—Th. of Music (2d)

33—Grant, George, 17, Aberdeen M.I., clerk—Eng. Lang. (3d)

229—Grant, John H., 19, Burnley M.I., teacher—Fch. (3d)

228—Grant, William L., 22, Burnley M.I., accountant and teacher—Fch. (3d)

1188—Gratrix, Timothy, 19, Patricroft M.I., clerk—Arith. (3d); Bkpg. (2d)

370—Gray, Alex., 23, Glasgow Anderson. Univ. Pop. Evg. Classes, clerk—Th. of Mus. (2d)

462—Gray, David, 27, Glasgow M.I., book-keeper—Mus. Comp. (2d)

573—Greaves, James B., 16, Holbeck M.I., draper—Arith. (3d); Bkpg. (3d)

1157—Greaves, John W., 20, Oldham Lyceum, warehouseman—Arith. (1st); Bkpg. (1st); Eng. Lang. (2d)

750—Green, Charles E., 27, Beauvoir Coll., cabinet maker—Mus. Comp. (2d); Th. of Mus. (2d)

581—Green, John T., 16, Huddersfield M.I., clerk—Fch. (3d)

832—Green, John W., 20, Birkbeck L. and S.I., clerk—Bkpg. (3d)

1179—Greenlees, Robert, 24, Paisley Artizans' I., warehouseman—Th. of Music (2d)

94—Greenwood, Wilson, 20, Bacup M.I., mule spinner—Arith. (2d)

258—Gregory, Benjamin, 30, Cheltenham W.M. Club, clerk—Mens. (3d); Bkpg. (3d)

586—Grey, John, 24, Hull Young People's Chr. and Lit. I., gardener—Flor. (3d); Fruit and Veget. Cult. (2d)

64—Griffith, Arthur, 21, Aldershot, soldier—Arith. (3d)

1422—Griffiths, John A., 23, Manchester M.I., engineer student—Mus. Comp. (2d)

612—Grimwade, Sidney R., 17, Ipswich M.I., clerk—Eng. Hist. (3d)

904—Groocock, Edwin, 16, City of London Coll., architect and surveyor—Arith. (3d)

122—Grundy, Harriette, 24, Birm. and Midl. I., assistant school mistress—Eng. Lang. (2d); Geog. (1st)

1162—Hague, Charles, 19, Oldham Lyceum, warehouseman—Arith. (3d)

1129—Haigh, James, 22, Mossley M.I., maker-up—Bkpg. (3d)

623—Hale, Charles E., 25, Ipswich M.I., compositor—Bkpg. (3d)

808—Hale, John W., 16, Birkbeck L. and S.I., solicitor's clerk—Fch. (3d)

123—Hall, Alfred, 19, Birm. and Midl. I., clerk—Arith. (2d); Mens. (3d); Geog. (3d)

675—Hall, Richard, 21, Leeds Y.M. Chr. Assoc., butcher Arith. (3d); Bkpg. (2d)

603—Hall, Thomas N., 20, Hull Y. People's Chr. and L.I., clerk—Bkpg. (2d)

905—Hallam, John, 20, City of Lon. Coll., clerk—Fch. (3d)

145—Halliwell, Edwin, 35, Blackburn Sci. Sch., national schoolmaster—Arith. (1st); Eng. Hist. (1st); Eng. Lang. (1st)

63—Halloran, Thomas, 24, Aldershot, soldier—Arith. (1st); Mens. (3d)

80—Hamer, Ralph T., 19, Bacup M.I., Weaver—Dom. Econ. (2d)

372—Hamilton, James, 28, Glasgow Anderson. Univ. Pop. Evg. Classes, joiner—Th. of Mus. (2d)

615—Hammond, Charles, 17, Ipswich M.I., newspaper reporter—Eng. Lang. (1st)

790—Hammond, John, 22, Birkbeck L. and S.I., clerk—Arith. (1st); Met. Syst. (2d); Bkpg. (2d)

791—Hanna, William, 27, Birkbeck L. and S.I., clerk—Arith. (1st); Eng. Hist. (2d); Eng. Lang. (3d); Geog. (2d)

824—Hannington, Smith, 20, Birkbeck L. and S.I., gas fitter—Arith. (2d); Met. Syst. (2d)

406—Hardie, David, 20, Glasgow Ath., clerk—Com. Fch. (1st)

410—Hardie, Francis W., 18, Glasgow Ath., clerk—Fch. (2d)

671—Hardy, Joseph, 16, Leeds Y.M. Chr. Assoc., warehouseman—Eng. Lang. (3d)
414—Harley, Joan H., 21, Glasgow Ath. (no occupation stated)—Fch. (2d)
858—Harman, Henry, 17, Birkbeck L. and S.I., pupil teacher—Eng. Lang. (3d)
605—Harris, Simon, 30, Hull Y. People's Chr. and L.I., clerk—Bkpg. (1st)
762—Harris, William C., 34, Beauvoir Coll., clerk—Th. of Mus. (1st), with the first prize of £5
66—Harrison, William, 20, Ashford M.I., turner's apprentice—Arith. (2d)
1209—Harry, Caroline, 23, Penzance, teacher of music—Th. of Mus. (1st)
508—Hart, Andrew, 17, Glasgow M.I. (no occupation stated)—Eng. Lang. (3d)
676—Hartman, Frederick C., 19, Leeds Y.M. Chr. A., clerk—Arith. (1st); Eng. Lang. (3d)
124—Harvey, John T., 23, Birm. and Midl. I., teacher—Fch. (3d)
866—Harvey, William A., 17, Birkbeck L. and S.I., clerk—Eng. Hist. (3d); Eng. Lang. (3d)
969—Haselden, William H., 18, Roy. Polyt. I., clerk—Arith. (3d)
158—Haslam, James R., 19, Bolton Ch. I., law clerk—Geog. (2d)
164—Haslam, William H., 17, Bolton Ch. I., clerk—Arith. (2d); Bkpg. (3d)
1401—Hatfield, Charles A., 19, St. John's I., Wednesbury, clerk—Bkpg. (3d)
264—Hayward, Charles, 17, Cheltenham W.M. Club, pupil teacher—Arith. (2d)
79—Hayward, William, 28, Ashford M.I., tailor—Germ. (1st); Eng. Lang. (1st)
165—Heap, John R., 30, Bolton Ch. I., schoolmaster—Fch. (2d)
1270—Heap, Richard, 32, Salford W.M. Coll., clerk—Germ. (3d)
298—Heath, John, 19, Devonport M.I. (no occupation stated)—Bkpg. (3d); Fch. (3d)
73—Heckels, Richard D., 17, Ashford M.I., railway clerk—Bkpg. (1st)
962—Henderson, David G., 24, Royal Polyt. Inst., clerk—Fch. (2d)
3—Henderson, John, 20, Aberdeen M.I., shoemaker—Eng. Lang. (3d)
991—Hendré, Francis H., 21, St. Stephen's Evg. Sch., Westminster, clerk—Germ. (3d); Fch. (3d); Latin (2d), and the 1st prize of £5 for handwriting
1324—Henshaw, Frederic, 16, St. Martin's Sch. of Art, Stamford, pupil teacher—Geog. (3d)
545—Heyhurst, Phineas, 21, Halifax M.I., cabinet maker—Mens. (2d)
1029—Heywood, Charles, 21, Manchester M.I., clerk—Eng. Lang. (3d)
1221—Heywood, John J., 20, Avenham Inst., Preston, clerk—Mens. (2d)
213—Heyworth, William, 20, Bradford M.I., in stuff warehouse, Fch. (3d)
224—Hill, Arthur, 17, S. Bromley Classes, clerk—Arith. (2d)
906—Hill, Arthur, 17, City of Lond. Coll., clerk—Bkpg. (3d)
847—Hill, Gilbert J., 16, Birkbeck L. and S.I., clerk—Bkpg. (3d)
1094—Hill, Jane, 21, Manchester M.I., dressmaker—Dom. Econ. (3d)
606—Hill, William W., 30, Hull Young People's Chr. and L.I., engineer's clerk—Bkpg. (2d)
556—Hinchliffe, Albert, 17, Halifax W.M. Coll., clerk—Bkpg. (3d)
216—Hindle, John E., 19, Bradford M.I., overlooker—Arith. (3d)
125—Hirons, Charles A., 22, Birm. and Midl. I., clerk—Bkpg. (3d)
907—Hobbs, William H., 28, City of Lond. Coll., clerk—Bkpg. (2d)
865—Hodges, John E., 20, Birkbeck L. and S.I., clerk—Bkpg. (2d)
1315—Hoey, Henry J., 20, Southampton Ath., clerk on Ordnance Survey—Geog. (3d)
829—Hoffmeister, John M., 22, Birkbeck L. and S.I., porter—Arith. (1st)
1040—Hogg, James, 25, Manchester M.I., mechanic—Arith. (3d); Dom. Econ. (2d); Mens. (3d)
375—Hogg, Thos., 27, Glasgow Anderson. Univ. Pop. Evg. Classes, gardener—Flori. (3d); Fruit and Veg. Cult. (2d)
126—Holbrook, George W. H., 17, Birm. and Midl. I., pupil-teacher—Arith. (2d)
1125—Holden, Frederick, 19, Mossley M.I., pupil-teacher—Arith. (3d); Geog. (3d)
1350—Holding, Azariah, 18, Tottington Mut. Imp. Soc., clogger—Arith. (3d)
1159—Hollingworth, George H., 19, Oldham Lyceum, book-keeper—Mens. (2d)
202—Holroyd, Samwell, 18, Bradford M.I., clerk—Arith. (1st)
1391—Holt, Charles W., 27, Hulme W.M.I., clerk—Bkpg. (2d)
1268—Holt, Samuel, 16, Salford W.M. Coll., clerk—Arith. (3d)
1269—Holt, Thomas, 18, Salford W.M. Coll., engraver—Arith. (3d)
231—Hope, John L., 19, Carlisle M.I. (no occupation stated)—Arith. (1st)
908—Hopwood, Edwin E., 18, City of Lond. Coll., clerk—Bkpg. (2d)
1175—Hornby, Alexander, 16, Oldham Lyceum, assistant pupil-teacher—Arith. (1st)
749—Hotine, Henry, 48, Beauvoir Coll., warehouseman—Mus. Comp. (3d); Th. of Mus. (2d)
1146—Howard, John A., 21, Newton-heath All Saints No. 2 Sci. Class, clerk—Arith. (3d)
98—Howarth, John W., 29, Bacup M.I., woollen-printer—Mus. Comp. (2d); Theory of Mus. (3d)
288—Howarth, William, 23, Dean Mills Evg. Classes, book-keeper—Bkpg. (3d)
461—Howden, John, 22, Glasgow M.I., engineer—Arith. (2d)
241—Howie, Robert, 17, Carlisle M.I. (no occupation stated)—Arith (2d)
1010—Howorth, Benjamin, 17, Liverpool Inst., accountant's assistant—Arith. (2d); Bkpg. (3d); Eng. Lang. (2d); Geog. (3d)
84—Hoyle, Sarah, 18, Bacup M.I. (no occupation stated)—Dom. Econ. (2d)
188—Hulton, Samuel, 28, Bolton M.I., cloth finisher—Arith. (3d)
470—Hunter, Thomas, 22, Glasgow M.I., compositor—Eng. Lang. (3d)

539—Illingworth, Thomas, 21, Halifax M.I., mechanic—Eng. Lang. (3d)
1110—Ingham, John, 20, Manchester M.I., clerk—Arith. (3d); Bkpg. (1st)
209—Ingham, John, 23, Bradford M.I., warehouseman Eng. Hist. (2d)
558—Ingham, William H., 18, Halifax W.M.C., overlooker—Bkpg. (3d)
1138—Inglis, Robert, 26, Newcastle-on-Tyne Excelsior Temperance Class, gardener—Floric. (1st), with 1st prize of £5, and the Royal Hort. Society's prize of £5; Fruit and Veg. Cult. (1st), with 1st prize of £5, and the Royal Hort. Society's prize of £5
8—Ingram, Alexander, 19, Aberdeen M.I., granite-dresser—Eng. Lang. (3d)
432—Ingram, David, 19, Glasgow Ath., clerk—Fch. (3d)
436—Innes, George, 19, Glasgow Ath., clerk—Fch. (3d)

147—Isherwood, Thomas, 28, Blackburn Science Sch., teacher—Eng. Lang. (1st)

512—Jack, William S., 17, Glasgow M.I., merchant—Mus. Comp. (3d)
578—Jackson, Joe, 18, Huddersfield M.I., clerk—Bkpg. (3d) ; Fch. (3d)
694—Jackson, William, 22, Leeds Y.M. Christ. Assoc., clerk—Arith. (3d) ; Bkpg. (2d)
1360*James, Job, 20, Walsall Ch. I., clerk—Bkpg. (3d)
128—James, John M., 20, Birm. and Midl. I., assistant-schoolmaster—Fch. (2d)
1195—James, John R., 18, Pembroke Dock M.I., shipwright (apprentice)—Arith. (2d) ; Mens. (3d)
910—Jauralde, Alexander, 22, City of Lond. Coll., clerk—Span. (1st)
911—Jay, Samuel A., 19, City of Lond. Coll., writer in Privy Council office—Arith. (3d)
1213—Jenkin, George E., 19, Penzance, accountant—Eng. Hist. (3d)
1193—Jenkins. Philip, 17, Pembroke Dock M.I., ship wright (apprentice)—Mens. (2d)
800—Johnson, Edward J. W., 17, Birkbeck L. and S.I., silversmith—Fch. (3d)
517—Johnston, David, 18, Glasgow M.I., designer—Mus. Comp. (2d) ; Th. of Mus. (1st)
1048—Johnston, William, 19, Manchester M.I., book-keeper—Arith. (2d) ; Eng. Lang. (2d)
269—Jones, Allen F., 16, Cheltenham W.M. Club, surveyor's apprentice—Mens. (2d)
1204—Jones, John, 17, Pembroke Dock M.I., shipwright (apprentice)—Arith. (2d)
1022—Jones, Robert, 22, Manchester M.I., warehouseman—Arith. (2d) ; Bkpg. (2d)
153—Jones, William, 22, Bollington Useful Knowledge Soc., cotton-spinner—Arith. (3d)
1001—Jones, William C., 47, Liverpool I., fellmonger—Mus. Comp. (1st)
262—Joyner, Frederick W., 18, Cheltenham W.M. Club, teacher—Eng. Hist. (2d) ; Eng. Lang. (2d) ; Geog. (3d)

1260—Kay, Herbert, 18, Salford W.M. Coll., clerk—Bkpg. (3d)
1261—Kay, Reuben, 25, Salford W.M. Coll., clerk—Geog. (2d)
1262—Kay, William, 16, Salford W.M. Coll., saddler—Arith. (3d)
913—Keeble, George T., 24, City of London Coll., clerk—Pol. Econ. (2nd)
1112—Keen, Thomas, 19, Manchester M.I., clerk—Bkpg. (2d)
74—Keene, James G., 16, Ashford M.I., railway clerk—Arith. (3d)
485—Keith, Joseph, 20, Glasgow M.I., clerk—Bkpg. (3d)
271—Keller, Denis D., 19, Cork Cath. Y.M. Soc., accountant—Arith. (3d) ; Eng. Lang. (2d)
708—Kemp, James V., Leeds Y.M. Chr. Assoc., cloth finisher—Arith. (1st) ; Eng. Hist. (3d) ; Eng. Lang. (3d) ; Geog. (3d)
1140—Kenmir, George, 20, Newcastle-on-Tyne Excelsior Temperance Class, compositor—Eng. Lang. (3d)
378—Kerr, James H., 28, Glasgow Anderson. Univ. Pop. Evg. Classes, goldsmith—Mus. Comp. (3d) ; Th. of Mus. (3d)
559—Kershaw, Leonard, 22, Halifax W.M.C., schoolmaster—Bkpg. (3d)
760—Kett, Francis L., 25, Beauvoir Coll., teacher—Th. of Mus. (2d)
647—Kidney, John, 21, Leeds M.I., solicitor's clerk—Dom. Econ. (1st), with the second prize of £3 ; Met. Syst. (1st) ; Latin (3d)
770—King, Benjamin G., 23, Birkbeck L. and S.I.—book-keeper—Bkpg. (2d)
771—Kirk, John C., 19, Birkbeck L. and S.I., clerk—Bkpg. (2d)

546—Kitchen, Cooper, 18, Halifax M.I., apprentice to an ironmonger—Eng. Hist. (2d) ; Mens. (3d)
458—Kyle, David, 28, Glasgow I., gardener—Bkpg. (3d)

335—Landale, Isabella, 24, Edinburgh Watt I., (no occupation stated)—Fch. (3d)
379—Lang, William F., 20, Glasgow Anderson. Univ. Pop. Evg. Classes, engineer—Arith. (1st) ; Mens. (3d)
977—Larke, Arthur, 21, Royal Polyt. I., clerk—Arith. (1st) ; Geog. (3d)
766—Lascaridi, Peter T., 19, Birkbeck L. and S.I., clerk—Pol. Econ. (2d)
611—Last, Frederick D., 17, Ipswich M.I., clerk—Bkpg. (2d)
284—Latham, William B., 18, Crewe M.I., fitter and turner—Arith. (3d) ; Eng. Hist, (3d)
413—Lawcock, Anna B., 17, Glasgow Ath., (no occupation stated)—Fch. (2d)
1309—Lawrence, Hamilton E., 16, Scarbro' M.I., clerk—Arith. (1st)
818—Lawrence, Julia, 17, Birkbeck L. and S.I., (no occupation stated)—Bkpg. (3d)
915—Lawson, Henry, 21, City of Lond. Coll., clerk—Geog. (2d)
916—Lawson, James A., 18, City of Lond. Coll., clerk—Arith. (2d)
841—Lawson, William T., 16, Birkbeck L. and S.I., clerk—Arith. (3d) ; Eng. Hist. (2d)
917—Ledger, George, 21, City of Lond. Coll., clerk—Pol. Econ. (1st) ; Span. (1st)
1178—Lee, Charles H., 19, Paisley Artizans' I., clerk—Arith. (2d)
49—Lee, Thomas, 30, Aldershot, soldier—Arith. (1st)
656—Lee, William, 21, Leeds M.I., mechanic—Arith. (1st)
794—Levy, Louis, 16, Birkbeck L. and S.I., (no occupation stated)—Fch. (3d)
259—Lewis, William F., 31, Cheltenham W.M. Club, schoolmaster—Arith. (2d) ; Dom. Econ. (1st) ; Mens. (3d) ; Geog. (2d)
23—Lindsay, John, 16, Aberdeen M.I., clerk—Geog. (3d)
380—Linn, Maggie, 21, Glasgow Anderson. Univ. Pop. Evg. Classes, at school—Th. of Mus. (2d)
1128—Lister, Alfred, 22, Mossley M.I., book-keeper—Bkpg. (3d)
1116—Livesey, James, 18, Manchester M.I., clerk—Arith. (3d) ; Bkpg (3d)
918—Lloyd, Charles E., 23, City of Lond. Coll., clerk—Span. (2d)
1117—Locke, Joseph, 21, Manchester M.I., clerk—Bkpg. (2d)
525—Lockie, John, 18, Glasgow M.I., engineer—Arith. (1st)
479—Logie, William J., 20, Glasgow M.I., salesman—Eng. Lang. (3d)
673—London, Thomas, 29, Leeds Y.M. Chr. Assoc., teacher—Dom. Econ. (1st) ; Eng. Lang. (1st) ; Fruit and Veg. Cult. (3d)
255—Lord, Alfred, 17, Carlisle M.I., attorney's clerk—Mens. (3d)
418—Lorimer, William, 31, Glasgow Ath., clerk—Fch. (2d)
129—Louch, Alfred W., 21, Birm. and Midl. I., jeweller—Eng. Hist. (3d)
130—Lovett, William J., 18, Birm. and Midl. I., rose engine-turner—Met. Sys. (2d)
99—Lowden, James, 20, Belfast People's L.I., book-keeper—Bkpg. (2d)
813—Lowrie, Augustus F., 25, Birkbeck L. and S.I., clerk—Bkpg. (2d)
1258—Lucas, John E., 17, Salford W.M. Coll., warehouseman—Latin (2d)
541—Lumb, Dixon, 20, Halifax M.I., card maker—Arith. (3d) ; Eng. Hist. (3d)

1020—Lynas, Joseph, 17, Liverpool I., clerk—Bkpg. (3d)

469—Macdonald, James, 27, Glasgow M.I., customs officer—Eng. Lang. (3d)

1180—Macfarlane, Peter, 25, Paisley Artizans' Inst., brass-finisher—Mus. Comp. (2d) ; Th. of Mus. (2d)

764—MacKenzie, Alexander, 40, Beauvoir Coll., clerk—Th. of Mus. (2d)

518—Mac Laren, John, 22, Glasgow M.I., clerk—Span. (1st)

919—Maclaren, R. S., 25, City of Lond. Coll., clerk—Bkpg. (1st)

382—Macnair, John C., 25, Glasgow Anderson. Univ. Pop. Evg. Classes, clerk—Th. of Mus. (2d)

845—Madden, Ronald G., 23, Birkbeck L. and S.I., clerk—Arith. (2d) ; Bkpg. (3d) ; Fch. (2d)

83—Maden, Isabella, 22, Bacup M.I., (no occupation stated)—Dom. Econ. (1st) with the £2 Prize for Females.

542—Mallinson, James E., 19, Halifax M.I., clerk—Arith. (1st)

283—Mann, Henry, 18, Crewe M.I., fitter (apprentice) Arith. (3d) ; Eng. Lang. (3d)

51—Marchant, Edward T., 24, Aldershot, soldier—Arith. (1st)

200—Marchbank, Marshall, 17, Bradford M.I., manufacturer's apprentice—Arith. (3d)

132—Marlow, Frederick G., 20, Birm. and Midl. I., teacher—Geog. (2d)

37—Marr, Alexander, 26, Aberdeen M.I., clerk—Bkpg. (1st) ; Eng. Lang. (2d)

428—Marshall, James, 16, Glasgow Ath., warehouseman—Fch. (3d)

405—Marshall, James N., 21, Glasgow Anderson. Pop. Evg. Classes, commercial traveller—Th. of Mus. (2d)

498—Marshall, William, 20, Glasgow M.I., clerk—Bkpg. (2d)

820—Marston, Emma L., 34, Birkbeck L. and S.I., governess—Eng. Lang. (2d) ; Geog. (2d)

920—Martin, Arthur J., 17, City of Lond. Coll., clerk—Arith. (3d)

588—Martin, John, 23, Hull Y. People's Chr. and L.I., clerk—Bkpg. (2d)

782—Martin, Mary E., 22, Birkbeck L. and S.I., (no occupation stated)—Germ. (2d)

1115—Massey, William T., 18, Manchester M.I., maker-up—Bkpg. (2d)

921—Masters, John, 17, City of Lond. Coll., artificial limb maker—Dom. Econ. (1st)

774—Matthews, Thomas, 25, Birkbeck L. and S.I., teacher—Th. of Mus. (3d) ; Fch. (3d) ; Latin (3d)

922—Mavity, Frederick W., 17, City of Lond. Coll., clerk—Arith. (2d) ; Bkpg. (3d)

133—Maxwell, Charles E., 20, Birm. and Midl. I., clerk—Eng. Lang. (3d)

923—May, William, 21, City of Lond. Coll., clerk—Fch. (3d)

1257—Mayor, William, 18, Salford W.M. Coll., clerk—Arith. (2d)

505—McAllister, Robert, 23, Glasgow M.I., baker—Mus. Comp. (2d)

427—McAlpine, John, 20, Glasgow Ath., warehouseman—Logic (2d) ; Bkpg. (2d) ; Pol. Econ. (1st), with the first prize of £5

329—McCankie, James, 22, Edinburgh Watt I., clerk—Bkpg. (2d)

276 McCarthy, Edward V., 17, Cork Cath. Y.M. Soc., in an office—Logic (3d) ; Mens. (3d)

530—McCloyd, Robert, 19, Gilford Y.M. Mut. Imp. Soc., book-keeper—Bkpg. (2d)

592—McCollin, Donald, 26, Hull Young People's Chr. and Lit. Inst., engineer—Bkpg. (3d)

474—McConechy, Neil, 22, Glasgow M.I., clerk—Bkpg. (3d)

483—McCutchion, James, jun., 16, Glasgow M.I., clerk—Bkpg. (3d)

481—McGlashan, James, 18, Glasgow M.I., engineer's apprentice—Arith. (2d)

194—McKay, George P., 17, Bradford M.I., book-keeper—Arith. (2d)

1134—McKendrick, William, 23, Newcastle-on-Tyne Excelsior Temperance Class, clerk — Mus. Comp. (2d)

493—McKnight, Joseph, 19, Glasgow M.I., law clerk—Latin (3d)

384—McKinnon, William K., 23, Glasgow Anderson. Univ. Pop. Evg. Classes, cork cutter—Th. of Mus. (2d)

480—McLaren, Alex. 24, Glasgow M.I., engineer—Span. (3d)

13—McLean, George, 28, Aberdeen M.I., clerk—Bkpg. (3d) ; Eng. Lang. (2d)

1076—McMillan, John, jun., 16, Manchester M.I., clerk—Arith. (3d)

748—McNaught, William G., 22, Beauvoir Coll., clerk—Mus. Comp. (1st), with the second prize of £3

253—McNicol, Joseph B., 16, Carlisle M.I., pupil teacher—Arith. (3d)

447—McSkimming, William, 19, Glasgow I., clerk—Arith. (1st) ; Bkpg. (2d) ; Eng. Lang. (3d)

100—Meharg, Hugh, 19, Belfast People's L.I., clerk—Bkpg. (2d)

423—Mellis, Robert McH. jun., 20, Glasgow Ath., in civil service—Eng. Lang. (1st), with the first prize of £5

1384—Mellor, William, 26, Hulme W.M.I., warehouseman—Bkpg. (3d)

751—Merritt, George, jun., 22, Beauvoir Coll., clerk—Mus. Comp. (2d) ; Th. of Mus. (3d)

39—Meston, William, 21, Aberdeen M.I., clerk—Th. of Mus. (3d)

385—Millar, Alexander H., 23, Glasgow Anderson. Univ. Pop. Evg. Classes, upholsterer—Mus. Comp. (1st)

827—Miller, William W., 20, Birkbeck Lit. and Sci. Inst., clerk—Arith. (2d)

720—Mills, James, 24, Leeds Y.M. Chr. Assoc., schoolmaster—Eng. Lang. (3d)

1388—Mills, James, 22, Hulme W.M.I., gardener—Flor. (2d) ; Fruit and Vegetable Culture (2d) ; Bkpg. (3d)

134—Mills, Marian, 29, Birm. and Midl. I. (no occupation stated)—Arith. (2d)

1061—Mills, Thomas G., 20, Manchester M.I., draughtsman—Bkpg. (2d) ; Mens. (3d)

14—Milne, James, 17, Aberdeen M.I., clerk—Bkpg. (3d)

1005—Milne, John H., 19, Liverpool I. (no occupation stated)—Eng. Lang. (3d) ; Latin (3d)

1323—Mitchell, Henry W., 18, St. Martin's School of Art, Stamford, terra-cotta finisher — Arith. (3d)

232—Moffett, John J., 20, Carlisle M.I., attorney's clerk—Arith. (3d)

1039—Monaghan, William, 20, Manchester M.I., delivery clerk—Bkpg. (3d)

925—Monday, Alfred, 21, City of London Coll., clerk—Fch (3d).

1407—Mooney, Thomas, 29, Lurgan M.I., teacher—Bkpg. (2d)

1161—Moore, Octavius, 20, Oldham Lyceum, mechanic—Met. Syst. (3d)

661—Moorhouse, James C., 18, Leeds M.I., mechanic—Arith. (3d)

1201—Morgans, Henry J., 17, Pembroke Dock M.I., shipwright (apprentice)—Arith. (3d)

1032—Morris, William H. 20, Manchester M.I., clerk—German (2d)

35—Morrison, James, 25, Aberdeen M.I., clerk—Bkpg. (3d) ; Eng. Lang. (2d)

67—Mortleman, George, 18, Ashford M.I., fitter's apprentice—Arith. (2d)
263—Morton, Henry, 16, Cheltenham W.M. Club., lawyer (proposed)—Eng. Lang. (3d)
560—Morton, Sidney, 19, Halifax W.M. Club, warehouseman—Bkpg. (3d)
1253—Morton, William, 17, Salford W.M. Coll., in a warehouse—Bkpg. (3d)
926—Mosey, Philip S., 22, City of London Coll., clerk—Bkpg. (2d)
927—Mountjoy, Richard A., 28, City of London Coll., clerk—Arith. (1st); Fch. (3d); Geog. (2d)
387—Muir, Alexander, jun., 16, Glasgow Anderson. Univ. Pop. Evg. Classes, at school—Arith. (3d)
531—Mulligan, William M., 21, Gilford Y.M., Mut. Imp. Soc., clerk—Fch. (2d)
781—Mungeam, Mary S., 28, Birkbeck L. and S.I., (no occupation stated)—Germ. (2d); Fch. (3d)
163—Murphy, Peter, 17, Bolton Ch. Inst., piecer—Arith (3d)
24—Murray, John I., 19, Aberdeen M.I., railway clerk—Arith. (1st); Eng. Lang. (3d)
247—Murray, William, 23, Carlisle M.I. (no occupation stated)—Arith. (2d); Eng. Hist. (3d)
1181—Murray, William H., 21, Paisley Artizans' Inst., clerk—Th. of Mus. (1st)
1135—Myers, James, 30, Newcastle-on-Tyne Excelsior Temperance Class, potter—Bkpg. (3d)

387—Neilson, David, 25, Glasgow Anderson. Univ. Pop. Ev. Classes, weigher—Mens. (2d)
1024—Nelson, George, 24, Manchester M.I., buyer (proposed)—Fch. (3d); Com. Fch. (1st)
842—Nevill, James F., 18, Birkbeck L. and S.I., clerk—Bkpg. (3d)
637—Newton, George, 20, Leeds Ch. Inst., clerk—Bkpg. (3d)
856—Newton, Richard B., 17, Birkbeck L. and S.I., assistant in geological museum—Eng. Hist. (2d); Eng. Lang. (3d)
267—Niblett, Alfred, 16, Cheltenham W.M. Club, soda water manufacturer—Arith. (2d); Eng. Lang. (2d); Geog. (3d)
1251—Nichols, James W., 18, Salford W.M. Coll. draughtsman—Arith. (3d)
1250—Nichols, William, 19, Salford W.M. Coll., clerk—Arith. (2d)
1037—Nightingale, William, 17, Manchester M.I., clerk—Bkpg. (2d)
389—Nimmo, James, 16, Glasgow Anderson. Univ. Pop. Evg. Classes, pupil teacher—Arith. (1st)
1182—Niven, Robert, 20, Paisley Artizans' Inst., clerk—Arith. (2d)
445—Nixon, James, 19, Glasgow I., draper's assistant—Bkpg. (2d)
1249—Noar, Herbert, 19, Salford W.M. Coll. clerk—Bkpg. (2d); Fch. (3d)
985—Nobes, Henry J., 19, Lambeth Evg. Classes, teacher—Arith. (3d); Eng. Hist. (3d); Eng. Lang. (3d)
966—Norman, Alfred, 31, Royal Polytechnic I., commercial traveller—Bkpg. (3d)
135—Norman, John G., 26, Birm. and Midl. I., jeweller—Fch. (3d)
956—Norris, James, 22, Roy. Polyt. I., clerk—Arith. (2d); Fch. (3d)
672—Northrop, James, 21, Leeds Y.M. Chr. Assoc., clerk—Arith. (1st); Geog. (3d)
1248—Nuttall, Edward B., 21, Salford W.M. Coll., clerk—Arith. (1st); Bkpg. (2d); Span. (1st)
89—Nuttall, Samuel, 16, Bacup M.I., warehouse-boy—Arith. (3d)
963—Nye, Henry, 20, Roy. Polyt. I., clerk—Fch. (2d)

747—O'Brien, Edward, 28, Beauvoir Coll., law stationer—Mus. Comp. (2d)
1093—O'Donnell, Elizabeth, 23, Manchester M.I., umbrella maker—Dom. Econ. (3d)
277—O'Driscoll, Daniel, 18, Cork Catholic Y.M. Soc., assistant book-keeper—Arith. (3d)
28—Ogilvie, Robert, 21, Aberdeen M.I., hardware merchant—Eng. Lang. (3d)
837—Oliver, Edward W., 28, Birkbeck L. and S.I., solicitor's clerk—Logic (2d)
1353—Orrell, Charles, 17, Tottington Mut. Imp. Soc., warehouseman—Arith. (3d)
616—Orriss, James S., 21, Ipswich M.I., accountant—Eng. Lang. (3d)
823—Osborne, John H., 19, Birkbeck L. and S.I., clerk—Met. Syst. (2d)
1230—Over, George E., 17, Rugby, bookseller's assistant—Bkpg. (2d)
1232—Over, Henry W., 20, Rugby, clerk—Bkpg. (2d)
1030—Owen, William A., 17, Manchester M.I., clerk—Fch. (3d)
1360—Owen, William C., 25, Walsall Ch. I., gig-saddler—Arith. (2d); Eng. Lang. (2d)

733*-Padgett, John W., 26, Leeds Y.M. Chr. Assoc., boot and shoe salesman—Bkpg. (3d)
928—Page, Edmund, 17, City of Lond. Coll., architect's assistant—Arith. (1st); Eng. Lang. (2d); Geog. (3d)
718—Page, James, 16, Leeds Y.M. Christ. Assoc., clerk—Arith. (3d); Eng. Hist. (3d)
769—Page, John K., 25, Birkbeck L. and S.I., clerk—Pol. Econ. (1st), with a prize of books to the value of £1
696—Palliser, John W., 22, Leeds Y.M. Christ. Assoc., art student—Eng. Lang. (3d)
568—Parker, John, 18, Hebden-bridge M.I., factory operative—Arith. (3d)
92—Parker, John H., 19, Bacup M.I., weaver—Dom. Econ. (2d)
929—Parker, John J., 22, City of Lond. Coll., clerk—Bkpg. (1st.); Eng. Lang. (2d)
1418—Parkes, Robert, 20, Manchester M.I., engraver's apprentice—Bkpg. (1st); Pol. Econ. (3d)
1083—Parkes, Walter, 22, Manchester M.I., solicitor's clerk—Fch. (3d)
1126—Parkin, William, 19, Mossley M.I., minder—Bkpg. (2d)
1051—Parkins, Sidney, 18, Manchester M.I., photographic artist—Bkpg. (2d); Geog. (3d)
1006—Parkinson, William, 19, Liverpool I., clerk—Eng. Lang. (3d)
136—Parsons, George C. T., 21, Birm. and Midl. Inst., clerk—Mus. Comp. (1st)
1052—Partington, Ralph, 20, Manchester M.I., clerk—Bkpg. (2d)
151—Payne, James, jun., 33, Blandford L.I., attorney's clerk—Eng. Lang. (2d)
978—Pearson, Robert H., 31, Roy. Polytechnic I., clerk—Bkpg. (3d)
1185—Peart, Thomas, 16, Parsonstown Y.M. Chr. Assoc., farmer—Arith. (3d)
1108—Peddie, William, 16, Manchester M.I., clerk—Arith. (3d)
176—Pennington, Robert T., 26, Bolton Ch. Inst., warehouseman—Bkpg. (3d)
848—Pentony, Rebecca E., 30, Birkbeck L. and S.I., governess—Germ. (1st); Fch. (2d)
1414—Pettitt, Frederick M., 19, Manchester M.I., book-keeper—Fch. (3d)
1316—Petty, John, jun., 25, Southampton Ath., Customs officer—Arith. (2d)
32—Philip, Margaret J., 16, Aberdeen M.I. (no occupation stated)—Fch. (2d)
149—Phillips, Harry, 28, Blackburn Sci. Sch., schoolmaster—Arith. (1st); Met. Syst. (3d)
390—Picken, James, 21, Glasgow Anderson. Univ. Pop. Evg. Classes, teacher—Arith. (2d)

958—Pickering, Edward, 20, Roy. Polytechnic I., clerk and foreign correspondent—Span. (1st); Eng. Lang. (1st)
157—Pickering, Thomas, 22, Bolton Ch. I., clerk—Th. of Mus. (1st); Eng. Lang. (1st)
631—Pickup, Henry, 18, Irwell I., woollen spinner—Arith. (1st)
1348—Pilkington, Samuel W., 17, Tottington Mut. Imp. Soc., pupil-teacher—Arith. (3d)
1349—Pilkington, Thomas, 21, Tottington Mut. Imp. Soc., weaver—Arith. (3d)
1050—Pilling, Thomas, 18, Manchester M.I., clerk—Arith. (2d); Bkpg. (2d)
662—Pillow, Edward, 18, Leeds M.I., mechanic—Arith. (2d); Eng. Hist. (3d)
648—Pindar, George A., 17, Leeds M.I., printer—Arith. (3d); Geog. (3d)
930—Pollard, Henry T., 23, City of Lond. Coll., clerk—Bkpg. (2d)
831—Pollard, Kate, 24, Birkbeck L. and S. I., governess—Fch. (2d)
1118—Pollard, William, 17, Manchester M.I., clerk—Bkpg. (2d)
1247—Pollitt, William, 19, Salford W.M. Coll., clerk—Italian (2d); Eng. Lang. (1st) with the second prize of £3; Latin (1st), with the first prize of £5
211—Popplewell, William, 16, Bradford M.I., clerk—Arith. (2d)
1410—Porter, George, 27, Lurgan M.I., teacher—Arith. (1st); Bkpg. (3d)
1136—Porteus, Joseph, 26, Newcastle-on-Tyne Excelsior Temperance Class, tailor and draper—Mus. Comp. (3d)
668—Potts, Alfred, 17, Leeds Y.M. Chr. Assoc., clerk—Bkpg. (2d)
1246—Powell, William E., 24, Salford W.M. Coll., clerk—Latin (2d)
71—Prankerd, Samuel, 16, Ashford M.I., driller—Arith. (1st)
65—Precious, Henry, 16, Ashford M.I., turner's apprentice—Arith. (3d)
1332—Prestwich, David, 18, Stockport Sunday Sch. Imp. Soc., in an office—Eng. Hist. (3d); Geog. (2d)
1119—Price, Thomas, 19, Manchester M.I., porter—Arith. (3d)
931—Prior, Samuel J. B., 23, City of Lond. Coll., coal merchant—Fch. (3d)
391—Provan, Andrew, jun., 21, Glasgow Anderson. Univ. Pop. Evg. Classes, clerk—Th. of Mus. (2d)
295—Pudner, William H., 21, Devonport M.I., clerk—Arith. (1st); Bkpg. (2d)
684—Pullon, Henry, 16, Leeds Y.M. Chr. Assoc., surgeon's pupil—Eng. Lang. (3d)
658—Pullon, Joseph T., 20, Leeds M.I., mechanic—Dom. Econ. (3d)
730—Purchon, Samuel R., 20, Leeds Y.M. Chr. Assoc., lithographer—Eng. Lang. (3d); Geog. (3d)

1013—Quail, George, jun., 21, Liverpool I., clerk—Mus. Comp. (3d); Th. of Mus. (2d)
976—Quick, John H., 21, Royal Polytechnic I., solicitor's clerk—Fch. (3d)

666—Raby, John, 17, Leeds Y.M. Chr. Assoc., pupil teacher—Arith. (2d); Eng. Lang. (3d); Geog. (1st); Eng. Hist. (3d)
1426—Radcliffe, Frederick A., 17, Manchester M.I., clerk—Span. (1st)
137—Radclyffe, Frederick C. P., 19, Birm. and Midl. I., chemist—Met. Syst. (2d)
1307—Radford, Frank, 17, Salford W.M. Coll., insurance clerk—Geog. (3d)
863—Randle, Samuel B., 28, Birkbeck Lit. and Sci. I., warehouseman—Logic (2d)
805—Rawlinson, Walter G., 19, Birkbeck Lit. and Sci. Inst., solicitor's clerk—Geog. (3d)
1062—Redfearn, Abraham, 17, Manchester M.I., warehouse boy—Bkpg. (2d); Eng. Lang. (3d)
1088—Redfern, John R., 18, Manchester M.I., clerk—Fch. (3d); Span. (3d)
1371—Reed, Benjamin, 16, York I., pupil teacher—Arith. (2d)
1325—Reedman, Benjamin, 18, St. Martin's Sch. of Art, Stamford, carpenter and joiner—Arith. (3d); Geog. (3d)
435—Reid, David, 19, Glasgow Ath., clerk—Fch. (3d)
392—Reid, Robert, 33, Glasgow And. Univ. Pop. Evg. Classes, boot and shoemaker—Mus. Comp. (3d); Th. of Mus. (2d)
1411—Reid, William J., 17, Lurgan M.I., apprentice in linen trade—Bkpg. (3d)
106—Reilly, Patrick, 25, Belfast People's Lit. I., clerk—Bkpg. (3d)
1199—Richards, Joseph, 20, Pembroke Dock M.I., pupil teacher—Eng. Hist. (2d); Geog. (2d)
640—Ridge, Alfred, 17, Leeds Ch. I., pupil teacher—Th. of Mus. (2d).
150—Riley, William, 46, Blackburn Sci. Sch., teacher—Arith. (1st); Geog. (3d)
649—Rinder, Samuel S., 16, Leeds M.I., apprentice to cloth business—Arith. (3d); Eng. Hist. (3d)
961—Riorden, George J., 20, Royal Polytechnic I., engraver—Fch. (2d)
1038—Ritchie, Joshua, 18, Manchester M.I., clerk—Bkpg. (2d)
811—Roberts, Robert A., 17, Birkbeck Lit. and Sci. I., clerk—Logic (3d); Bkpg. (2d); Geog. (3d)
660—Roberts, William B., 16, Leeds M.I., nail cutter—Arith. (1st)
529—Robertson, Archibald, 16, Glasgow M.I., joiner—Arith. (2d)
393—Robertson, James A., 18, Glasgow Anderson. Univ. Pop. Evg. Classes, at school—Arith. (3d)
2—Robertson, John, 22, Aberdeen M.I., clerk—Eng. Lang. (3d)
562—Robinson, Aminadab, 19, Halifax W.M.C., clerk—Bkpg. (3d)
1306—Robinson, James I., 20, Salford W.M Coll., clerk—Bkpg. (2d)
995—Robinson, John, 18, Liverpool I., clerk—Bkpg. (2d)
932—Rolfe, William T., 39, City of Lond. Coll., clerk in Admiralty Court—Bkpg. (1st)
933—Rookwood, Joseph, 16, City of Lond. Coll., surveyor—Bkpg. (2d)
934—Rose, John H., 23, City of Lond. Coll., clerk—Eng. Hist. (3d); Eng. Lang. (2d)
1219—Ross, Caroline H., 18, Penzance (no occupation stated)—Th. of Mus. (1st)
331—Ross, David, 22, Edinburgh Watt I., clerk—Eng. Lang. (2d)
487—Ross, Hew R., 17, Glasgow M.I., clerk—Bkpg. (3d)
59—Ross, Hugh, 27, Aldershot, soldier—Arith. (3d)
394—Ross, Zachary M. H., 19, Glasgow Anderson. Univ. Evg. Classes, student—Logic (1st); Eng. Lang (2d); Latin (2d)
148—Rostrom, Isaiah, 22, Blackburn Sci. Sch., schoolmaster—Pol. Econ. (3d)
294—Rowe, Frederic G., 29, Derby, grocer—Mus. Comp. (2d)
610—Rushbrooke, Joseph, 24, Ipswich M.I., clothier's assistant—Pol. Econ. (3d)
548—Rushworth, Ratcliffe, 23, Halifax M.I. timekeeper—Eng. Hist. (2d); Fch. (3d)
442—Russell, Robert, 20, Glasgow Ath., clerk—Fch. (2d)
936—Rust, Thomas, 22, City of Lond. Coll., clerk—Bkpg. (3d)
798—Rymer, Edward D. F., 19, Birkbeck L. and S.I., law clerk—Fch. (2d), and the 2nd prize of £3 for handwriting

955—Salter, William, 26, Royal Polyt. I., engraver—Bkpg. (1st), with the first Prize of £5

937—Sargeant, George D., 20, City of Lond. Coll., builder—Bkpg. (2d)

938—Sargeant, James D, 17, City of Lond. Coll., clerk—Arith. (3d)

250—Sayer, Thomas, 17, Carlisle M.I. (no occupation stated)—Arith. (1st)

1122—Schofield, John, 18, Mossley M.I., piecer—Bkpg. (2d)

726—Scholefield, Walter, 17, Leeds Y.M. Christ. Assoc. clerk—Eng. Lang. (3d)

670—Scholes, Thomas, 27, Leeds Y.M. Christ. Assoc., book-keeper—Arith. (3d)

1423—Scott, William B., 18, Manchester M.I., student Fch. (3d)

395—Scouller, John, 24, Glasgow Anderson. Univ. Evg. Classes, clerk—Mus. Comp. (3d)

622—Scrivener, John, 16, Ipswich M. I., clerk—Bkpg. (3d)

939—Seamon, William F., 25, City of Lond. Coll., clerk—Bkpg. (1st)

292—Selby, Joseph, 16, Derby, pupil-teacher—Th. of Mus. (2d)

515—Shand, James, 21, Glasgow M.I., warehouseman—Th. of Mus. (3d)

309—Shapcote, Richard A., 19, Devonport M.I., engineer student—Arith. (1st); Mens. (2d)

291—Sharpe, Margaret, 17, Derby (no occupation stated)—Arith. (2d); Eng. Hist. (2d); French (2d)

577—Sharpe, Samuel, 16, Huddersfield M.I., warehouse-boy—Arith. (2d)

1156—Shaw, John W., 23, Oldham Lyceum, piecer—Arith. (3d); Bkpg. (3d)

681—Sheard, John, 22, Leeds Y.M. Christ. Assoc., clerk—Arith. (1st); Bkpg. (2d)

1012—Shepherd, John, 21, Liverpool I., smith—Mus. Comp. (2d)

1072—Shiel, Thomas J., 21, Manchester M.I., book-keeper—Logic (1st), with 2nd prize of £3; Pol. Econ. (2d)

778—Shirley, Joseph H., 17, Birkbeck L. and S.I., clerk—Eng. Lang. (2d)

682—Shoesmith, George, 21, Leeds Y.M. Christ. Assoc., currier—Bkpg. (3d)

1008—Shore, William J., 18, Liverpool I., assistant shipping-agent—Arith. (3d); Dom. Econ. (1st); Pol. Econ. (3d)

1098—Sidebotham, George H., 19, Manchester M.I., clerk—Span. (3d)

68—Silverwood, Thomas A., 18, Ashford M.I., metal-turner—Arith. (2d)

27—Sim, John, 18, Aberdeen M.I., clerk—Fch. (3d)

215—Sim, William H. C., 19, Bradford M.I., clerk—Bkpg. (1st)

1144—Simister, James W., 16, New Mills (near Stockport) W.M.I., pupil teacher—Arith. (3d)

1033—Simlott, Henry, 23, Manchester M.I., clerk—Bkpg. (1st)

563—Simpson, Edward, 17, Halifax W.M. Coll., pupil teacher—Eng. Lang. (3d)

321—Sinclair, Allan, 29, Edinburgh Watt I., sergeant and clerk, Edinburgh County Constabulary—Eng. Lang. (2d)

1320—Skeats, Frank G., 25, Southampton Ath., clerk—Logic (3d); Bkpg. (2d); Eng. Lang (2d); Geog. (2d), and the first Prize of £3 for Writing and Manuscript Printing

236—Skelton, John, 16, Carlisle M.I. (no occupation stated)—Arith. (3d); Bkpg. (2d)

593—Slack, Henry, 20, Hull Young People's Chr. and Lit. I., clerk—Bkpg. (2d)

940—Slade, George F., 19, City of London Coll., clerk—Arith. (2d)

1080—Slater, Frederick, 19, Manchester M.I., clerk—Fch. (3d)

252—Slater, Joseph, 17, Carlisle M.I. (no occupation stated)—Arith. (1st); Eng. Hist. (3d); Mens. (3d); Geog. (3d)

325—Slight, John, 26, Edinburgh Watt I., clerk—Bkpg. (2d)

1043—Smethurst, George H., 21, Manchester M.I., assistant—Bkpg. (3d)

316—Smith, Benjamin, 20, Eccleshill M.I., warehouseman—Fch. (3d)

941—Smith, Edwin A., 22, City of London Coll., clerk Span. (1st)

613—Smith, Harry, 20, Ipswich M.I., clerk—Eng. Hist. (2d)

473—Smith, James M., 18, Glasgow M.I., compositor—Eng. Lang. (3d)

810—Smith, John H. A., 20, Birkbeck L. and S.I., transfer clerk—Bkpg. (2d)

1424—Smith, John R., 17, Manchester M.I., in a warehouse—Bkpg. (3d); Eng. Lang. (3d)

260—Smith, Robert, 27, Cheltenham W.M. Club, gardener—Geog. (3d)

942—Smith, William A., 20, City of London Coll., clerk, —Bkpg. (2d)

620—Smyth, Robert W., 16, Ipswich M.I., clerk—Bkpg. (2d)

624—Snell, Robert, 16, Ipswich M.I., baker—Bkpg. (3d)

783—Snow, Horace W., 20, Birkbeck L. and S.I., clerk—Fch. (3d)

205—Snowden, George R., jun., 21, Bradford M.I., joiner and cabinet maker—Arith. (3d)

809—Solomon, Jessy L., 19, Birkbeck L. and S.I., teacher of music—Fch. (3d)

943—Spiller, Arthur, 18, City of Lond. Coll., civil service clerk—Arith. (1st)

964—Stammwitz, Amelia, 25, Royal Polyt. I. (no occupation stated)—Germ. (2d)

959—Stammwitz, Louisa, 21, Royal Polyt. I. (no occupation stated)—Germ. (2d); Fch. (3d)

564—Stansfield, Edward, 16, Halifax W.M. Coll., grocer—Bkpg. (3d)

337—Stapley, Charles R., 16, Farnham, engineer—Eng. Lang. (3d)

635—Stead, Thomas, 18, Leeds Ch. I., clerk—Bkpg. (1st)

655—Stead, William J., 17, Leeds M.I., banker's clerk Arith. (3d)

29—Steele, Andrew, 16, Aberdeen M.I., pupil teacher—Arith. (1st)

584—Stephenson, William, 26, Hull Young People's Chr. and L.I., tobacco manufacturer's assistant—Dom. Econ. (1st), with a prize of books to the value of £1; Met. Syst. (2d)

519—Stewart, Charles, 18, Glasgow M.I., clerk—Span. (1st)

398—Stewart, George C., 26, Glasgow Anderson. Univ. Evg. Classes, clerk—Mus. Comp. (1st)

1211—Stewart, Henry, 17, Penzance, tin-plate worker (proposed)—Mens. (3d)

944—Stockham, James A., 17, City of Lond. Coll., clerk—Arith. (3d)

945—Stockman, George N., 20, City of Lond. Coll, clerk—Bkpg. (2d)

439—Strang, Robert K., 20, Glasgow Ath., clerk—Span. (1st), with 2nd prize of £3

399—Struthers, Thomas R., 19, Glasgow Anderson. Univ. Evg. Classes, tailor—Th. of Mus. (2d)

607—Sutcliffe, Charles T., 18, Ipswich M.I., newspaper agent and reporter—Th. of Mus. (2d)

95—Sutcliffe, John, jun., 18, Bacup M.I., draughtsman—Dom. Econ. (2d)

1408—Sutton, Alexander A., 22, Lurgan M.I., clerk—Bkpg. (2d)

645—Sutton, Edward, 17, Leeds Ch. I., clerk—Bkpg. (1st); Eng. Lang. (3d)

1090—Sutton, Richard H., 18, Manchester M.I., bookseller's assistant—Arith. (2d)

946—Swain, John, 17, City of Lond. Coll., clerk—Bkpg. (3d)
758—Swynfin, Herbert F., 20, Beauvoir Coll., clerk—Mus. Comp. (2d)
576—Sykes, Charles C., 17, Huddersfield M.I., warehouse boy—Fch. (3d)
572—Sykes, Joseph, 20, Holbeck M.I., factory hand—Arith. (3d); Bkpg. (3d)
590—Sykes, Samuel, 26, Hull Y. People's Chr. and L. I., clerk—Bkpg. (3d)
1046—Sykes, William E., Manchester M.I., apprentice—Germ. (2d); Fch. (3d)

1079—Taggart, William, 22, Manchester M.I., clerk—Fch. (3d)
22—Tait, James, 29, Aberdeen M.I., clerk—Germ. (1st), with the second prize of £3
1137—Tait, James H., 18, Newcastle-on-Tyne Excelsior Temperance Class, clerk—Bkpg. (3d)
516—Tait, John, 27, Glasgow M.I., cabinet maker—Theory of Music (3d)
982—Tapp, George W., 22, St. Stephen's Evg. School, Westminster, clerk—Bkpg. (2d)
728—Tasker, Joseph, 19, Leeds Y.M. Chr. Assoc., butcher—Bkpg. (2d)
139—Taylor, Annie M., 23, Birm. and Midl. I. (no occupation stated)—Th. of Mus. (2d)
138—Taylor, Aulton, 20, Birm. and Midl. I., clerk—Bkpg. (2d)
514—Taylor, Charles, 21, Glasgow M.I., boot and shoe cutter—Mus. Comp. (3d); Th. of Mus. (2d)
752—Taylor, Henry, 35, Beauvoir Coll., schoolmaster—Mus. Comp. (2d)
140—Taylor, James, 35, Birm. and Midl. I., clerk—Germ. (1st)
93—Taylor, James H., 22, Bacup M.I., roller coverer—Dom. Econ. (2d)
1104—Taylor, John H., 21, Manchester M.I., land surveyor—Arith. (3d); Mens. (3d)
582—Taylor, Percy, 21, Hull Young People's Chr. and L.I., clerk—Arith. (1st)
1060—Taylor, Thomas, 19, Manchester M.I., warehouseman—Arith. (3d); Bkpg. (1st)
1158—Taylor, William, 18, Oldham Lyceum, warehouseman—Mens. (2d)
599—Taylor, William H., 20, Hull Y. People's Chr. and L.I., clerk—Bkpg. (2d)
657—Taylor, William S., 16, Leeds M.I., clerk—Arith. (1st); Met. Sys. (1st)
222—Terrell, James, 18, S. Bromley Classes, clerk—Arith. (3d)
256—Terry, George, 31, Carlisle M.I., teacher—Th. of Mus. (1st)
1389—Tetlow, Walter F., 19, Hulme W.M.I., clerk—Arith. (3d)
521—Thom, Jasper, 17, Glasgow M.I., pupil teacher—Arith. (1st); Th. of Mus. (3d)
1202—Thomas, Alfred, 18, Pembroke Dock M.I., shipwright (apprentice)—Arith. (2d); Mens. (3d)
1198—Thomas, George M., 18, Pembroke Dock M.I., shipwright (apprentice)—Arith. (2d); Geog. (2d)
689—Thompson, Alfred, 18, Leeds Y.M. Chr. A., joiner—Bkpg. (3d)
443—Thompson, Richard, 20, Glasgow I., clerk—Arith. (3d); Bkpg. (3d)
444—Thomson, James, 29, Glasgow I., warehouseman—Eng. Lang. (3d)
861—Thomson, James H., 16, Birkbeck L. and S.I., clerk—Logic (2d); Met. Syst. (1st), and the third Prize of £2 for Handwriting
21—Thomson, William, 18, Aberdeen M.I., clerk—Eng. Lang. (3d)
844—Thorn, Arthur G., 16, Birkbeck L. and S.I., clerk—Met. Syst. (2d); Geog. (2d)
677—Tiffany, John B., 27, Leeds Y.M. Chr. Asssoc., tobacco manufacturer—Met. Syst. (1st)
238—Tiffen, John, 19, Carlisle M.I., shoemaker—Arith. (2d)
991*-Tilt, Edward S., 19, Lambeth Evg. Classes, clerk—Fch. (3d)
565—Timewell, Fred, 21, Halifax W.M. Coll., rug finisher—Bkpg. (2d)
1167—Toft, John J., 17, Oldham Lyceum, book-keeper Arith. (2d)
695—Tomlinson, John W., 20, Leeds Y.M. Chr. Assoc., mechanic—Arith. (3d)
1206—Trayler, Jonas N., 23, Pembroke Dock M.I., tanner and currier—Arith. (1st); Eng. Lang. (1st)
297—Treleaven, Joseph T., 21, Devonport M.I., shipwright—Dom. Econ. (1st), with the first prize of £5; Pol. Econ. (2d)
763—Treverton, Mrs. George F., 26, Beauvoir Coll., fancy box maker—Th. of Mus. (3d)
965—Troake, Edwin, 24, Royal Polyt. I., government messenger—Arith. (3d); Eng. Hist. (2d); Eng. Lang. (2d); Geog. (3d)
1208—Trounson, Susan M., 17, Penzance, (no occupation stated)—Th. of Mus. (3d)
1192—Turl, Charles P., 16, Pembroke Dock M.I., pupil-teacher—Arith. (2d)
1183—Turnbull, George, jun., 19, Paisley Artizan's I., clerk—Bkpg. (2d)
249—Turner, William, 17, Carlisle M.I., pupil-teacher—Arith. (2d)
1073—Turner, William J., 17., Manchester M.I., clerk—Bkpg. (3d)

1387—Urie, Thomas, jun., 20, Hulme W.M.I., clerk—Bkpg. (2d)
1070—Urquhart, Alexander H., 18, Manchester M.I., clerk—Eng. Hist. (2d); Eng. Lang. (3d)
491—Urquhart, John, 17, Glasgow M.I., clerk—Latin (3d)

1026—Vickers, Eli L., 16, Manchester M.I., clerk—Bkpg. (2d)
1027—Vickers, John C., 18, Manchester M.I., book-keeper—Bkpg. (1st)
1100—Vickers, Robert F., 21, Manchester M.I., clerk—Arith. (2d); Eng. Hist. (2d)
70—Vie, Edward J., 16, Ashford M.I., teacher—Arith. (1st); Bkpg. (3d); Eng. Lang. (2d); Geog. (2d)
1212—Vingoe, Alexander L., 19, Penzance, pupil-teacher—Mus. Comp. (1st), with 1st prize of £5
1378—Volans, William, 29, York I., book-keeper—Bkpg. (2d)
289—Vose, James, 18, Dean Mills Evg. Classes, pupil-teacher—Eng. Lang. (3d)
1053—Vosper, Henry, 20, Manchester M.I., buyer—Pol. Econ. (3d); Dom. Econ. (1st); Geog. (2d)

815—Waddington, William H., 17, Birkbeck L. and S.I., clerk—Bkpg. (2d); Met. Syst. (1st)
77—Waite, William T., 17, Ashford M.I., pupil-teacher—Arith. (3d)
1237—Walker, Alice, 17, Rugby, (no occupation stated)—Fch. (2d)
949—Walker, Daniel, 28, City of Lond. Coll., tradesman—Eng. Hist. (1st); Eng. Lang. (2d)
634—Walker, Frederick W., 17, Leeds Ch. I., pupil-teacher—Eng. Hist. (3d)
1300—Walker, Joseph, 20, Salford W.M. Coll., clerk—Arith. (3d)
1239—Walker, Kate, 18, Rugby, (no occupation stated)—Fch. (3d)
1301—Walker, Thomas, 17, Salford W.M. Coll., clerk—Arith. (3d)
950—Walker, William, 21, City of Lond. Coll., warehouseman—Bkpg. (3d)
522—Wallace, James, 20, Glasgow M.I., clerk—Span. (1st)

170—Wallace, James W., 17, Bolton Ch. I., clerk—Arith. (1st); Eng. Hist. (2d); Fch. (3d)

989—Wallack, Harry J. A., 16, St. Stephen's Evg. Sch., Westminster, clerk—Fch. (3d)

1113—Wallis, George, 21, Manchester M.I., hosier and glover—Bkpg. (2d)

566—Walsh, Walter, 18, Halifax W.M. Coll., boot finisher—Eng. Lang. (3d)

141—Ward, Thomas, 17, Birm. and Midl. I., clerk—Arith. (1st)

206—Ward, Thomas L., 19, Bradford M.I., clerk—Fch. (3d)

652—Wardle, James W., 21, Leeds M.I., engineer—Arith. (1st); Met. Syst. (1st), and the second Prize of £2 for Writing and Manuscript Printing

1077—Wardle, John, 19, Manchester M.I., clerk—Arith. (3d); Eng. Hist. (3d); Fch. (2d); Com. Fch. (1st)

1044—Wardle, William, 21, Manchester M.I., clerk—Bkpg. (2d)

339—Warr, Thomas, 31, Faversham I., agent—Mus. Comp. (2d)

1111—Waterhouse, Alfred, 17, Manchester M.I., surveyor's apprentice—Arith. (2d); Mens. (3d)

36—Watson, Alexander G., 19, Aberdeen M.I., cloth finisher—Eng. Lang. (2d)

242—Watson, Isaac, 20, Carlisle M.I., (no occupation stated)—Arith. (2d)

15—Watt, George, 23, Aberdeen M.I., clerk—Fch. (3d)

401—Wauds, Frederick, 16, Glasgow Anderson. Univ. Pop. Evg. Classes, musician—Th. of Mus. (2d)

951—Way, Thomas H., 25, City of Lond. Coll., teacher—Eng. Hist. (2d)

725—Weatherburn, Thomas, 16, Leeds Y.M. Christ. Assoc., office boy—Eng. Hist. (2d)

583—Wells, George F., 18, Hull Y. People's Christ. and L.I., plumber—Arith. (3d)

1226—Wharhirst, John, 25, Rotherham M.I., chaser—Arith. (3d)

299—Wheeler, George H., 19, Devonport M.I., clerk—Arith. (2d); Bkpg. (2d)

1019—Whinerey, Robert, 21, Liverpool I., invoice-clerk—Bkpg. (3d)

1308—Whipp, George, 20, Scarborough M.I., joiner—Arith. (3d)

96—Whitaker, John, 19, Bacup M.I., clerk—Arith. (1st), with the 1st prize of £5

952—White, Henry G., 20, City of Lond. Coll., clerk—Fch. (3d)

1004—White, Henry T., 29, Liverpool I., clerk—Mus. Comp. (2d)

733—Whiteley, Benjamin, 21, Leeds Y.M. Christ. Assoc., clerk—Bkpg. (1st)

602—Whiteley, John W., 26, Hull Y. People's Chr. and L.I., clerk—Bkpg. (2d)

1085—Whitelowe, Edward T., 16, Manchester M.I., engineer's assistant—Germ. (3d); Met. Syst. (2d)

536—Whitley, Phineas, 19, Halifax M.I., teacher of music—Th. of Mus. (2d)

235—Whittaker, Archibald, 20, Carlisle M.I., (no occupation stated)—Arith. (2d)

1292—Whyatt, Lewis, 18, Salford W.M. Coll., draughtsman—Arith. (3d)

156—Wild, Frederick, 17, Bolton Ch. I., charcoal-grinder—Arith. (3d); Geog. (3d)

254—Wild, William, 18, Carlisle M.I., engineer's clerk—Bkpg. (2d)

852—Wilkinson, Jeannette G., 27, Birkbeck L. and S.I., upholstress—English Hist. (2d); Pol. Econ. (2d)

1151—Willan, George, 17, Newton Heath, All Saint's No. 2 Sci. Class, clerk—Arith. (1st)

753—Williams, Benjamin M., 38, Beauvoir Coll., compositor—Th. of Mus. (3d)

1007—Williams, Daniel P., 39, Liverpool I., grocer—Mus. Comp. (3d); Th. of Mus. (1st)

851—Williams, Edward P., 24, Birkbeck L. and S.I., clerk—Bkpg. (2d); Pol. Econ. (2d)

644—Willis, Ambrose R., 21, Leeds Ch. I., national schoolmaster—Arith. (1st); Eng. Hist. (2d); Eng. Lang. (1st); Geog. (1st)

953—Willoughby, William H., 29, City of Lond. Coll., shopman—Span. (1st), with first Prize of £5

19—Wilson, Annie, 17, Aberdeen M.I., (no occupation stated)—Fch. (2d)

30—Wilson, George, 20, Aberdeen M.I., clerk—Fch. (2d)

438—Wilson, James, 22, Glasgow Ath., clerk—Fch. (1st), with the 1st prize of £5

520—Wilson, James, 22, Glasgow M.I., clerk—Span. (3d)

1141—Wilson, John, 35, Newcastle-on-Tyne Excelsior Temperance Class, joiner—Logic (3d)

142—Wilson, Joseph A., 22, Birm. and Midl. I., clerk—Eng. Hist. (2d); Geog. (2d)

290—Wilson, Kate M., 18, Derby, (no occupation stated)—Eng. Hist. (3d); Geog. (3d)

38—Wilson, Mary J., 20, Aberdeen M.I., (no occupation stated)—Fch. (1st), and the £2 prize for females

107—Wilson, Matthew, 28, Belfast People's L.I., clerk—Bkpg. (2d)

1131—Wilson, Thomas, 19, Newcastle-on-Tyne Ch. I., clerk—Arith. (2d); Bkpg. (2d)

408—Wilson, William, 19, Glasgow Ath., warehouseman—Arith. (1st); Bkpg. (2d)

219—Wilson, William J., 20, S. Bromley Classes, clerk—Arith. (2d)

503—Wingate, William, 16, Glasgow M.I., clerk—Bkpg. (3d)

177—Wingfield, Thomas R., 23, Bolton Ch. I., clerk—Fch. (3d)

1297—Wolstenholme, Richard H., 18, Salford W.M. Coll., pupil-teacher—Eng. Hist. (2d); Eng. Lang. (1st)

967—Womack, Alice, 17, R. Polytechnic I., at school—Germ. (3d)

203—Wood, Butler, 16, Bradford M.I., in a warehouse—Eng. Hist. (3d)

596—Wood, George E., 17, Hull Y. People's Chr. and L.I., apprentice—Bkpg. (3d)

1031—Wood, Henry, 19, Manchester M.I., clerk—Arith. (2d); Eng. Lang. (3d); Geog. (2d)

597—Wood, Hewson, 19, Hull Y. People's Chr. and L.I., clerk—Bkpg. (2d)

567—Wood, James E., 17, Haughton Dale M.I., office boy—Th. of Mus. (3d)

495—Wood, Thomas, 16, Glasgow M.I., clerk—Latin (3d)

1296—Wood, Thomas, 23, Salford W.M. Coll., warehouseman—Arith. (3d)

411—Wood, Patrick, 23, Glasgow Ath., clerk—Fch. (3d)

1063—Woods, Aaron, 21, Manchester M. I., warehouseman—Bkpg (2d)

1109—Woods, John, 18, Manchester M.I., clerk—Bkpg. (1st)

143—Wootton, Bertha M., 17, Birm. and Midl. I., (no occupation stated)—Eng. Hist. (2d); Fch. (3d)

653—Worfolk, George W., 21, Leeds M.I., chemist and druggist—Arith. (3d); Met. Syst. (3d)

1295—Worsley, Alfred, 16, Salford W.M. Coll., shopman—Arith. (2d)

1058—Worstencroft, James, 20, Manchester M.I., stationer—Bkpg. (2d)

571—Wrenn, Alice L., 16, Hertford L.I., pupil teacher—Eng. Hist. (3d); Geog. (3d)

1293—Wright, Robert, 16, Salford W.M. Coll. clerk—Arith. (1st)

1341—Wright, Robert F., 16, Swindon M.I., pupil teacher—Arith. (3d)

1294—Wright, William, 23, Salford W.M. Coll., clerk—Arith. (3d)

1066—Wrigley, James, 19, Manchester M.I., clerk—Bkpg. (2d)
1065—Wrigley, Seth, 17, Manchester M.I., clerk—Bkpg. (1st)
446—Wylie, Thomas M., 19, Glasgow I., clerk—Arith. (2d); Bkpg. (2d)
403—Wylie, William C., 17, Glasgow Anderson. Univ. Pop. Evg. Classes, clerk—Bkpg. (3d)

1042—Yates, William P., 18, Manchester M.I., draughtsman (proposed)—Arith. (1st), with second prize of £3; Mens. (2d)
1393—Yeadon, Thomas, 19, Hulme W.M.I., mechanic—Arith. (3d)
954—Youatt, George H., 20, City of Lond. Coll., clerk Bkpg. (3d)
496—Young, John, jun., 18, Glasgow M.I., assistant librarian—Latin (2d)
867—Young, Sidney W., 25, Birkbeck L. and S.I., clerk—Dom. Econ. (1st)
404—Young, William, 20, Glasgow Anderson. Univ. Pop. Evg. Classes, clerk—Germ. (2d)
501—Young, William, 23, Glasgow M.I., law clerk—Mus. Comp. (1st); Th. of Mus. (2d)
773—Young, William E., 24, Birkbeck L. and S.I., engineer—Arith. (1st); Mens. (2d); and the third prize of £1 for Writing and Manuscript Printing

779—Zotz, Catherine, 35, Birkbeck L. and S.I., governess—Germ. (3d); Fch. (3d)

GENERAL NOTES.

Resources of India.—The *Asiatic* says, on the letter from Captain R. Taylor, headed the "Resources of India," which appeared in the *Journal* of 26th May:—"Upon the subject matter of the letter generally we need not here remark; but the writer's observations in referring to Mr. Hyde Clarke's proposal for the establishment of an Oriental Congress, are rather peculiar. He thinks the proposal must be abandoned, because 'insurmountable difficulties' beset us in Asia. Captain Taylor thinks that, India being our dependency, we could 'introduce salutary laws, make roads, develop trade, and thus materially improve the social condition of the masses under British rule'—a mode of proceeding, by the way, which we have been supposed to have been adopting, more or less, for a pretty long series of years past. But in countries like Persia and China, being 'independent states' (rather a novel mode of describing the countries of the Shah and the Celestial Emperor), the writer is of opinion 'our utmost efforts could only produce commercial treaties.' This is a most absurd argument against Mr. Hyde Clarke's congress. We should like to know what Captain R. Taylor's notion of an Englishman's vocation in these countries is. If there are persons—and they who appeared to have travelled in the East with their eyes open—who labour under the impression that there is no practical good for us in prosecuting relations with Eastern nations unless we can repeat the history of England in India, why, we confess there is a stronger argument in favour of Mr. Hyde Clarke's proposal than many are disposed to accord to it. If we have not ourselves advocated prominently the suggested congress, it is not that we are not well-wishers to the scheme. But as regarded India, seeing the good the East India Association was doing, we considered that, as union is strength, it were better for Mr. Hyde Clarke and his friends to throw in their strength with the Association. But if such crude notions as to British enterprise in the East, and the capabilities of such a country as China, which the long letter in the Society of Arts *Journal* indicates, should exist to any extent among our countrymen, by all means let us have the congress, and the sooner the better."

The Handel Festival.—The forthcoming festival at the Crystal Palace will present several new and important features. Besides drawing upon fresh resources in the matter of band and chorus, some fresh acoustic arrangements have been made, and the organ has been completed according to the scale of its original design by the makers, Messrs. Gray and Davison.

Patent Heating Furnace.—The agent for the Earl of Dudley, at the Round Oak Ironworks, has lately been testing a heating furnace, patented by Mr. Andrew Howatson, late of Messrs. Baird's works, Muirkirk, Ayrshire, in the 12-inch mill. The process consists of introducing heated air instead of cold air, as formerly, into the ash-hole. The air is heated by its being allowed to pass round the bottom of the stack, and under, and at the back of the furnace itself. It is supposed that the air is by this means heated to a temperature of 600 degrees. The back of the ash-hole and the firing-hole are securely fastened up by air-tight doors, so that no cold air whatever is allowed to pass into the furnace. The consequence of this is that the iron is not "cut away," or wasted through raw air entering through the firing-hole and bridge.

The British Association for the Advancement of Science holds its next meeting on Wednesday, the 2nd of August, in Edinburgh, under the presidency of Sir William Thomson, M.A., LL.D., D.C.L., F.R.S., Professor of Natural Philosophy in the University of Glasgow. The railway companies, in terms of arrangement amongst themselves, will convey members of the Association from any part of Great Britain to and from Edinburgh, with 1st or 2nd class return-tickets, such tickets being available from Tuesday, the 1st day of August, until and including Friday, the 11th day of August, being the day after the meeting is concluded. Further particulars will be given on application, and cards of membership forwarded, entitling the party to obtain such tickets. Tourists' tickets to the North and West Highlands may also be obtained at the principal railway stations, available for return within one month, with permission to break the journey at Melrose, Edinburgh, Perth, Dunkeld, Blair-Athole, Aberdeen, Inverness, and any other station where the train or steamer stops, either in going or returning. A list of the principal hotels and lodging-houses has been made up, with a tariff of their charges, which will be available to members on application to Mr. Alexander Crum-Brown or Mr. J. D. Marwick, hon. local secretaries.

MEETINGS FOR THE ENSUING WEEK.

Mon. .. Royal United Service Institute, 8½. Col. Middleton, "The Education of the Army with reference to Young Officers."
Royal Geographical, 8½. Rev. G. P. Badger, "A Journey in the Interior of Southern Arabia, by Capt. Miles and Werner Munzinger, with explanatory remarks."
Social Science Association, 8. Col. C. E. Webber, R.E., On the Utilisation of Open Spaces in the Metropolis."
Tues. ...Medical and Chirurgical, 8½.
Photographic, 8.
Wed. ...Royal Literary Fund, 3.
Archæological Association, 8.
Thurs...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. 1. Rev. C. P. Cambridge, "On British Spiders." 2. Dr. Burmeister, "On a Luminous Coleopterous Larva."
Chemical, 8. Sir B. C. Brodie, "On Experimental Inquiry as to the Action of Electricity upon Oxygen."
Numismatic, 7. Annual Meeting.
Fri.......**SOCIETY OF ARTS. 8½.** Conversazione at the South Kensington Museum.
Philological, 8¼.
Royal Institution, 9. Extra Meeting. Mr. William Bradford, "On the Esquimaux and Ice of Greenland." (Illustrated by drawings and photographs.)
Architectural Association, 7½. Mr. Aldridge, "Architectural Decoration."
Royal Botanic, 4. Professor Bentley, "Economic Botany."
Sat ......Working Men's Club and Institute Union. Lecture at the Royal School of Mines, by Mr. R. Coningsby, "Paris under Insurrection."

Journal of the Society of Arts.

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FRIDAY, JUNE 16, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

DRILL REVIEW.

The Council have the satisfaction of announcing that H.R.H. Prince Arthur has consented to review the boys from the District and other schools, in or near the metropolis, where drill forms part of the system of education. The review will take place in the Royal Horticultural Gardens at South Kensington, on Thursday, the 22nd of June.[*]

The price of admission to the gardens to see the review will be one shilling.

There will be a limited number of reserved seats near the Saluting-Post, the price of which will be five shillings, including admission to the gardens, and to the performance of the united Bands in the Royal Albert Hall after the review. As there are only a few of these seats for disposal, early application should be made.

A subscription fund has been set on foot to defray the expenses of the transit of the boys to and from the gardens, and some refreshment for them. Members are earnestly invited to contribute to this fund, and subscriptions to it may be sent to the Secretary of the Society of Arts, John-street, Adelphi.

SUBSCRIPTIONS RECEIVED.

	£	*s.*	*d.*
James Austin....	1	0	0
B. W. Bartram ..	1	1	0
L. Biden........	1	0	0
Sir W. H. Bodkin	1	0	0
W. W. F. Bolton	1	1	0
Wm. Botly	0	5	0
A. Cassels	0	10	0
A. S. Cole	0	10	0
Henry Cole	2	0	0
Sir Daniel Cooper, Bart. (will increase if needed)	1	0	0
Rev. B. M. Cowie	1	1	0
J. A. Crookenden .	0	10	6
Thomas Dixon ..	0	10	6
John E. Evans ..	0	10	0
W. H. Fell......	1	1	0
F. Filliter.......	1	1	0
J. A. Franklin ..	0	10	0
Samuel Harton (to be doubled if required)......	0	5	0
T. N. Hooper....	1	1	0
Chas. Horne (will give 10s. more if required)	0	10	0
Dr. Albert Horwitz..........	0	5	0
Maj. E. W. Mathew	0	10	0
R. Nicol	1	1	0
James Noble	1	1	0
John Pritchit....	0	5	0
Edward Rosher ..	0	10	0
W. S. Rumsey ..	0	5	0
Philip Sancton ..	1	0	0
W. H. Tanquerary	0	10	6
Charles Telford..	1	0	0
W. H. Thomas ..	1	0	0
E. C. Tufnell....	5	0	0
Z. Watkins......	0	5	0
C. Williams	1	1	0
W. B. Wrightson	1	0	0
	£31	0	6

CONVERSAZIONE.

The Annual Conversazione of the members will take place this evening, at the South Kensington Museum. His Royal Highness the Prince of Wales, President of the Society, and Her Royal Highness the Princess of Wales have signified their intention to be present. The following are the arrangements for the evening:—

1. A vocal concert, consisting of glees, directed by Mr. J. Foster, will be given, with intervals every half-hour, from 9 to 11 o'clock, in the lecture theatre; and the Council request, that as the theatre will only hold seven hundred persons, the audience will change at every interval, to enable the greatest number to have the pleasure of listening to the concert.
2. Visitors will be able to make the tour of the Art Schools, both on the first and second floors.
3. The Raphael cartoons, the Sheepshanks and the National Gallery's picture galleries will be open.
4. The courts and corridors of the ground-floor will be open. The seats will be chiefly in the south court, where the reception will be held by the Chairman of the Council (the Lord Henry G. Lennox, M.P.) and the Council.
5. The Art Library will be opened.
6. A promenade concert will be given by the band of the Coldstream Guards in the north court, and the box for the royal visitors will be prepared in the gallery above, which will of necessity be reserved for their Royal Highnesses. There will, this year, be no formal reception of the Prince and Princess of Wales.
7. Refreshments will be supplied as usual in the refreshment rooms in the central corridor of the museum.
8. Ladies' cloaks and gentlemen's coats will be taken charge of, but hats cannot be received.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

ANNUAL CONFERENCE.

The Twentieth Annual Conference of the Representatives of the Institutions in Union, and the Local Educational Boards, with the Council of the Society, will be held this day (Friday, the 16th inst.), at 12 o'clock noon. Lord Henry G. Lennox, M.P., Chairman of the Council, will preside.

The Educational Officer will read the following

Report.

To the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Gentlemen,—

It again becomes my duty, as the officer of the Society entrusted with the educational department, to submit to the Council, for the information of the Conference, a report of the Society's proceedings since we met last year, so far as they relate to Education.

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[*] Unavoidably postponed from the 14th, as announced in the *Journal* of the 2nd inst.

The branch of the subject more immediately interesting to the Institutions is the results of the Society's system of Examinations for the present year. It will be remembered that a very material alteration was made in the programme for 1870, as compared with those of former years, by the removal from it of those subjects, to the number of sixteen, in which the Science and Art Department of the Government holds Examinations. This important change, which involved the omission of many of the most popular subjects, including all those bearing on physical science, as well as freehand and mechanical drawing, necessarily led to a considerable diminution in the number of candidates last year as compared with former years; but I am happy to say that this year there has been a considerable increase as compared with 1870, showing that, although these Examinations are now restricted to a comparatively small area of knowledge, they are still valued as highly as ever by those for whose benefit they were established. A reference to the Tables will show that this year there were 1,251 examined, and 985 passed, against 1,162 examined, and 953 passed, in 1870, and thus the proportion of those who have succeeded in obtaining certificates is slightly less this year than last, when 82 per cent. were successful, while on the present occasion rather less than 79 per cent. have been so; it is fair to add, however, that this per-centage is far higher than that of the previous year, when only 69 per cent. obtained certificates. A more favourable feature is the number of prizes awarded, which is 60 this year, as compared with only 45 last year, a very important increase.

This year, the Prince Consort's Prize of twenty-five guineas, a valued gift, by which Her Majesty graciously signifies each year her continued interest in the Society's examinations, has been awarded to a candidate connected with the Devonport Mechanics' Institution, Thomas Dawe, aged 20, clerk, who has obtained the largest number of first-class certificates in this and the three preceding years, the subjects being arithmetic, mensuration, book-keeping, algebra, the metric system, navigation and nautical astronomy, domestic economy, logic, English history, political economy, and geography.

It is to be regretted that neither this year nor last have the Council been able to award the prize of ten guineas offered to females, no qualified candidate having fulfilled the conditions, and that only two of the twelve other prizes offered specially to females have been taken, one of them, however, being in domestic economy, a subject in which it is to be regretted that more females do not present themselves, only four certificates having been gained by them in it this year. Out of the 1,251 candidates examined, I may mention that there were only 65 females, most of them describing themselves as governesses, of whom 53 obtained certificates, the principal subjects taken up being French, English history, the English language, music, and German. There are nearly twice as many certificates in French gained by females as in any other subject.

Most of the prizes given by other societies, or by individuals, for the encouragement of special branches of knowledge, have been taken this year, the only exception being those offered by the proprietors of the *Gardeners' Chronicle*. The four prizes offered by the Royal Horticultural Society to gardeners, the Royal Geographical Society's prize to the best candidate in geography, and the prizes given by Mrs. Harry Chester and by Mr. T. Twining, for the encouragement of a knowledge of political economy and domestic economy respectively, have all been claimed, those in the two subjects last mentioned not having been awarded last year.

It will be remembered that among the novel features in last year's programme, was a special attempt made to encourage an improved style of writing. Prizes were then for the first time offered by one of our Vice-Presidents, Mr. Henry Cole, for the best specimens of writing and manuscript printing, but on that occasion no candidate was thought by the examiner to be worthy of reward. This year, however, the four prizes have been given, and the examiner, Mr. A. J. Trendell, was, I have reason to know, well satisfied with the productions thus distinguished. The prizes offered by the Council for the best specimens of ordinary handwriting, as shown in any of the papers worked in any subject, have also been awarded.

Another novelty in the programme for last year was a suggestion by a member of the Council, Mr. Hyde Clarke, that *vivâ voce* examinations in modern languages should be held by such Local Boards as had facilities for doing so. It is to be regretted that, as yet, this proposal has met with but little favour, as last year only one Board, that of the Birkbeck Institution, and this year only one, that of the Birmingham and Midland Institute, have held these Examinations. I cannot but hope that the advantages of a really practical knowledge of modern languages, so well pointed out by Mr. Hyde Clarke in his Memorandum, printed in the Examination Programme, will, by degrees, be felt in our great commercial centres, and these *vivâ voce* examinations will become a more important feature.

The most important change made in this year's Programme was the addition of two subjects, Commercial French and Commercial German. It was felt that, without ceasing to encourage a general and classical knowledge of these languages, as tested by the examinations hitherto held, it would be specially in accordance with the functions of a Society one of whose chartered objects is the promotion of commerce, to encourage amongst the classes for whom its examinations are more particularly intended, the acquirement of that facility in French and German commercial correspondence which is known to be so useful in the office of the merchant and the manufacturer. The Council therefore added the above-mentioned subjects to the Programme, the papers set being particularly intended to test the capacity of candidates to fill the post of foreign correspondent in a house of business. The number of candidates examined, 17 in French and four in German, is as great as could fairly be expected, considering how recently the subjects have been introduced into the Programme, and the fact that only first-class certificates, and no prizes, are offered in them.

Those who were present at last year's Conference will remember that among the suggested modifications in the Programme was the separation of the subject of political economy from that of civil government, of logic from mental science, and of the English language from English literature. The addition of other subjects, such as general history and land-surveying, was also proposed. When these proposals came under the consideration of the Council, the justice of the complaint, as to the inconvenience of combining two subjects in one paper, was at once acknowledged, but the Council did not feel justified in adding so largely to the number of subjects as the adoption of all these suggestions would have involved. They therefore decided that the subjects of civil government, mental science, and English literature should be omitted, and that papers should be set in Political Economy, Logic, and the English Language. If we may judge by the number of candidates, this change appears to have been favourably received, as there has been an increase in all the subjects thus treated, especially in the last-mentioned, no less than 170 papers having been worked in the English language this year, as compared with 82 last year in the combined subjects of the English language and literature.

In looking at the Table which shows the number of papers worked in each subject in this and preceding years, it will be noticed that there has been either an increase this year, as compared with last, or the numbers have remained stationary, in no less than fourteen subjects, while there has been a decrease in only four—the metrical system, English history, floriculture, and fruit and vegetable culture. It is somewhat remarkable that in the two last-mentioned only five and six candidates respectively came up for examination, notwithstanding the special stimulus of additional prizes offered by the Royal Horticultural Society to gardeners, to whom such knowledge could not fail to be most valuable.

The remarks of the examiners, given in the appendix to this report, are in the greater number of subjects favourable to the candidates. In some instances, indeed, very unusual praise has been bestowed upon the papers; the examiner in German speaks of the work this year as "far more satisfactory" than on any previous occasion; and the examiner in political economy says of some of the best papers that they "might, without discredit, go to press as parts of an elementary work" on the subject. These expressions cannot fail to be highly encouraging to candidates, as well as to their teachers, to whom, doubtless, much of the credit is fairly due. On the other hand, some of the examiners still complain of bad spelling, a drawback which the Elementary Education Act will, it is hoped, diminish every year.

It was urged by several speakers at the last Conference that the recognition by the Society of teachers of classes who send up successful candidates would act as an important encouragement to them in their valuable, but often ill-requited, labours. The Council therefore determined to grant certificates to any teachers who might desire to have them, stating the number of students who have obtained first-class certificates in the subjects taught by them. Teachers of classes desiring to have such certificates are, therefore, invited to forward to the Secretary of the Society of Arts, now that the results of the Examinations are published, a list of the Candidates taught by them who have obtained first-class certificates.

The Society has now, for several years, furnished to such Local Boards as desire to have them, papers for use in Elementary Examinations, and also forms of certificate, to be awarded by the local examiners. The number of centres at which these examinations have been held is larger this year, and the demand for the papers has been considerably greater, showing that the facilities thus afforded to Local Boards are increasingly appreciated. In 1870, 2,999 candidates were examined, and 1,810 passed, while this year, 3,300 were examined, and 1,847 passed, the per-centage of failures being unfortunately higher than at last year's Examinations. The number of female candidates is considerably less than in 1870, being only 647, as compared with 755; and in the lower grade, the number of females who have been successful is only 248 out of 531, while last year 430 out of 690 obtained certificates. The detailed results are shown in the annexed table:—

ELEMENTARY EXAMINATIONS, 1871.

NAME OF UNION OR LOCAL BOARD.	Number of Centres.	HIGHER GRADE.				LOWER GRADE.			
		Male Candidates.		Female Candidates.		Male Candidates.		Female Candidates.	
		Examined.	Passed.	Examined.	Passed.	Examined.	Passed.	Examined.	Passed.
Bishop's Stortford	1	5	3	..	..	3	..	..	..
Cheltenham Working Men's Club	1	15	15	..	..	28	26	..	..
Christchurch (Hants)	1	3	2	..	..	35	34	..	..
Farnham and Aldershot District	2	43	33	12	4	72	58	32	19
Hertford	6	20	15	7	2	75	48	25	16
Lancashire and Cheshire Union of Institutes	67	330	131	44	8	1,055	565	382	168
Lurgan	1	8	6	..	..	12	9	..	..
Penzance	1	11	5	..	..	50	38	..	..
Rugby	1	..	..	7	5	..	..	15	6
Stamford (St. Martin's)	1	5	5	..	..	16	10	..	..
Swindon (New)	1	9	5	..	..	16	8	28	16
Tottington	1	7	5	..	..	12	10	10	8
Weston-super-Mare	1	2	1	..	..	26	9	..	..
Yorkshire Board of Education	24	146	74	46	38	649	427	39	15
Totals (1871)	109	604	300	116	57	2,049	1,242	531	248
Totals (1870)	101	520	320	65	41	1,724	1,019	690	430

In concluding my remarks on the examinations of the present year, I feel justified in saying that on the whole, considering the serious changes made last year, by the omission of no less than sixteen subjects, including many of those especially taught in the institutions, and popular among the candidates, this year's examinations may be described as highly successful.

You are aware that, since we last met, what may justly be characterised as the most important educational event that has ever happened in this country, has been brought about; I refer, of course, to the passing of the Education Act. In my last report I referred to the action of the Council in reference to this measure, and particularly to a series of reports upon the existing state of education in various districts, with a view to ascertain how best to supply the acknowledged deficiency. Three such reports had then appeared, and I have only to add that another was published last autumn, on the state of education in Battersea. I must not omit to mention a report by the Educational Committee, printed in the *Journal* last July, the main object of which is to show the great advantage of large over small schools, or, as therein expressed, "that the power of teaching and training is in time, in efficiency, and in economy, very much as the number that can be brought together for a division of skilled educational labour and simultaneous class teaching." This principle is now becoming more generally acknowledged.

In October last, two other documents were issued, under the authority of the Council, in reference to the elections for school boards, urging the electors to disregard "political and religious controversies," and to choose persons "who have given proofs that they understand the means by which the efficiency of teaching may be increased, the expense diminished, and the time of learning reduced, so as to admit of secondary art and science instruction where practicable; and to reject persons who offer themselves merely with political and sectarian aims, and much self-assertion, and who have given no such proofs." It is to be feared that in some places at least, this useful advice has not been taken, though it must be acknowledged that upon the whole, the school boards are trying to do their best for the children committed to their care.

One of the subjects to which the Society has, for several years past, directed its attention is that of education in music. The want of a really National Training School for Music, worthy to be compared with the great schools of France, Belgium, Germany, and Italy, has long been felt in this country, although, at the time of the Reformation, the cultivation of music among all classes of the people was general. While much has been done by the State for the encouragement of the arts of painting and sculpture, the art of music, the influence of which upon the masses of the people is universally acknowledged to be far greater than that of the sister arts, has been left to itself, for the small government grant to the Royal Academy of Music is too insignificant to be productive of any palpable results. The Council has had the subject specially before it during the past year; and with the view of obtaining a fund which may serve at least to commence the great work of establishing a National Training School for Music, it has arranged a series of concerts, two of which have been successfully held in the Royal Albert Hall. It will be observed that one of the subjects set down for discussion at the present Conference is—"How far can institutions encourage instruction in music by establishing local scholarships, to be open to public competition, and held in a National Training School for Music," and the Council is about to address the trustees of endowed funds on the subject.

Another important branch of education, namely, drill, has for some time past occupied the attention of the Council, and a large committee, to "consider how drill may be introduced into all schools throughout the United Kingdom," was appointed in 1869. Towards the latter part of last June, a most successful review of naval, military, district, and other schools was held at the Crystal Palace, in presence of his Serene Highness the Prince of Teck, and a distinguished company, when prizes for gymnastics and swimming, as well as for drill, were given. Field-Marshal Sir John Burgoyne, in a letter referring to this review, observes that military exercises must tend "physically and morally to the advantage of the individual and the community." He says it has been proved "that young men who had been drilled were capable of doing perceptibly more work than others who had not been subjected to the same exercise; while morally the practice inculcates imperceptibly a spirit of order, obedience, implicit attention to instructions, and a deference to superior authorities." A similar review will be held by his Royal Highness Prince Arthur, in the Royal Horticultural Gardens, on Thursday next, the 22nd inst. In connection with this subject, an interesting paper was lately read before the Society by General Eardley-Wilmot, entitled "On Drill as a Complement of School Instruction." A highly useful discussion ensued, and the subject was afterwards treated in the *Journal* by Mr. Edwin Chadwick, who, as is well-known, has devoted much attention to it.

In reference to female education, you are aware that the Council have now for several years endeavoured to give encouragement to it, by the offer of the Council prize of ten guineas, and of special prizes to female candidates in many of the subjects of examination. The question has recently formed the subject of discussion at one of our evening meetings, when a very able paper upon it was read by Mrs. Grey. The writer quoted from the report of the Schools Inquiry Commission on the Education of Girls, which certainly presents a sad picture. The Commissioners, in this document, sum up the results of the Assistant-Commissioners' inquiries in the following words:—"Want of thoroughness and foundation; want of system; slovenliness and showy superficiality; inattention to rudiments; undue time given to accomplishments, and those not taught intelligently, or in any scientific manner; want of organisation." One of the assistant-commissioners calculates that girls give "5,520 hours of their school life to music, against 640 to arithmetic;" and similar evidence abounds of an utterly faulty system. Mrs. Grey points out that the fundamental evil lies with the parents; that there is no demand for a better female education, and she advocates the formation of an Educational League, whose objects shall be—(1) the creation of a sounder public opinion respecting the need and obligation of educating girls; (2) the redistribution of educational endowments, so as to give a fair share of them to girls; (3) the improvement of the female teachers by their examination and registration according to fixed standards. With reference to the third point, the writer says:—"It may be that public opinion is not prepared to follow in this country to its full extent the system of Prussia, where no person can teach anything professionally without a certificate of competency from the authorities established under government for that purpose, but the nearer approach that can be made to it, by enlightening the public mind on the necessity of requiring some test of teaching capabilities, and by inducing those who intend to teach to qualify themselves to pass such a test, the better chance there will be of weeding out the present incompetent race of governesses, and replacing them by others trained to their work." So much has been done of late to improve the education of boys, that when public opinion is once enlightened, it is to be hoped that that of girls will not long remain far behind.

The attempt made last year, in the *Journal*, to touch, so far as space permitted, upon many of the important educational questions of the day, has been continued. Though, happily, the passing of the Education Act has put an end to agitation upon the subject, there are still so many points brought under discussion at meetings of School Boards, in the press, and elsewhere, that it is hoped the "Educational Notes" referring to them have not been without interest.

In my last year's report, I referred to an important educational work undertaken by the Society, in connexion with the International Exhibition of the present year. At the request of her Majesty's Commissioners, the Council undertook, with the aid of a large and influential Committee, to make arrangements for the Educational Section of that Exhibition; and I then took the opportunity of drawing the special attention of the representatives of the Institutions to this branch of the Exhibition, with the view of inducing them to interest themselves locally in its success. It certainly forms one of the most interesting and characteristic features of this year's Exhibition, and, as mentioned in the circular calling the present Conference, arrangements will be made for such of the representatives present as may desire to do so, to visit it to-morrow (Saturday) morning. I have therefore thought that a very brief description of it here may not be out of place.

The educational portion of the Exhibition is, for the most part, arranged in the two small theatres on the upper floor of the Royal Albert Hall. It is divided into five sections:—School Buildings, Furniture, &c.; Books, Maps, Globes, Instruments, &c.; appliances for Physical Training, including Toys and Games; Specimens and Illustrations of modes of teaching Fine Art, Natural History, and Physical Science, including Music; and Specimens of School Work, serving as Examples of the results of teaching; the last being divided into several sub-sections, as follows:—(*a*). Writing, Plain and Ornamental, Examination Papers and other School-work, showing the results of general, scientific, and artistic instruction; (*b*). Drawing and design; (*c*). Modelling in Clay, Carving in Wood, &c.; (*d*). Drawings and Models of Machinery, Building Construction, &c.; (*e*). Needlework, Plain and Ornamental, Lace, Knitting, Plaiting, &c.; (*f*). Miscellaneous work done in Convict Prisons, Schools, and Reformatories; (*g*). Miscellaneous Work by Pupils in Schools for the Blind, Deaf, and Dumb.

It would, of course, occupy too much time were I to attempt to draw your attention to all these sections, or even to point out the most interesting productions in each. This will be done very fully by the reporters in each section, whose reports are, I believe, now in the press. But I will merely touch upon a very few of the most characteristic features.

The objects in the first division (school buildings, fittings, furniture, &c.) are, for the most part, arranged in the theatre over the western portico in the Albert Hall, and in the Swedish model school, which is erected on the vacant space between the main road and western galleries, and fitted up with a very complete set of educational appliances. With regard to models and plans of schools, there are but few sent by English exhibitors, but I may mention a model of an infant-school contributed by the Home and Colonial School Society. The Austrian and Hungarian designs, which are in the Austrian Court, should not be overlooked. Numerous specimens of school desks are shown, many of them ingenious, but some probably too elaborate in their construction.

The second division (books, maps, &c.) would naturally require considerable time for anything like accurate inspection. It is in the same theatre as the last section, and the books have been classified under several divisions, in order to facilitate examination. The maps and atlases present no specially new feature; some of the latter, from Austria, with the political and physical maps on opposite pages, are worthy of notice.

I now come to one of the most characteristic portions of the exhibition, the section of appliances for physical training, including toys and games. That gymnastic apparatus, as a means of physical development, should be assigned a place in an educational exhibition will excite no surprise, but that toys should be included may at first appear to require some explanation; a little consideration, however, will show that in a child's early days play is a necessary part of its occupation, indeed, perhaps the principal part, and it is therefore most important that the toys it plays with should be of such a nature as to open its mind, and lead it to seek knowledge, besides exercising its physical powers, and developing its taste. The present collection of toys (which is in the western theatre of the hall) is most remarkable, as showing what progress has been made in this branch of manufacture; and though perhaps there is not much to be said in favour of the very costly toys that we now sometimes see in the hands of children, the advantages of good form and colouring, which even the cheap ones many of them now possess, are very great. With reference to toys which may be regarded as really educational, I may mention some building bricks, showing the various styles of architecture, and some toy cooking-stoves, by which a taste, at least, for acquiring the art of cookery would naturally be given to the girls using them. I cannot help drawing special attention to the international collection of toys exhibited by Mr. Cremer, as being by far the best typical collection of the toy-manufactures of various states ever brought together.

The next section shows the methods of teaching fine art, natural history, physical science, and music. Under fine art is naturally included various kinds of drawing materials and models, and here the Swedish specimens are well worth attention. The natural history specimens include stuffed animals, collections of insects, and skeletons mounted for lecture purposes, various microscopic preparations and botanical diagrams, &c. The physical section apparatus presents few new features, but the collection of musical instruments will well repay examination, some of the school pianos and harmoniums especially appearing remarkably good at the price.

Perhaps the most remarkable portion of this exhibition is the last section, showing the results of school work. They consist mainly of examination papers, in such subjects as writing and ornamental writing, arithmetic, geography, grammar, history, map drawing, drawing — mechanical, landscape, and freehand, algebra, Euclid, geometry; and translations—French and Latin, with specimens of modelling, &c. It would occupy too much of your time to refer to them in detail, but the reports upon them, which will be made by gentlemen specially competent in the various departments, will be awaited with much interest.

I have now attempted, however, imperfectly, to describe the educational work of the Society during the past year. I have shown you that notwithstanding the friendly rivalry of other examining bodies, its Examinations are still highly valued, and its certificates much sought. As the Education Act comes into operation, its efforts to encourage mere elementary instruction will, perhaps, in the course of years, become unnecessary, but it seems likely to be long before its Final Examinations (as they are termed in the Programme) will become superseded.

Allow me, in conclusion, to quote from the paper of Mrs. Grey, which I before referred to, one of the best definitions of education ever given. The writer says :—" The true meaning of the word education is not instruction, technical or otherwise. It is intellectual, moral, and physical development, the development of a sound mind in a sound body, the training of the reason to form just judgments, the discipline of the will and the affections to obey the supreme law of duty, the kindling and strengthening of the love of knowledge, of beauty, of goodness, till they become governing motives of action."

I have the honour to be, Gentlemen,
Your faithful servant,
Charles Critchett,
Officer for Education.

Appendix.

EXAMINERS' REMARKS.

The Examiner in *Arithmetic* says :—" As compared with the papers of former years, I think the present, as a whole, are equal, if not superior, to any that have come under my inspection."

The Examiner in the *Metric System* says :—" I have little to add to the remarks I have already made in former years. The candidates, though not numerous, come well prepared, and the per-centage of failures is remarkably low. This is a very gratifying result, as a proof of the simplicity of the system, and the ease with which it can be mastered. I would recommend future candidates to practice the metric system in daily life a few weeks before entering for this examination. This may be done, without becoming a task, by estimating the metric equivalent of each quantity of solid and liquid food they may purchase, or each distance they walk, &c."

The Examiner in *Book-keeping* says :—" Some of the first-class papers are extremely good, but the general average of merit hardly reaches that of previous years."

The Examiner in *Mensuration* says :—" Seventy-four candidates have been examined, of whom 24, or above 30 per cent., have failed to pass ; the rest have done very fairly, 8 being in the first-class. Four or five have done so badly that they ought not to have been presented at all. One who attempted eight questions failed to obtain a single mark."

The Examiner in *Floriculture* says :—" I have still to remark on the careless and erroneous way in which plant names are written, even such as are quite familiar in gardens, as "Chorezimea" for "Chorozema," "Silliea" for "Scilla," "Tatrathea" for "Tetratheca," "Wigilia" for "Weigela," "Aascantheaus" for (I suppose) "Aschynanthus." The questions least satisfactorily answered were those referring to terrestrial orchids and to glazing."

The Examiner in *Fruit and Vegetable Culture* says :—" Though the papers this year are not of the high order which characterised some of the papers of former examinations, yet they are very satisfactory, and show that there is among us a rising class of intelligent gardeners."

The Examiner in *Domestic Economy* says : — " The papers generally are very creditable. More than a third of the candidates have got into the first class, and only two have not passed. I have, however, still to complain of bad spelling in many of the papers, great deficiency in punctuation, and very few of them show good handwriting, though perhaps this may be partly accounted for by the haste in which they are written. As the subject is universally known, at least in part, the candidates seem mostly over-anxious to say something on every question."

The Examiner in *Political Economy* says :—" There is an increase this year, both in the number of candidates, and in the proportion which have attained first class certificates. The general character of the answers is very satisfactory, showing the diffusion among the candidates of a fair degree of reading and reflection. On those who have attained first-class certificates, and especially on those who rank highest among them, greater praise may be bestowed. To considerable knowledge and thought some of these candidates add much skill in treatment, and the command of an excellent style. In some cases the answers might, without discredit, go to press as parts of an elementary work."

The Examiner in *Geography* says :—" The papers are, on the whole, more satisfactory than those of last year. They bear evidence of more thoughtful appreciation of the subject on the part of the writers, and of more careful preparation for the task undertaken. There are several failures, and a large proportion of only third-class merit ; but the number of really good answers is also considerable, and the few first class papers evince merit of a very high order."

The Examiner in *English History* says :—" I am sorry to say that the answers to the questions do not display the same ability, care, and correctness as those of last year and the year before. I observe also in the papers of this year a much larger amount of bad spelling and bad grammar than I have seen for some time."

The Examiner in the *English Language* says :—" The exercises in English of this year are by no means unsatisfactory, though there are but a small proportion of them which I can mark as excellent. The work in general is characterised by a fair mediocrity."

The Examiner in *Logic* says :—" As this is the first occasion when I have examined for the Society, I have no means of knowing the relative excellence of the results this year, but I may fairly say that they are quite as good as I expected, and I have felt fully justified in placing four candidates in the first-class."

The Examiner in *Latin*, after expressing regret that only one of the candidates deserved a first-class certificate, says :—" I would again call attention to the imperative duty of attaining accuracy in parsing, *e.g.*, knowing the perfects of verbs, and the genitives and genders of substantives ; and I would also (a very much

TABLE I.

RESULTS OF THE FINAL EXAMINATION OF 1871.

NAME OF LOCAL BOARD.	No. of Candidates Examined at Previous Examination by Local Board.	No. of Candidates who Passed Previous Examination by Local Board.	No. of Candidates Examined at Final Examination.	No. of Candidates who Passed at Final Examination.	No. of Papers Worked at Final Examination.	No. of First-class Certificates awarded.	No. of Second-class Certificates awarded.	No. of Third-class Certificates awarded.	No. of Prizes awarded to Candidates.	No. of Unsuccessful Candidates.
Aberdeen	55	37	32	28	37	5	10	18	2	4
Accrington	30	24	6	2	8	1	...	1	...	4
Aldershot	...	...	8	7	16	3	3	5	...	1
Ashford	12	11	15	14	19	7	7	4	...	1
Bacup	25	25	16	10	20	2	7	2	2	6
Belfast	8	8	11	8	13	2	4	4	...	3
Birmingham and Midland Institute	28	21	29	29	37	7	18	12	1	...
Blackburn	10	10	7	7	11	7	...	4	...	...
Blandford	...	...	1	1	1	...	1	...	...	...
Bollington	...	...	3	2	3	...	...	2	...	1
Bolton (Church Institute)	98	79	20	16	44	5	6	15	...	4
,, (Mechanics' Institute)	15	15	4	3	7	...	2	2	...	1
Bradford	31	19	21	15	25	3	6	9	1	6
Bromsgrove	...	...	1	...	1	...	...	...	...	1
Burnley (Mechanics' Institute)	...	...	3	2	3	...	...	2	...	1
Carlisle (Mechanics' Institute)	24	21	26	21	36	9	9	9	3	5
Cheltenham (Working Men's Club)	8	8	10	9	26	1	8	8	...	1
Chorley	...	...	1	...	1	...	...	...	...	1
Cork	8	8	7	3	11	...	1	4	...	4
Crewe	4	4	9	3	16	...	...	5	...	6
Dean Mills	...	...	3	2	3	...	...	2	...	1
Derby	3	3	5	5	9	...	6	2	...	...
Devonport	7	7	15	15	27	13	10	3	6	...
Dudley	4	4	3	1	3	...	1	...	...	2
Eccleshill	...	...	1	1	1	...	...	1	...	...
Edinburgh	14	14	18	13	28	1	7	9	...	5
Farnham	...	...	1	1	3	...	...	1	...	...
Faversham	...	...	1	1	1	...	1	...	...	...
Freetown (Glossop)	...	...	1	1	1	...	1	...	...	...
Gilford	...	...	2	2	2	...	2	...	...	...
Glasgow (Andersonian University Popular Evening Classes)	40	40	56	46	75	13	30	17	1	10
,, (Athenæum)	37	34	29	23	36	7	12	11	4	6
,, (Institution)	24	20	16	13	24	2	8	10	...	3
,, (Mechanics' Institution)	58	54	61	50	72	10	22	27	...	11
Halifax (Mechanics' Institution)	21	21	15	10	26	1	4	9	...	5
,, (Working Men's College)	20	16	18	14	20	...	3	11	...	4
Haughton Dale	1	1	1	1	1	...	...	1	...	...
Hebden Bridge	4	4	3	2	4	...	...	3	...	1
Hertford	1	1	1	1	3	...	...	2	...	...
Holbeck	1	1	2	2	4	...	...	4	...	...
Huddersfield	50	12	8	6	9	...	1	6	...	2
Hull	23	20	22	21	24	5	12	6	1	1
Hulme	21	17	14	12	19	1	6	8	...	2
Ipswich	25	23	22	22	22	2	10	10	...	...
Irwell	6	6	2	1	2	1	...	...	...	1
Leeds (Church Institute)	8	8	10	9	15	5	4	4	...	1
,, (Mechanics' Institute)	7	7	16	13	35	8	1	12	2	3
,, (Young Men's Christian Association)	47	47	49	35	92	10	11	33	2	14
Leicester	20	20	12	3	15	...	1	4	...	9
London (Beauvoir College)	13	13	18	18	22	6	11	4	2	...
,, (Birkbeck Literary and Scientific Institution)	82	72	91	79	148	26	50	40	10	12
,, (Bromley, Middlesex)	...	...	8	4	8	...	3	1	...	4
,, (City of London College)	83	79	82	73	113	25	36	34	3	9
,, (Royal Polytechnic)	19	19	24	22	39	6	13	17	1	2
,, (St. Stephen's, Westminster)	19	16	12	6	21	1	3	9	1	6
Littlemoor	...	...	2	...	3	...	...	...	...	2
Liverpool	20	20	22	19	36	3	9	17	...	3
Lurgan	20	18	6	5	8	1	3	2	...	1
Manchester	78	76	106	93	172	22	60	54	3	13
Mossley	6	6	11	8	18	...	3	6	...	3
Newcastle-on-Tyne (Church Institute)	1	1	2	2	5	...	4	...	...	...
,, (Excelsior Temperance Class)	5	5	10	9	16	2	2	6	4	1
New Mills	...	...	1	1	1	...	...	1	...	...
Newton Heath	4	4	5	3	5	1	...	2	...	2
Oldham	20	18	23	11	30	3	5	6	...	12
Paisley	8	7	7	7	9	1	7	...	...	...
Parsonstown	3	3	2	2	2	1	...	1	...	...
Patricroft	7	7	3	1	4	...	1	1	...	2
Pembroke Dock	18	18	16	16	22	5	13	4	1	...

TABLE I.—(Continued).

NAME OF LOCAL BOARD.	No. of Candidates Examined at Previous Examination by Local Board.	No. of Candidates who Passed Previous Examination by Local Board.	No. of Candidates Examined at Final Examination.	No. of Candidates who Passed at Final Examination.	No. of Papers Worked at Final Examination.	No. of First-class Certificates awarded.	No. of Second-class Certificates awarded.	No. of Third-class Certificates awarded.	No. of Prizes awarded to Candidates.	No. of Unsuccessful Candidates.
Penzance	13	12	12	12	12	7	2	3	1	...
Preston	12	12	4	2	10	...	1	...	...	
Richmond	...	...	1	1	1	1	...	...	2	...
Rotherham	3	3	3	3	5	1	3	1	...	...
Rugby	10	9	14	12	28	1	11	6	...	2
Salford	...	...	58	37	69	9	15	20	3	21
Scarborough	...	...	3	3	3	2	...	1	...	...
Smethwick	...	...	4	1	8	...	1	1	...	3
Southampton	1	1	5	5	9	2	4	2	1	...
Stamford	5	4	5	4	11	1	1	5	...	1
Stockport	5	5	9	3	13	2	2	2	...	6
Swindon	6	6	6	3	7	1	...	3	...	3
Tottington	3	3	6	4	6	...	...	4	...	2
Wakefield	5	5	5	2	5	...	2	...	...	3
Walsall	1	1	3	3	4	1	2	1	1	...
Wednesbury	6	6	5	1	5	...	...	1	1	4
Weston-super-Mare	3	3	8	1	8	1	...	...	...	7
York	12	12	12	3	14	1	2	...	1	9
Totals	1289	1134	1251	985	1811	264	504	557	60	266

Number of Local Boards, 100.

N.B.—Ninety-nine Candidates came forward in Writing from Dictation, and twenty-six in Writing and Manuscript Printing, but, as Certificates are not given for those subjects, they are not included in the above Table, but the prizes awarded in both these subjects, and also the prizes offered by the Council for Handwriting generally, are included in the list.

TABLE II.—Number of Papers Worked in each Subject in the Four Last Years; with the Result for the Year 1871.

SUBJECTS.	1868.	1869.	1870.	1871.				
				No. of Papers Worked.	No. of First-class Certificates.	No. of Second-class Certificates.	No. of Third-class Certificates.	No. of Papers in respect of which no Certificate was awarded.
Arithmetic	528	621	501	546	92	101	121	232
Metrical System	..	42	52	30	11	10	6	3
Book-keeping	255	253	290	295	37	134	105	19
Mensuration	78	98	63	74	8	18	24	24
Floriculture	16	12	9	5	1	2	2	..
Fruit and Vegetable Culture ..	13	9	8	6	2	3	1	..
Domestic Economy	32	31	13	29	16	6	5	2
* Political Economy	7	*19	25	31	9	10	7	5
Civil Government	..	*8		(discontinued)				
Geography	114	99	103	103	7	26	39	30
English History	99	94	120	105	4	36	35	30
English Literature	33	37	82	(discontinued)				
English Language	..	..	..	170	13	40	78	39
Logic	9	24	16	23	4	5	7	7
Latin	21	17	20	21	1	8	9	3
French	148	140	145	158	4	27	73	54
Commercial French	..	..	..	17	3	..	..	14
German	16	26	26	26	6	9	8	3
Commercial German	..	..	..	4	1	..	..	3
Italian	3	9	3	3	..	2	1	..
Spanish	6	13	10	19	12	3	4	..
Theory of Music..	97	69	72	87	18	37	18	14
Elementary Musical Composition (Tonic Sol-fa System) ..	..	57	51	59	16	27	14	1
Totals	1,475	1,698	1,609	1,811	264	504	557	486

* These two subjects were united in 1870.

smaller matter) caution candidates against mixing up 'you' and 'thou' in the same sentence. Let them use one or the other, not both. As a rule, though subject to exceptions, 'you' will be best in prose, 'thou' in verse."

The Examiner in *French* and *Commercial French* says:—"The French papers are not, on the whole, very satisfactory this year. There is, indeed a large proportion of them showing a fair mastery of the elements of the grammar, and therefore entitled to a third-class certificate; but the candidates deserving of a first-class are unusually few. Many of those who have aimed at a first-class certificate will probably be surprised to find that they have only secured a third-class, or even altogether failed to pass, but I have so often warned our candidates and their advisers against excessive confidence, that those who will still attempt what is so so far above their powers have only themselves to blame for their failure.—Of the papers in *French Commercial Correspondence*, it gives me pleasure to speak favourably, though, as only first-class certificates are given in this subject, the number of these is small. Were certificates of lower grades awarded, many of the other candidates would have been entitled to them. On the whole, the result fully justifies the addition of this special subject to the Society's Programme of Examinations."

The Examiner in *German* and *Commercial German* says:—"I have much pleasure in stating that the entire work of the candidates was this time far more satisfactory than it has been since I have had the honour to conduct the examination. This year's candidates have evidently followed my suggestion in last year's report, which I beg to repeat for the benefit of future candidates, viz., to acquire, first of all, an accurate knowledge of German accidence, and to devote afterwards considerable attention to the acquisition of a certain facility in translating from English into German, and, finally, that they should only make use of such grammatical works as give the theory of German grammar in a systematic form. I cannot help, however, expressing at the same time my surprise and regret that the number of German candidates is so small in proportion to the very large total of candidates for the examinations. I think that the study of German ought to be more generally cultivated in the numerous literary institutions throughout the country. A good knowledge of German will not only be of great practical utility to most students of the language, but it will also afford them considerable intellectual advantages, on account of the strictly grammatical structure of the German language, and the beneficial influence derived from the perusal of classical German works.—As regards the examination in *Commercial German*, the result of the first experiment is as follows:—Four candidates have presented themselves, one of them fully deserves a first-class certificate, the three others would be entitled to a second-class certificate if such a one were awarded in the subject in question. The reason of their failure must be sought in the circumstance that they are not yet fully acquainted with German commercial phraseology. Their work was, however, sufficiently well done, on the whole, to show that, with another year's assiduous practice, they are very likely to pass a thoroughly satisfactory examination in the subject."

The Examiner in *Italian* "is glad to perceive that the papers this year have been worked generally with more care, and show evidences of more diligent study than those of 1870. However, as in some instances only a portion of the paper was done, and in others the knowledge of the language was not sufficiently extensive, it is not in his power to grant any first-class certificates."

The Examiner in *Spanish* says:—"I am very glad to observe that the number of candidates of the present year in this subject has been nearly twice that of the preceding year, and that they show in their general character considerable improvement."

The Examiner in *Elementary Musical Composition* says:—"I am happy to award a far higher number of marks than last year. This is partly because one of last year's questions was out of the range of the candidates' knowledge, but partly because the average merit of this year's exercises is much above that of those produced in last year's examination. On the whole, I think there is decided proof of the musical aptitude of of our English people, in the fact that persons who have had no professional training should in so many cases as are here presented produce pieces which, apart from their more or less technical correctness, evince very strong musical feeling."

A report of the proceedings of the Conference will appear in the next *Journal.*

ANNUAL INTERNATIONAL EXHIBITIONS.

On Monday evening, a meeting was held at the Educational Institute, Stockwell-green, the Rev. Joseph Wallis, M.A., vicar of St. Andrew's, Stockwell, in the chair, when Mr. Edward Hall, F.S.A., authorised by her Majesty's Commissioners, delivered an address explanatory of the aim and scope of the Exhibitions, of which the first is now open. A resolution was passed to the following effect:—"That this meeting cordially approves the project of the Annual International Exhibitions, the realisation of which is calculated to contribute to the progress of Art, Science, Industry, and Commerce, the growth of wealth, and the improvement of the social condition of the different classes in each nation of the world, to promote harmony in the relations between the peoples or governments, and ultimately to substitute for the present alternation of armed truce and international strife, a general and constant recognition that the interests of each nation are bound up with those of other nations, or that one country or nation has advantages of soil and climate, geographical location, or character of the race or people, which another country has not, and that mutual assistance, and general economy of production throughout the world would tend towards an eventual state of perfect comfort and happiness of each nation and each individual."

EDUCATIONAL NOTES.

The School Fees of Indigent Children.—On Monday last, the Liverpool School Board finally adopted the bye-law providing that, where parents satisfy the Board that they are unable to pay school fees, the latter may be remitted in the case of Board schools, and paid by the Board in the case of other schools.

The Industrial Schools Act.—At the meeting of the London School Board, on the 31st ult., a report was presented by the Industrial Schools Committee respecting the extent to which Denison's Act is in operation in the metropolis, and showing what poor-law guardians have hitherto done to enforce education among the outdoor poor. The committee had been in communication with the different unions and parishes, inquiring concerning the outdoor pauper children, and had obtained returns with respect to the manner in which education has been enforced under permissive laws. From this document it appeared that the total number of children of paupers to whom outdoor relief is given was 38,577, and of these the school fees of 3,125 are paid, exclusive of some whose fees are calculated in relief. The whole amount paid last year was £1,396 4s. 9d. The returns, however, were not quite complete. It appears that in

Camberwell, where the parents are summoned for the non-attendance of their children, "the Act has worked satisfactorily," and this is also the case in Mile End Old Town, where the fees of 280 children out of 1,136 are paid, and where attendance is enforced. On the other hand, in Wandsworth and Clapham, although the Act is in force, there are "no regulations for securing attendance," and, as might be expected, "the Act is not much profit to the children." Special attention was drawn to the return from the Strand Union, in which the words "nothing known about such an Act," occurred.

The Influence of the Compulsory Clauses.—"Although the Blackburn School Board," says the *Blackburn Times*, "have not yet begun to exercise their power of compelling attendance, we think they may now very speedily do so, and, in the meantime, it is satisfactory to learn that the mere rumour of approaching compulsion has had the effect of sending great numbers of children to school who have hitherto been suffering total neglect in respect to their education. It is certain that within the last six months a very significant augmentation has taken place in the numbers of children going to school."

The Universities and the Public Schools.—On the proposition of a Committee of Masters of Public Schools, a Syndicate of the Cambridge Senate recommends—1, that the University undertake to examine the highest grade schools, and that the examination be in the school work, and be such as to enable the examiners to report on the general character and efficiency of the teaching in each school; 2, that the University also undertake to examine individually all boys who offer themselves for that purpose on leaving school, and to certify, if the case be so, that the candidates have reached a standard suitable for boys (1) under 19, (2) under 16. It is proposed that an agreement should be established with the other English Universities as to the standard for certificates. In reference to the subjects of examination, the Committee of Public Schoolmasters propose that they should be clessified on some such system as the following:—Group A.—1, Latin; 2, Greek; 3, English, with French or German. Group B.—1, Arithmetic; 2, Algebra; 3, Geometry; 4, Chemistry; 5, Experimental Mechanics; 6, any other two scientific subjects from a list to be specified. That every candidate be required to pass in five of these subjects, two from group A, two from group B, and the fifth left to the candidate's discretion. The details of the scheme, however, are not yet settled.

Religious Tests at the Universities.—It may be mentioned that at length the controversy on this subject has reached its close. On Tuesday last, the House of Lords agreed not to insist on its amendments, and the Bill awaits the Royal assent in the form in which it went up the second time from the Commons.

The Teaching of Geography.—Mr. Francis Galton draws special attention to the want of systematic instruction in this subject at our great public schools, where, although it "may be taught in some of the lower forms, it is not there learnt as it ought to be learnt by every young English gentleman, whatever is to be his future career in life." This view is confirmed by the Public Schools Commissioners, and Mr. Galton believes that the principal blame should be thrown on the universities. "What these demand the older and more famous public schools will teach; and, conversely, those public schools will not teach what the universities do not demand. It is not only a case of supplying what is asked for, but it is also that the public school teachers, being all of them university men. adhere to university traditions. Hence it is that even the Civil Service examinations (which include geography) have so little influence on those schools." In a leader upon the subject, the *Times* urges that "unless a rudimentary knowledge of physical and political geography be made part and parcel of the academical system, the mass of students will remain content" to be ignorant of it, and that "a very favourable opening is now presented for the consideration of the question. For years past the institution of a compulsory entrance examination has been under discussion at both universities; this idea has recently been revived in a new form, and a committee of head masters has laid before the universities of Oxford and Cambridge a scheme for examinations, to be conducted under their joint authority, but in which geography has, as yet, no place assigned to it." The *Times* thinks "it is hardly possible that its omission could have been deliberate, or that any objection could be made to its recognition, if the scheme should ultimately take effect."

Technical Education for Farmers.—Mr. Little, of Heckington, Lincolnshire, has addressed a letter to the Lincolnshire Farmers' Association, on the above subject, in which he points out how undesirable it is that men destined to the pursuit of agriculture should be entirely ignorant of such of the simple elements of chemistry as would give them a complete knowledge of the application and properties of the various materials used in the manufacture of artificial manures, when such knowledge may be acquired with little trouble, in a short time, and at small expense. "Why should the business and pursuit of agriculture be an exception in the rules of guidance for the successful pursuit of any other business or profession. For the practice of medicine, law, engineering, architecture, &c., a special course of study is required, and is really necessary. Agriculture, as a business pursuit, offers abundant occupation for the highest order of intelligence, and stands second to none in its claim to scientific skill and sound practical sense, and has, therefore, an equal claim with other professions, that those engaged in it should be properly qualified by a special form of education."

Education in the Colonies.—Mr. Edwin Pears writes:—"In all the Australian colonies, good workable systems of primary education have been established. In all, good schools for secondary education have been provided. Two universities are already at work. Melbourne and Sydney have each an efficient staff of professors, good university buildings, good libraries, museums, and other appliances. I believe that in all the colonies there are abundance of scholarships between the primary and secondary schools, and between the latter and the universities. In none of the colonies is public money grudged for education. Wherever popular instinct has had play, it has always been found that its estimate of the value of education is high. As an example of the spirit in which these democratic little States legislate for education, take the fact that the island of Tasmania, with a population under 100,000, has two scholarships a-year of £200 per annum to any British university, in addition to a number of smaller exhibitions."

School Boards and the Ballot.—In reply to an inquiry recently addressed to him by some Welsh educationists, asking whether the present Ballot Bill will, if carried, enable the School Boards to be thus elected, Mr. Forster stated that, "when the Ballot Bill becomes law, the same provisions will be extended to School Boards by a supplementary measure." At the same time, in reply to the question, "When are we to expect the announcement of the formation of school districts in the country? There are many neighbourhoods, where the parish, as such, cannot form a district, that are anxiously waiting for that, that they may know how to proceed in applying for Boards," Mr. Forster said, "Inspectors will go round very shortly to arrange districts."

GENERAL NOTES.

The Gobelins.—The following extract from the *Journal Officiel*, respecting the Gobelins manufactories, has been received, through the Foreign-office, from her Majesty's Ambassador at Paris:—"The destruction of the Gobelins is not so great as was at first supposed. We have ascertained with pleasure that only a portion of the manufactory has been burnt, and much of the tapestry work has been saved. The workshop of the famous Savonnerie carpets, the dyeing rooms, the offices, and the dwellings are untouched. Even in the store-rooms, which have been partly burnt, some of the finest pieces have been preserved. We name specially a "Dead Christ," after Phillippe De Champaigne, and the portrait of Louis XIV., after Rigault, the glory of the Gobelins, and a *chef-d'œuvre* of the famous manufacture. The collection of patterns recently placed in the Gobelins by the Administration des Musées is intact.

Improved Labourers' Dwellings.—Lord Derby presided lately at an influential public meeting, held for the purpose of forming in Liverpool a company for the promotion of improved dwellings for the working classes, either by the purchase and improvement of existing court property, or erecting new property, at moderate rents, on suitable sites near the centres of labour. His lordship, in the course of his speech, said that, taking Liverpool as a whole, and adopting no very high standard of comparison, the deaths were at least 10 per thousand yearly more numerous than they ought to be, or need be. We have to ask ourselves, said his lordship, first, what are the causes of this excessive disease and mortality; and next, how are we to find a remedy? The causes, I think, are few and simple—overcrowding, drunkenness, and immorality; and, among a certain class, a want of a sufficiency of wholesome food. I say nothing of the temporary mischief produced by epidemics, except so far as they are aggravated by unfavourable physical conditions; nor do I touch upon the subject of drunkenness, because that is not before us, except from this point of view, that if a man, or a woman, has to live in a hole where cleanliness and decency are impossible, you must not wonder if they try to drown—I will not call it their misery—but their discomfort and humiliation, in drink. There is a kind of action and re-action in this matter. Crowded lodgings and poisoned air produce the craving for stimulants, and drunken habits keep the family from ever moving into a more respectable home. I hear many people say, "Oh, improved education will set all that right." Now, I am as warm a friend to popular education as any one, but I am not quite so sanguine. If a man is placed in a position where moderately pure air is unattainable, and self-respect almost impossible, it is not being able to read and write that will keep him out of the gin-shop. I am not arguing in disparagement of either educational teaching or of that direct preaching of temperance, or rather abstinence, upon which many people rely. It is well that the evil we have to fight against should be attacked from many points at once; but I believe that if it were possible that every man, woman, and child in Liverpool should have a clean, wholesome, and decent lodging, you would have struck a heavier blow at intemperance than could be struck by all the school boards and all the teetotal gatherings in England put together. Of course I don't argue that, even under these conditions, the effect would be immediate. All changes where human habits and character are concerned are slow in operation. But that is a point of less practical importance, because, do what we may, we can only provide accommodation for comparatively few at a time, and by a kind of process of natural selection the model lodger would be the first to find out and to use the model lodging. On the whole, it may be taken as proved that, with ordinary good and economical management, a return of five per cent. in average years can be got from investments of this kind, without either giving less in the way of accommodation than health and decency require, or, on the other hand, asking more than the working class are willing to pay and actually do pay for the wretched hovels they live in now. Now, I do not contend that the return I spoke of would tempt a speculator, or that better investments may not be found, but if a man can get 5 per cent., or even 4½ or 4, with scarcely any risk of losing the principal, and at the same time have the satisfaction of knowing that he is helping on a good work, it seems to me that he might do worse with his savings, both for his pocket and his conscience. Objection has been taken to this movement on the ground that the means employed are inadequate to the object. My answer is, that depends on the spirit in which it is taken up. If we cannot do all that we could wish, we can at least set an example and make a beginning, and it is to my mind vitally essential that the work we have in hand should be done by private enterprise. Either it will pay or it will not. If it will, there is no need to call on any public authority to help us. If it will not—but that is an hypothesis I do not accept for an instant—it is no light matter to require the local governing body of the town to provide homes for the poor at less than their cost price. You would by that course be sanctioning a principle of which it is not easy to see how or where you could limit the application. For if a poor man, not being a pauper, has a right to be supplied with lodging at less than its cost, why not the food also?—the one is as necessary as the other; and then you come to what would be nothing less than a system of universal outdoor relief. I only indicate the difficulties of that alternative. By voluntary action we avoid them altogether. It is to voluntary action, to individual and collective effort, that we appeal.

Steam Engines at Milan.—The number of steam-engines at Milan has been greatly increased within the last few years, and there are now double the number there were three years ago. In 1850, there was only one steam-engine at work; ten years later (1860), 17; in 1864, 24; in 1867, 37; and at the present time 74. In the commune of the Corpi Santi, which comprises all the suburbs of Milan, and containing a total population of 60,000 persons, the number of steam-engines is 45. One of Howard's patent boilers is now being put up at a large distillery in Milan.

Zinc Production of North America.—In 1860, only £15,000 worth of zinc ore, and £2,250 worth of zinc, were produced in the United States; whereas, up to the end of June, 1870, the State of Missouri alone produced £6,625 worth of zinc ore, and £21,250 worth of zinc, or £10,625 worth more than the whole produce of the United States ten years previous.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal Colonial, 8½.
Royal United Service Institute, 8½. 1. Major R. H. Stotherd, R.E., "On Defensive Sub-marine Warfare." 2. Rev. S. Beal will exhibit a Model of a Chinese Torpedo, and read a Translation of a Native Work on the subject.
British Architects, 8.
Asiatic, 3.
Anthropological Institute, 8.
Social Science Association, 8. Mr. John Westlake, "On the Interpretation of the Extradition Act as effecting Political Crimes."

Tues. ...Statistical, 8. Mr. Hyde Clarke, "On the Transmissibility of Intellectual Qualities, as illustrated by Statistical Evidence."

Wed. ...Meteorological, 7. Annual Meeting.
Geological, 8. 1. Mr. A. H. Green, "Notes on the Geology of part of the County of Donegal." 2. Mr. W. Carruthers, "On some supposed Vegetable Fossils." 3. Mr. Alfred Tylor, "Memoranda on the most recent Geological Changes of the Rivers and Plains of Northern India, to show the practical application of Mr. Login's theory of the abrading and transporting power of water to effect such changes." By Mr. T. Login.
Royal Society of Literature, 8½.

Thurs...**SOCIETY OF ARTS, 2.** Review of School Drill at the Royal Horticultural Gardens at South Kensington.
Statistical, 4½. Annual Meeting.
Royal Society Club, 6½. Annual Meeting.

Fri.......Royal Botanic, 4. Professor Bentley, "Economic Botany."
Quekett Club, 8.

Sat ......Working Men's Club and Institute Union. Lecture at the Royal School of Mines, by Miss Faithfull, "The Best Society."

Journal of the Society of Arts.

No. 970. Vol. XIX.

FRIDAY, JUNE 23, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

ANNUAL GENERAL MEETING.

The One Hundred and Seventeenth Annual General Meeting, for the purpose of receiving the Council's report, and the Treasurers' statement of receipts, payments, and expenditure during the past year, and also for the election of officers, will be held, in accordance with the Bye-laws, on Wednesday next, the 28th of June, at four p.m.

The Council hereby convene a Special General Meeting of the Members of the Society to ballot for members, such meeting to take place at the close of the Annual General Meeting.

By order,
P. Le Neve Foster, *Secretary.*

Society's House, Adelphi, June 21st, 1871.

FINANCIAL STATEMENT.

The following statement is published in this week's *Journal*, in accordance with Sec. 42 of the Society's Bye-laws, which provides that, at the Annual General Meeting, the Council shall render to the Society a full account of their proceedings, and of the receipts, payments, and expenditure during the past year; and a copy of such statement shall be published in the *Journal* of the Society on the Friday before such general meeting:—

TREASURERS' STATEMENT OF RECEIPTS, PAYMENTS, AND EXPENDITURE, FOR THE YEAR ENDING MAY 31st, 1871.

Dr.

	£	s.	d.	£	s.	d.
To Cash in hands of Coutts and Co., 31st May, 1870	532	3	6			
Do. do. Secretary	5	0	11			
				537	4	5
To Subscriptions received during the year, from Members and Institutions in Union	5,605	8	9			
Life Contributors	165	18	0			
				5,771	6	9
To Dividends on Stock:—						
Consols, £4,746 19s. 5d.	140	0	8			
,, £167 7s. 3d. North London Exhibition Trust	4	18	10			
Great Indian Peninsula 4 Railway Debenture Stock:— Alfred Davis' bequest ...£1,950 Alexander Robbs' bequest 220						
£2,170	38	7	0			
Reduced 3 per cents., £434 8s. 6d.	12	16	2			
New 3 per cents.:—						
Dr. Fothergill's Trust, £388 1s. 4d.	11	9	0			
Indian 5 per cent. Notes, 52,000 rupees	241	2	3			
				448	13	11
To Examinations:—						
The Prince Consort's Prize	26	5	0			
Royal Geographical Society's Prize	5	0	0			
Candidates' Fees	9	13	6			
				40	18	6
To Sale of Books, &c.:—						
Journals	52	16	5			
Messrs. J. M. Johnson and Sons, advertisements	274	19	0			
Transactions	9	10	4			
				337	5	9
To Bequests:—						
Alfred Davis, £2,000, less legacy duty, £200	1,800	0	0			
Alexander Robb	200	0	0			
				2,000	0	0
To Musical Education Committee (Concerts)	1,556	14	1			
Drill Committee	29	8	0			
Postal Committee	21	15	0			
House and Office	6	0	0			
Art-Workmanship, the Salters' Company	10	10	0			
				1,624	7	1
To South Australian Institute				250	0	0
				£11,009	16	5

Cr.

	£	s.	d.	£	s.	d.
By Re-payment of overpaid by S. T. Davenport				3	10	6
By House and Premises:—						
Rent, Rates, and Taxes	115	18	2			
Insurance, Gas, Coal, Water, and House Charges	193	7	1			
Repairs and Alterations	113	18	3			
				423	3	6
By Office:—						
Salaries, Wages, and Commissions	1,800	15	5			
Stationery and Printing	336	5	2			
Advertising	144	2	5			
Postage Stamps and Parcels	161	4	0½			
				2,442	7	0½
By *Journal*, including Printing, Stamps, and Distribution to Members	2,015	5	7			
Library, bookbinding, &c.	122	6	0			
Conversazione	255	9	9			
				2,393	1	4
By Union of Institutions, including Examinations, Prizes, Postage, Printing, &c.	578	1	1			
Prince Consort's Prize	26	5	0			
				604	6	1
By Art-Workmanship Prizes	255	4	9			
Society's Albert Memorial Medal	20	18	0			
,, Medals	6	9	6			
				282	12	3
By Exhibition of 1871	26	1	10½			
North London Exhibition Prize	4	18	0			
				30	19	10½
By Committees:—						
General Charges	12	4	4			
Cab Committee	1	0	0			
Dinner Account	0	0	6			
Drill Committee	102	0	2			
Education Committee	107	10	7½			
Food Committee	14	10	9			
Government and Inventors	13	1	0			
Indian Committee	13	15	8½			
Life-boat Committee	2	9	8			
Musical Education Committee	689	10	6			
Postal Committee	18	12	7			
Tablets Committee	3	4	6			
				978	0	4
By South Australian Institute	375	3	9			
Cantor Lectures	197	15	10			
				572	19	7
By Bequests invested:—						
Alfred Davis	1,793	7	0			
Alexander Robb	201	0	6			
				1,994	7	6
				9,725	8	0
Balance at Bank, 31st May, 1871				1,283	14	7
,, in Secretary's hands				0	13	10
				£11,009	16	5

LIABILITIES.

	£	s.	d.	£	s.	d.
To Sundry Creditors:—						
Balance of Bequest by Alfred Davis, uninvested	5	12	6			
Sir W. C. Trevelyan (for Prize)	70	0	0			
John Murray (for Building Fund)	50	0	0			
Prince Consort's Prize	26	5	0			
Art Workmanship Prizes	179	0	0			
North London Exhibition Trust	7	7	9			
Examination Prizes (Society's)	146	0	0			
Do. Royal Geographical Society's Prize	5	0	0			
Do. Royal Horticultural Society's Prizes	16	0	0			
Do. Tonic Sol-fa Association	8	0	0			
Do. Lord Fortescue's Prize	5	0	0			
Do. Henry Cole, C.B., Prize	6	0	0			
Do. Thomas Twining	5	0	0			
Do. Mrs. Harry Chester	5	0	0			
Examiners' Fees	202	13	0			
Musical Education Committee (Concerts)	867	7	3			
Rent, Rates, and Taxes	250	0	0			
Tradesmen's Bills	860	8	0			
South Australian Institute	50	12	7			
				2,765	6	1
By excess of Assets over Liabilities				3,967	2	9
				£6,732	8	10

ASSETS.

		£	s.	d.	£	s.	d.
By Reduced 3 per Cent. Stock £388 1s. 4d., at 91⅝		355	11	3			
Consols, £146 19s. 5d., at 93⅜		137	4	8			
Invested in India 5 per Cent. Rupee Notes		353	11	6			
Do. Great Indian Peninsular Railway 4 per Cent. Debenture Stock, £199 13s., at 90¾		220	0	0			
Subscriptions of the year uncollected	1,547 18 0						
Less 15 per cent.	232 2 0						
		1,315	16	0			
Do. of former years unpaid	1,686 16 0						
Less 50 per Cent.	843 8 0						
		843	8	0			
Barry's Pictures and other property		2,000	0	0			
Prince Consort's Prize		26	5	0			
Royal Horticultural Society's Prizes		16	0	0			
Tonic Sol-fa Association Prizes		8	0	0			
Lord Fortescue's Prize		5	0	0			
Henry Cole, C.B., Prizes		6	0	0			
Thomas Twining's Prize		5	0	0			
Mrs. Harry Chester		5	0	0			
Journals, per Bell and Daldy		31	4	0			
					5,328	0	5
Cash in the hands of Coutts and Co.		1,283	14	7			
Do. London and Westminster Bank, on account of Sir W. C. Trevelyan's Prize		70	0	0			
Do. in the hands of S. T. Davenport, on account of J. Murray's donation to a Building Fund		50	0	0			
Do. in hand of Secretary, petty cash		0	13	10			
					1,404	8	5
					£6,732	8	10

P. Le Neve Foster, *Secretary.*

Stock standing in the name of the Society at the Bank of England.

Consols	£4,914 6 8
New 3 per Cents.	388 1 4
Reduced 3 per Cents.	434 8 6
Great Indian Peninsular Railway 4 per Cent. Debenture Stock	2,170 0 0
India 5 per Cent. Rupee Notes	Rs. 52,000

Trust Funds included in the above.

Swiney Bequest	£4,500	0	0	Consols, chargeable with a sum of £200 once in five years.
John Stock's Trust	100	0	0	„ chargeable with the Award of a Medal.
North London Exhibition Trust	167	7	3	„ chargeable with the Award of the Interest as a Money Prize.
Fothergill's Trust	388	1	4	New 3 per Cents., chargeable with the Award of a Medal.
Cantor Bequest	5,049	9	7	Invested in India 5 per Cent. Rupee Notes, 52,000 rupees.
Alfred Davis's Bequest	1,800	0	0	„ Purchase of £1,950 Great Indian Peninsular Railway 4 per Cent. Debenture Stock.

The Receipts of the Society set forth above have been credited by Messrs. Coutts and Co.
The Payments set forth above have been made by authority of the Council.
The Assets, represented by stock at the Bank of England, and by cash balance at Messrs. Coutts', have been duly verified.

J. A. Franklin, } *Auditors.*
Andrew Cassels, }

Society's House, Adelphi, 20th June, 1871.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

◆

CONVERSAZIONE.

The Annual Conversazione of the Society took place on Friday evening, June 16th, at the South Kensington Museum.

About four thousand eight hundred of the Members and their friends were present. The company was received by Lord Henry G. Lennox, M.P., Chairman of Council.

Their Royal Highnesses the Prince and Princess of Wales arrived at half-past eleven. They were received by Lord Henry G. Lennox, M.P., Chairman of Council, and other Members of Council, with their ladies and the officers of the Society, and conducted to the Competition Gallery, in which the following distinguished guests had assembled:—His Royal Highness the Duke of Edinburgh; His Royal Highness Prince Arthur; Her Royal Highness Princess Louise and the Marquis of Lorne; Her Royal Highness the Princess of Teck and His Serene Highness the Prince of Teck; the Grand Duke Wladimir of Russia; His Serene Highness Prince Christian; His Serene Highness Prince Edward of Saxe-Weimar; Prince John of Glucksburg; the Duke and Duchess of Ossuna and Princess Solens Braunfels; Prince and Princess Poniatowsky; Duke and Duchess of Manchester; Duke and Duchess of Sutherland; Duke and Duchess of Richmond and the Ladies Gordon Lennox; Duke and Duchess of Marlborough; Duke and Duchess of St. Albans; Marquis and Marchioness of Westminster; Marquis and Marchioness of Bristol; Marquis and Marchioness of Camden; Maria, Dowager Marchioness of Ailesbury, the Marquis and Marchioness of Ailesbury; Marquis of Hamilton; Earl and Countess Granville; Earl and Countess of Brownlow; Earl and Countess of March; Earl of Clonmel; Countess Westmoreland; Lady Emily Kingscote; Lord and Lady Cecilia Bingham; Lord and Lady Londesborough; Lord De L'Isle; the Right Hon. B. Disraeli and the Vicountess Beaconsfield; the Right Hon. Sir John Pakington, Bart., M.P., and Lady Pakington; Baron Rothschild; the Right Hon. W. E. Forster, M.P., and Mrs. Forster; Sir Julius Benedict; Mr. Henry Cole, C.B., and Mrs. Cole; Mr. Edwin Chadwick, C.B.; Mr. and Mrs. Hyde Clarke; Mr. and Mrs. William Hawes; Mr. and Mrs. Seymour Teulon; Mr. E. Carleton Tufnell; Major-Gen. Eardley-Wilmot; Mr. and Mrs. Bartley; Captain Donnelly, R.E.; Mr. R. Rawlinson, C.B., and the officers of the Society. Colonel Keppel and the Hon. Mrs. Coke were in attendance on the Prince and Princess of Wales. His Highness the Nawab Nazim of Bengal, with his two sons and suite, also honoured the Council by their presence.

The Band of the Coldstream Guards, under Mr. F. Godfrey, performed the following music in the North Court:—

Overture	"L'Italiana in Algieri"	*Rossini.*
Waltz	"Hydropaten"	*Gung'l.*
Operatic Selection	"Lucia di Lammermoor"	*Donizetti.*
Austrian Hymn	"God preserve the Emperor" Arranged with Variations from the celebrated Quartette.	*Haydn.*
Euphonium Solo	"O ruddier than the cherry" Mr. DARNLEY.	*Handel.*
Selection	"Reminiscences of Weber" Selected and arranged from the following Operas:— "Preciosa," "Der Freischütz," "Oberon," and "Euryanthe."	*F. Godfrey.*
Cornet Solo	"Robert, toi qui j'aime" Mr. PAGE.	*Meyerbeer.*
Waltz	"Amèlie"	*F. Godfrey.*
Operatic Selection	"Princess Trebizonde"	*Offenbach.*
Piccolo Solo	"The Carnival of Venice" Mr. NICE.	*Paganini.*
Glee	"The Chough and Crow"	*Sir H. Bishop.*
Overture	"Massaniello"	*Auber.*

The following glees were sung at intervals in the lecture theatre by Mr. John Foster, Mr. Coates, Mr. Montem Smith, Mr. Hilton, and Mr. Winn:—

"Come, bounteous May"	*Spofforth.*
"When the wind blows"	*Horsley.*
"I wish to tune"	*Walmisley.*
"The Bee"	*Elliott.*
"Queen of the Valley"	*Callcott.*
"By Celia's Arbour"	*Horsley.*
"O the sweet contentment"	*Horsley.*
"Under the greenwood tree"	*Bishop.*
Catch, "Would you know my Celia's charms"	*Webbe.*

DRILL REVIEW.

The review of schools took place on Thursday, the 22nd inst., at the Horticultural Gardens, South Kensington, in the presence of His Royal Highness Prince Arthur and a distinguished company. His Royal Highness, who was accompanied by His Serene Highness the Prince of Teck, was received at the entrance in Prince Albert's-road by Lord Henry Lennox, M.P., Chairman, and other Members of Council, and conducted to the Dais erected in the gardens. The march past then took place. On arrival at the Albert Hall, the prize banners were presented by His Royal Highness to the schools which had shown themselves on inspection to be most efficiently drilled. The First Prize was won by the Royal Naval School, Greenwich, and the Second Prize by the South Metropolitan District School. A Certificate of Merit was also awarded to the Stepney Industrial School.

The following schools took part:—

Central London	186	
South Metropolitan	312	
Forest-gate	100	
Marylebone	96	
Goliath Training Ship	249	
Stepney	144	
Lambeth	109	
Holborn	75	
Mile-end	103	
Islington	62	
Shoreditch	137	
West Ham	67	
Strand Union	100	
Royal Naval School	540	
Bethnal-green	80	
St. Mary's Orphanage	172	
Marine Society's Training Ship *Warspite*	205	
Homeless Boys of London:—		
Chichester Training Ship	200	470
Refuge Farm School	130	
The Home	140	

The following Instructions were issued to the Schools:—

1. The Schools must arrive at the Horticultural Gardens a little before 2 p.m., so as to be in position at that hour.

2. They may enter by either of the entrances marked on the accompanying plan, and march at once to the lower western terrace, where they will find the positions assigned to them. The position of each School will be marked by a bandrol carrying its name.

3. The Schools will be formed in line of contiguous close columns, right in front, as shown in the plan.

4. It is essential, from the confined nature of the ground, that no company should consist of more than 25 files. A school that has more than 50 boys must be broken up into two or more equal companies, of not less than 12 files each.

5. A Sergeant-Major of the Guards will be in charge of the parade, and direct all the movements. He will receive instructions from the committee as to the position of the several schools in line, which must depend on various circumstances.

6. The line of close columns will receive His Royal Highness Prince Arthur at 3 p.m., the bands playing the National Anthem. Immediately the bands cease playing, three cheers will be given for the Queen.

7. The march past will then commence. The schools will, in succession, move to the right in fours till they arrive at the steps marked A B in the plan. Each school or column will then wheel to the left and take up its position as shown for marching past.

8. The schools will march past in quick time in open column headed by their own bands, each company moving off in succession at wheeling distance. A school will not move off till the preceding school has passed the Reviewing Officer, and its band has ceased playing.

9. The master or the drill instructor of each school will march in front of the centre of his leading company, and salute as he passes the Reviewing Officer.

10. Each school will be provided with a bandrol on the ground, which will be carried by one of the boys at the head of the school. When the school is in line of columns, the bandrol will be in front of the centre.

11. After marching past, the schools will march into the Albert Hall by the route shown on the plan. They will form in fours on arriving at the end of the terrace, and continue their march in that formation.

12. The position of the several schools will be shown to them in the Albert Hall.

13. His Royal Highness Prince Arthur will then present two silk banners to the schools which have drilled best at their inspection, and presented the best appearance generally on this parade.

Bands.

14. On forming line of contiguous close column to receive His Royal Highness Prince Arthur, the bands of all the schools will take up a position opposite the saluting point, to play "God Save the Queen." The bands will, while thus, be placed under the direction of the Band Master of the Royal Artillery.

15. After playing "God Save the Queen," the bands will rejoin their respective schools and march them past. As soon as each school has passed the saluting point its band will cease playing. The next succeeding school, with its band, will then commence its march past, the band striking up as it opens out from close column.

16. On arriving at the Albert Hall, all the bands will be massed to play some pieces of music together.

SUBSCRIPTIONS RECEIVED.

	£	*s.*	*d.*
James Austin....	1	0	0
B. W. Bartram..	1	1	0
L. Biden........	1	0	0
Sir W. H. Bodkin	1	0	0
W. W. F. Bolton	1	1	0
Wm. Botly	0	5	0
H. A. Bowler....	0	10	0
A. Cassels	0	10	0
A. S. Cole	0	10	0
Henry Cole	2	0	0
Sir Daniel Cooper, Bart. (will increase if needed)	1	0	0
W. Cooper.......	0	10	0
Rev. B. M. Cowie	1	1	0
Major-Gen. Croggan, R.A......	0	5	0
J. A. Crookenden.	0	10	6
Thomas Dixon ..	0	10	6
John E. Evans ..	0	10	0
W. H. Fell......	1	1	0
F. Filliter.......	1	1	0
J. A. Franklin ..	0	10	0
Samuel Harton (to be doubled if required)......	0	5	0
Sir Rowland Hill	1	1	0
G. N. Hooper....	1	1	0
Chas. Horne (will give 10s. more if required)	0	10	0
Dr. Albert Horwitz..........	0	5	0
Maj. E. W. Mathew	0	10	0
R. Nicol........	1	1	0
James Noble	1	1	0
John Noble	1	0	0
John Pritchit....	0	5	0
Edward Rosher..	0	10	0
W. S. Rumsey ..	0	5	0
Philip Sancton ..	1	0	0
South Metropolitan District School........	10	10	0
George Stanton..	0	10	0
W. H. Tanquerary	0	10	6
Charles Telford..	1	0	0
W. H. Thomas ..	1	0	0
E. C. Tufnell....	5	0	0
Z. Watkins......	0	5	0
C. Williams	1	1	0
W. B. Wrightson	1	0	0
	£45	6	6

ANNUAL CONFERENCE.

The Twentieth Annual Conference of the Representatives of the Institutions in Union, and the Local Educational Boards, with the Council of the Society, was held on Friday, the 16th inst., at 12 o'clock noon. Lord Henry G. Lennox, M.P., Chairman of the Council, presided.

The following is a list of the Institutions and Local Educational Boards represented at the Conference, with the names of their respective representatives:—

Aberdeen Mechanics' Institution	Professor Bain.
Bradford, Mechanics' Institution	Mr. John G. Best. Mr. A. Illingworth, M.P.
Bromsgrove, Literary and Mechanics' Institution....	Mr. R. P. Amphlett, M.P. Hon. C. S. Lyttelton, M.P.
Carlisle, Mechanics' Institute	Sir Wilfrid Lawson, M.P. Mr. E. Potter, M.P. Mr. William Steel.
Chelmsford, Literary and Mechanics' Institute......	Mr. John Gibbs.
Crewe, Mechanics' Institution	Mr. George Pottie.
Derby, St. Peter's Evening School..................	Mr. Herbert M. Holmes.
Faversham, Institute	Mr. John A. Anderson, jun.
Glasgow, Mechanics' Institute	Mr. George Anderson, M.P.
Hertford, Local Board......	Mr. Robert Dimsdale, M.P.
Hitchin	Mr. Joseph Pollard.
Huddersfield, Mechanics' Institution	Mr. J. H. Bower.
Lancashire and Cheshire Union of Institutes	Mr. Thomas Lawton. Dr. R. M. Pankhurst. Mr. Alderman Rumney, J.P.
Lockwood, Mechanics' Institution	Mr. J. R. Bentley. Mr. Bentley Shaw.
London, Beauvoir College ..	Rev. John Curwen. Mr. Robert Griffiths. Mr. John Sarll.
„ Birkbeck Institution	Mr. Thomas Lyle. Mr. J. Rigby Smith. Mr. George M. Norris.
„ City of London College	Rev. R. Whittington, Principal. Rev. J. G. Wrench. Mr. G. D. Hooper. Mr. J. H. Levy.
„ Lambeth..........	Mr. Heller.
„ Royal Polytechnic Institution	Rev. C. Mackenzie.
„ Walworth Literary and Scientific Institution	Mr. J. S. Noldwritt.
Lurgan, Local Board	Mr. William Macoun. Mr. William Heron.
Macclesfield, Useful Knowledge Society	Mr. W. Bullock. Mr. W. C. Brocklehurst, M.P.
Middlesborough, Mechanics' Institute	Mr. R. Wm. Taylor.
Newcastle, Temperance Society	Mr. J. W. Swanston.
Northallerton, Institute	Dr. J. S. Walton, jun. Mr. W. Jackson.
Penzance, Local Board	Mr. Councillor Rodd.
South Staffordshire Association	Mr. Fredk. Talbot.
Stourbridge, Church of England Association	Mr. Richard Freer.

The Educational Officer (Mr. C. Critchett) having read his Report to the Council, which appeared in last week's *Journal*,

The Chairman (Mr. S. Redgrave, Vice-Chairman of the Council, who presided, pending the arrival of Lord Henry Lennox) invited discussion upon the first question on the list.

The Society of Arts Examinations:—Whether any, and what, modifications in them would be desirable?

Mr. Lawton (Lancashire and Cheshire Union) said that although it was true, as stated in the report, that Mr. Hyde Clarke's suggestion for a *vivâ-voce* examination in modern languages, with certificates granted by that Society, had only been carried out in one instance, he wished to state, with regard to the Lancashire and Cheshire Union, that a similar plan had been adopted there, although they carried it out under their own supervision, awarding their own certificates and their own prizes. They called together the principal professors of French and German in Manchester and the neighbourhood, and held an examination in those languages. This year the examination was carried out, in the first instance, under the supervision of a local board, in such a way as to test candidates in composition; and all those who passed that examination were required to come to Manchester to converse with the examiner appointed by the Council. Twenty-six candidates offered themselves in the first instance, and sixteen of them were selected as being competent to try for the prizes. Two prizes were awarded in French, and only one in German. In Lancashire considerable interest was being created in this matter, and he would be glad to know whether the Society of Arts could assist them in giving to those examinations more of a national character, by sending down an examiner to the respective centres, to hold the conversational part of the examinations, because then the Society could make the award of the prizes and certificates. If that could be accomplished, and the districts would undertake to pay the expenses, as was done with regard to the Oxford and Cambridge examinations, he believed these examinations would have a much greater interest. He might take this opportunity of saying that the Society of Arts' certificates were valued very highly, more so than any local certificate, and indeed more than any certificates given by any other examining body.

The Rev. Richard Whittington (City of London College) said they must have one examination for the whole of England, and the difficulty would be that they would have to retain the services of a gentleman for a very long time, in order to enable him to go to the different local centres.

Lord Henry Lennox now arrived, and occupied the chair.

Mr. Talbot (South Staffordshire Association) urged that the age at which candidates were admitted to examination should be lowered from sixteen years to fourteen. These examinations would be most valuable to boys in their schools in Staffordshire, many of whom were considerably above the 6th standard of the New Code, and there was thus nothing for them to work for. If he understood rightly, the government science examinations would not touch those boys at all; but there were many teachers throughout the country who might be disposed to work them up for the examinations of the Society of Arts if the age were lowered as he had suggested. He found at the present time that a large number of boys in South Staffordshire left school at 14 years of age; they did not attend a night school, and there were very few evening classes for them, and thus their education was not continued. Probably not one in ten joined any institution, and they lost sight of these Society of Arts' examinations, which would be so specially valuable to them. This year, he was sorry to say, their district had fallen lower in number of candidates than before. He attributed this to the fact that institutes were going down very rapidly (though by-and-bye probably there would be a resurrection) owing to free libraries and other things of that kind. He desired to press very much the desirableness of lowering the age to 14.

Mr. Gibbs (Chelmsford) thought it was a very good suggestion, for many boys at 14 were in advance of others at 16, and there was no means at present by which their acquirements could be tested. In many cases, between the ages of 14 and 16, for want of some stimulus to mental activity, their energies ran to waste or were turned to a bad purpose.

Mr. Norris (Birkbeck Institution) wished to remark, with reference to the female prize not being awarded, that many of the female candidates were governesses, and were thus debarred, as "teachers," from competing. As this was just the class of persons for whom the examinations were intended, he would beg leave to suggest to the Council that they should take into their consideration the advisability of allowing governesses to compete for the prizes.

The Rev. R. Whittington said he was much interested in this question, because he felt it very important that the institutions, and the Society of Arts especially, should encourage the supplementing by youths of the education which they had had in school, but the difficulty was that, to a certain extent, the allowing the introduction of youths would interfere with the admission of older men. There was always a difficulty in getting men to come with young boys. He should prefer that, if possible, there should be special prizes offered for boys of a particular age.

Mr. Lawton said this subject was discussed about three years ago, and his feeling at that time was that the mixing of boys of 14 with men of 21 and upwards was very undesirable; for if adults found that they had to sit down with a large number of boys, they would not come, and what was gained on the one hand would thus be lost on the other. After the conference to which he referred, the Lancashire and Cheshire Council instituted a fresh examination, which they called a comprehensive elementary examination; one of their vice-presidents gave them a small sum for prizes, and special certificates were granted, so that they had a lower grade, a higher grade, a comprehensive elementary, and the final examination of the Society of Arts. In that way they got rid of the difficulty.

Mr. Heller (Lambeth) thought it would be very disadvantageous to lower the age, not only from the difficulty of mixing the classes, but because it would be difficult to prescribe an examination which would be adapted to boys and also to adult students. He would suggest to the Council to adopt some such course as the following; if they made any change at all, to limit the present examinations to 18, and to have some such intermediate examinations as Mr. Lawton referred to, for boys between 14 and 18. There was no question but that the usefulness of their classes would be immensely increased, if there were examinations adapted for children just leaving school.

Mr. Dimsdale, M.P. (Hertford), said he had been requested to support the reduction of age, if possible, the feeling in his part of the country being that it was of immense importance that there should be no gap between the school period and that when boys entered upon active life. With regard to the local examinations, which had been found most useful in bridging over that difficulty, he should be very glad to see the age of their candidates reduced from 12 to 11.

Mr. Levy (Birkbeck Institution) thought that there would be no advantage in reducing the age, for if they got more boys they would get fewer men. If anything was to be done at all in this way, it would be much better to institute special examinations for the younger students.

The Rev. J. Curwen (Beauvoir College) felt sure it would be injurious to lower the age without adopting some plan for having special examinations. At the same time, he agreed how important it was to encourage young persons to go on with their education from the time of leaving school.

Mr. Dimsdale then formally moved that the age be reduced from 16 to 14.

Mr. Hawes seconded the motion. He said he could not understand the reason for excluding boys of 14, and he did not value the objection at all that a man at 20 declined to work and be examined with a boy of 14. There were clever boys of 14, and if they were not enabled to fill up their time until they were 16, unless inducements were held out to them, there was great danger of their falling off. Besides, this would materially increase the number of candidates. On every ground he thought it desirable to include the largest number possible, and as 14 was the period at which a vast number of boys left school and entered into the active business of life, he thought everything should be done to encourage them to improve their education.

The Rev. R. Whittington begged leave to move an amendment, to the effect that the limit of age be retained as at present, unless the Council were prepared to give special prizes for youths between the ages of 14 and 18, in which case the age in the present examination should be raised to 18. If he judged rightly of the examinations, they were intended rather to supplement school education than to test that which had been obtained in school. It must not be supposed, however, that he wished in any way to discourage the giving of prizes to boys if the Society's funds would warrant it; but in such a case he should prefer special prizes in their case, and that the age for adults should be raised to 18.

Mr. Bullock (Macclesfield) seconded the amendment.

Mr. S. Redgrave said that probably, if the age was reduced to fourteen, it would greatly increase the number of candidates, but that, of course, would not be an objection if ultimate good resulted, but he must confess there were great difficulties in the way of getting adults to be examined with boys.

Mr. Lawton wished to direct attention to the scheme of the Science and Art Department, which, to a great extent, met the case of the boys of the age alluded to. No less than 50 boys in Lancashire came from a common elementary school to take the first stage of mathematics under the Science and Art Department, and in physical geography there was also a large number. As the Science and Art Department, therefore, took in boys of this age, he thought, under the circumstances, it was undesirable for the Society of Arts to weight itself with such an additional burden, especially as it would no doubt drive away adult candidates.

Mr. Gibbs said that boys who had just left school might be regarded as having received a superior education, and therefore, under the rules, as ineligible to take prizes. That, he thought, would obviate most of the difficulty complained of. It was very desirable that something should be done to meet their case, for he believed, in many instances, the lives of boys of good abilities had been thrown away, they being put to common handicrafts when their qualifications for a higher sphere of work would, under a system of examinations, have been made apparent.

Mr. W. G. Larkins said that, some three years ago, at the Metropolitan Association, of which he was then secretary, the same question as to whether the age should be lowered was discussed, and Mr. Harry Chester then propounded an idea of compromising the matter in this way—he suggested that boys from the age of 14 should be allowed to sit and be examined in the Society of Arts' subjects with older students, but that they should not be eligible to take prizes. This, he thought, removed the whole difficulty. A man had no objection to sit in class with a boy of 14, but he had a considerable objection to seeing a boy, fresh from school, take away the prize for which he was competing.

Mr. J. H. Bower (Huddersfield) could not agree with the last speaker. With regard to the practical difficulty of teaching men and boys in the same classes, he might say that, in the institution with which he was connected, so great was it found to be that they would not even meet in the same room. It was a very large and successful institution, but they did not have the adults and boys even on the same floor. The men had a strong objection to mix with the boys.

Mr. J. A. Anderson, Jun. (Faversham) also supported the amendment. He did so as the result of his own experience in an evening class, started some few years ago; for, having lowered the age, the result was that the class had dwindled down until it was almost confined to youths from 12 to 15.

Mr. Lawton suggested that there should be special examinations, which might be termed "the highest elementary grade," to meet the case of the boys referred to.

Mr. Heller said if any change were made at all, what was wanted was a lower grade of examination for special subjects which would be fitted for those young people between 14 and 18. He most warmly supported the amendment.

Mr. Rodd (Penzance) thought the matter might be safely left to the local boards to settle at what age they should admit the candidates. In the institution with which he was connected, they had been obliged to refuse very promising youths simply because they were just outside of the proper age.

Mr. Norris said that by leaving it open in this way, all the difficulties of the question would remain the same as before.

Mr. Dimsdale said he thought the question had been sufficiently discussed, and as the feeling of the meeting seemed averse to his resolution, he would ask leave to withdraw it.

This was acceded to, and the amendment was also withdrawn.

Mr. Norris (Birkbeck Institution) suggested that there should be an examination instituted in modern history, adding that if the Society did not feel itself justified in incurring the additional outlay for prizes, the same system might be carried out as in the examination for commercial French and German, viz., that of granting certificates without prizes. His definition of modern history would, for this purpose, include the last four centuries. He did not suggest any change in the English history examination; but it was deplorable that there was so much ignorance regarding modern history in general; and if this subject were added to the list he thought great good would result.

Mr. Levy said there could be no question about the advisability of adding this subject to the list, provided it were taught in a sufficient number of institutions. He should propose, therefore, that the Council should, if possible, ascertain how many institutions were likely to establish classes in it, and how many candidates were likely to come up. He would also propose that one year they might take modern history, and another year, in alternation, ancient history.

Mr. Norris said he would rather keep to modern history entirely, as it was of far more importance to the classes whom they were considering. It was unnecessary to inquire as to the number of candidates who would present themselves, because whenever a subject was added to the Society of Arts' list, there at once sprang into operation a large number of classes for teaching it in all parts of the kingdom.

The Rev. R. Whittington said, much as he agreed with

Mr. Norris as to the value of modern history, he was afraid that if the Society of Arts were to offer prizes in this branch of study, there would be, in the various institutions throughout the country, much more difficulty in finding efficient teachers than was the case with regard to English history, or many other subjects. No doubt, if the Society had funds sufficient to give prizes in all these subjects, it would be very desirable that they should do so; but as they had to make a selection, he thought it would be wiser to choose those which it was more probable would be thoroughly taught.

The Chairman said he would report the result of the discussion to the Council, and he had no doubt it would receive consideration.

The Rev. J. Curwen then begged leave to move a resolution:—

> "That the Council of the Society of Arts be requested to adopt the examination in elementary musical composition, under Mr. Macfarren, as a part of their regular programme, independently of the Tonic Sol-fa College, which has hitherto provided the prizes and extra expenses."

Three years ago, the young men who had obtained prizes and certificates under Mr. Hullah's examination in the theory of music petitioned the Council to establish an examination in elementary musical composition. Much doubt was then expressed whether a sufficient number of students could be found to justify the offering of prizes in this subject, and incurring other necessary expenses, and therefore the Tonic Sol-fa College and its friends offered to defray these expenses for three years. That time had now expired, and he was happy to say that there had been an average of nearly 60 students in each year. He hoped this would be taken as a sufficient proof that the public were interested in the matter. It was quite true that the Tonic Sol-faists had interested themselves most in the matter, but the general public had also united with them to a large extent in these examinations, and they would be in future even more useful than they had been. Although the children who at school were in the habit of writing themes or essays did not often become great public writers, still their efforts at school enabled them to read and understand better the writings of others, and, in the same way, this elementary musical composition, although of a comparatively humble kind, did give the students such an insight into the nature of music as created a vast number of educated listeners, and to those who were destined afterwards to enter the profession it would be of great use. The Tonic Sol-faists, being mostly poor, were not able to continue their subscriptions for this object; and they hoped that the Society of Arts would now be encouraged to take the matter up, and carry it on independently. He might mention that out of 128 who had obtained certificates this year, under Mr. Hullah and Mr. Macfarren, 106 were Tonic Sol-faists.

Mr. Griffiths (Principal of the Tonic Sol-Fa College) seconded the resolution. He said Mr. Curwen had given the statistics for the present year, but he might add that out of ten prizes given in connection with Mr. Hullah's examinations during the last five years, nine had been taken by Tonic Sol-faists, showing, therefore, that the interest they took was not simply confined to one year, but was continuous; and he believed that during the whole of that five years the majority of certificates given by the Society had gone to those who had gained a knowledge of music through the Tonic Sol-fa method.

Mr. Lawton had great pleasure in supporting the resolution, saying that in Lancashire and Cheshire the Tonic Sol-fa system was much adopted.

Mr. Gibbs also supported the resolution. Not only in Lancashire and Cheshire, where there was a dense population, but also in such a comparatively rural district as Chelmsford, the same fact was to be observed, the Tonic Sol-fa system being that upon which the most successful and popular music classes were conducted.

The Rev. R. Whittington also supported the resolution, which was put and carried unanimously.

Mr. Lyle (Birkbeck Institution) begged leave to suggest that English literature should be restored to the list of subjects for examination. He said that large numbers attended the classes in that subject when it was connected with the English language; and he thought it very desirable that it should be now added separately.

Mr. Rigby Smith said one reason why he had not very strongly advocated the addition of modern history was, that he was aware that this suggestion would be made with regard to English literature. For many years examinations had been held in this subject, and he did not think there was any subject on the list which tended more to develop thought amongst earnest young students. The examination itself was very well calculated to induce thorough study, taking, as it did, two or three works of one author, and demanding a very complete knowledge of them. This induced a habit of reading that remained to the student, and was of advantage to him whatever books he might afterwards read. He thought the examination in this subject should be conducted on the model of that in English history, viz., a general knowledge of the subject, and a particular knowledge of some one portion of it. So with regard to literature, there should be a general knowledge required of the names of authors and literary periods, and a particular knowledge of some one or two authors. He thought this general knowledge should be insisted upon in all cases.

The Chairman said this again was a subject which would have to be referred to the Council, and he had no doubt they would give it due consideration.

Lord Henry Lennox being here called away to a morning sitting at the House of Commons, the chair was taken by **Mr. Seymour Teulon**, Vice-Chairman of the Council.

Mr. Levy opened the discussion of the next topic, viz.:—

Whether the Council should not be asked to confer the title of Associate of the Society of Arts on students who have distinguished themselves at the Society's Examinations, the qualifications to be defined by the Council?

At present he remarked that certificates were given in a variety of different subjects, but no general one for proficiency in a group of subjects. Students who could afford higher fees than those demanded in connection with the Society of Arts examinations were able to go to King's College, and obtain, after a certain time, the degree of Associate of King's College, and it had occurred to him that the Society of Arts might do something of the same kind. In this way he believed the *prestige* of the Society's examinations would be greatly increased, and they would have a much larger number of candidates. Something of the kind had been done at two institutions with which he was connected, the City of London College and the Birkbeck Institution, but their position was not that of the Society of Arts, an associateship of which would really be of value throughout the country. In many cases, no doubt, it would aid young men in obtaining situations, and would be a voucher for their education in various ways. Whether or not anything in the nature of a prize should be attached to the distinction he would not venture to say, but it might be that privileges in connection with the Society could be included, such as free admission to lectures. He did not press that, however, his main object being that a title should be conferred as a voucher of having passed several examinations.

The Rev. R. Whittington had much pleasure in seconding the proposal. The terms of the suggestion left it entirely to the Society to say what should be required of the candidates and what should be done for them, but there was no doubt that an associateship, merely on a piece of paper, would be of immense value to the possessors in many cases. Any other privileges would of course make it more acceptable, but this would be entirely for the Council of the Society to consider.

Mr. Norris supported the proposition. At the institution which both he and Mr. Levy represented the degree of associate had been founded, and this distinction was eagerly sought after. He did not urge the granting of any privileges in connection with the certificate, as he thought this would be enough by itself, and anything else would not be of much practical value, except to institutions in London and the immediate neighbourhood. If the Council thought fit to determine that these certificates should be taken in different branches of education, he thought it would be advisable, as, for instance, mathematics, one department of history, and one department of mental science. If such an arrangement were insisted on, it would make the distinction far more valuable than if it were merely granted for a certain number of first-class certificates of any kind. He thought that grammar, arithmetic, and English history should be required first of all, and then the candidate should be required to show a first-class certificate in three other branches of knowledge which might be determined upon. There would thus be not more than two or three candidates each year, probably, who would come up to the standard, and the distinction would be the more highly prized.

Mr. H. M. Holmes (Derby) also supported the proposition. When the question of granting certificates was first mooted, he made inquiries in his neighbourhood, and sent up to the Council a list of some 50 or 60 leading manufacturers in the Midland Counties who agreed to pay regard to these certificates, and he had recently heard of an instance in which a most valuable situation had been gained by a candidate exhibiting his certificate from the Society of Arts. Such a distinction as that of an associateship would therefore be most highly valued, and would be an additional stimulus to young students. He quite agreed in the view that it would not be necessary that any special privileges should accompany the certificates.

Mr. Lawton suggested that the principle adopted in the case of the Prince Consort's Prize might be followed, taking a certain number in order of merit, making certain subjects, however, essential.

The Rev. J. Curwen had much pleasure in supporting the proposition, since he believed it would promote that many-sidedness of study which was so much to be desired. There was great danger, in many cases, of young people continuing their studies in one direction, without calling out the other powers of the mind.

The Chairman said the meeting seemed unanimous on this question; and to show the value of this kind of certificate, he would mention a case which had recently come under his own notice, where a vacancy having occurred in the office of secretary to an important bank, the position was conferred on a junior clerk at one of the branches, simply because he could write a good letter in French.

Mr. G. Anderson, M.P. (Glasgow), asked leave to make a remark on a topic which he had promised the institute that he represented to suggest to the Council. It was, whether it would be possible to do something more towards encouraging examinations by offering tangible rewards to the teachers, in a similar manner to that which was done by the authorities at South Kensington. They found, year after year, in his locality that the numbers that came up to the Society of Arts examinations gradually declined, whilst in the subjects examined in by the Science and Art Department the numbers constantly increased. This he attributed to the greater encouragements given by South Kensington, under their system of paying the teachers for results. He had not attended previous conferences, and did not know whether this subject had been considered.

The Chairman said it must be remembered that the Society of Arts had no funds for such a purpose, whereas South Kensington was a government department.

The Rev. R. Whittington, in justice to the Society, desired to call attention to the paragraph in Mr. Critchett's report, which showed how anxious the Society was to encourage teachers, although it had no funds for making pecuniary grants. The Society had arranged to grant certificates to those teachers who sent up successful candidates.

Mr. Norris suggested that topic No. 3:—

The best means of organising instruction in Mechanics' Institutions, in view of the results expected after the Education Act has been some years in operation, particularly by establishing Advanced Classes, as elementary adult teaching will be no longer necessary,

had better be deferred, as it could be taken up much more satisfactorily two or three years hence.

This having been agreed to,

Mr. Norris opened question No. 4:—

How far can Institutions be made available for improving Female Education?

Representing as he did an institution which had done a good deal for the promotion of female education, he ought, perhaps, to say a few words upon it. There was no doubt that these institutions could do almost as much in these ways as they did in the case of male instruction; all they had to do was to throw open their doors to females. He feared there were some which would not do that, on account, possibly, of certain old prejudices which animated them; but it was quite a mistake, in his opinion, to shut out females, who formed so large a proportion of the population, and he hoped the Council would urge upon all institutions the duty of admitting them to their classes. There were some who said that evil results would follow such a course; but the institution with which he was connected had been in the habit for some years of admitting females to their classes, and not the slightest difficulty had ever arisen, nor had the slightest impropriety ever occurred, but, on the contrary, great good had resulted. Mr. Critchett had spoken in his report of the great importance of female education, and he hoped the Council would call upon all institutions throughout the country to do what they could in this direction, and to admit females to those advantages which at present they often gave exclusively to the other sex.

Mr. Lawton said considerable attention had been given to this subject in his district, and its importance had been urged upon the institutions, as also the desirableness of giving local prizes to females in particular subjects, especially bearing on their after home life. Prizes had been given for domestic economy, cutting out, sewing, and household accounts. In the lower grade, out of 531 female candidates for the Society of Arts' lower grade examinations, 382 belonged to the Lancashire and Cheshire Union, and in addition to these, there was what was called a comprehensive female examination, similar to the one they had for males, in which they gave prizes and certificates. These females were examined in arithmetic, including household accounts, grammar, English composition, cutting out, and sewing. On every hand they had institutions making arrangements for female classes, and a very large number indeed were now under instruction.

The Rev. R. Whittington, as a clergyman of the Church of England, begged to say that, in his opinion, there was no more important question than that of female education, for it was impossible to effect what was required with regard to male education unless a great improvement was effected in that of the females. It was impossible not to acknowledge that female education was still much neglected, and he thought the suggestion was so framed that there could not be any doubt that every one present would support it. Whether the institutions could be made available for improving female education, and how far this or that institution could undertake this portion of the educational work, he would not say, but it was, no doubt, the duty of the Society to foster and promote female education by every means in its power.

The Chairman asked whether it was proposed that there should be separate classes for females in the institutions.

The Rev. R. Whittington said he thought not; but the proposal was put very guardedly, and, therefore, anyone might feel perfectly safe in supporting it.

Mr. Norris said that in the institution he represented, females were allowed to enter any of the classes, and with the most happy results. If they attempted to form separate classes for females, in many cases they would not be formed at all, because it would be necessary to have the professor's attendance for double the number of hours, and they would not be able to remunerate them sufficiently for their time; whereas, by mixing the sexes, a larger attendance of students was secured, and the professors were better paid.

Mr. Levy said he had intended to refer to this very point of mixing the sexes. As one of the teachers in the Birkbeck Institution, he had found that the greatest good resulted from having the ladies and gentlemen attending the classes together. Last year, one of his pupils, a gentleman, took the first prize of the Society of Arts in political economy, while the second prize was taken by a lady. The only difference he could perceive between mixed classes and classes for gentlemen only was that in the former case the gentlemen were more upon their good behaviour. Even in those institutions where ladies were not yet admitted some degree of progress had been made towards that end. His friend Mr. Whittington spoke very guardedly no doubt, but he might mention that at the City of London College a conference had been held between the council and the teachers of classes, and a resolution had been carried in favour of the admission of ladies to the classes wherever it was possible to do so. These matters were not arranged all at once, and their views were at present only represented by a minority at the council of the College, but it was a growing minority, and before long he believed it would be a majority, and they should have ladies admitted to all the benefits of the institution, as far as was compatible with the original intention, which was that of giving a better class of education to the young men of London. It was now often the case that a sufficient number could not be found to form a class, but if both sexes were admitted it could easily be done.

Mr. Lawton said the district which he represented was no doubt in some respects of an exceptional character, and that might account for the fact that though they had tried the system of mixed classes, it had not been found to answer. This arose probably from the fact of the amazing ignorance displayed by females of even eighteen or nineteen years of age, many of them being unable to read or write, or do the simplest sum in arithmetic, whilst their domestic education also had been seriously neglected. To show that female education was appreciated, he might mention that, some time ago, he attended a meeting and spoke upon the subject, and after the meeting some twenty or thirty of the audience met together, and formed a deputation to the directors of the institute, saying that something must be done, and that if female classes were not instituted they would open an institution on their own responsibility. The classes were then opened, and before long there were ninety young women attending them.

The Rev. R. Whittington said he did not think it desirable to go into the question of the particular mode in which each institution might advance this matter, but taking the proposition broadly as it stood, he could most heartily support it.

Mr. Heller was very glad that Mr. Lawton had given his voice against mixed classes, because he should not like it to have gone forth unreservedly that this system should be adopted universally. He believed that the City of London College and the Birkbeck Institution were in many respects exceptional, and it had been a matter of doubt to his mind whether they really did not compete with the other institutions in union with the Society on unequal terms. He knew, for instance, that in the City of London College there were a large number of men, actively engaged in elementary teaching, who joined classes there for secondary instruction. Therefore, no argument as to the mingling of the sexes in these classes would apply to the majority of institutions in union with the Society. At the same time, he must most strongly advocate the improvement of female education because of its bearing on the education of the next generation, which depended far more on the mothers than on the fathers. He believed that, in the majority of cases, it would be undesirable to have mixed classes for elementary instruction. Therefore, without offering any objection to what had been urged, he thought it was a matter which should be carefully weighed on both sides.

The Rev. J. Curwen said he believed the question as to the policy of mixed classes had been cleared up, and he hoped the Society of Arts would use all its influence to prevent the spread of that false notion that evil results of any kind were at all likely to follow from them. In Scotland, it was quite common for boys and girls to be educated together, and in those schools with which he had had to do he had always taken care that the two sexes should be mixed, because he had found everywhere that this was a great advantage—an advantage intellectually—because the girls were usually more sensitive and quick, and they stimulated the boys in the earlier stages of instruction. An advantage was also apparent in behaviour from the very earliest stages. He had known instances in which schoolmasters who had adopted the separate system had afterwards changed it, and who bore their testimony to the fact that the mixed system was the best, saying that both boys and girls behaved better to one another than they did before. He had often had an opportunity of conversing with gentlemen connected with education in the United States, where, even to the most advanced stages, young men and women studied together, and the testimony was both general and strong that there were no evil results, but, on the contrary, that an improvement of tone and conduct ensued.

The Chairman said he thought he should not come to a wrong conclusion if he gathered this from the discussion, that the institutions ought to be made available for female education, but that each institution must decide upon the mode in which it could best carry it out.

The fifth subject was—

The especial advantages of using Illustrations in Lectures on History and kindred subjects, as means of fixing the attention of the pupils.

Mr. Talbot introduced this subject, saying there were two classes of institutions represented at the conference, one, those similar to the Birkbeck and City of London College, whilst he represented the second and lower class, which were something above night schools, but were in some cases very little distinguished from them. In these institutions, it seemed very desirable that there should be something in the way of illustration, to encourage the attendance of students, and there seemed nothing specially adapted for this purpose. He was glad to find that these institutions were taking great root in the country, and increasing considerably in number. The teachers, however, complained greatly of the first part of the week being wasted, in consequence of penny entertainments of various kinds, which competed very powerfully with them for the attendance of the young people; and if they missed the first night or two of the week, they would not come for the rest. What was wanted, therefore, was something which should attract them to the schools on the first nights of the week, and it had occurred to him that the Society of Arts could do a very good work indeed by offering a medal, it might be to the publishing societies, for a series of diagrams to illustrate, say, English history.

Mr. Noldwritt (Walworth Institute) said he should like to have some more definite idea of what was wanted. He supposed they would select some salient points in history for teaching, but these would have to be treated entirely according to the imagination of the artist, and the diagrams might, and often did, convey wrong information, for many which had been published were most incorrect.

Mr. Levy said there was no doubt that great advantage was derived from the use of diagrams in teaching any subject, but what Mr. Talbot appeared to desire was a series of illustrations of history, rather in the nature of an attraction, to get the pupils together, than to aid in teaching the subject. He thought possibly the Society of Arts might be able to aid teachers in getting good diagrams. For instance, the material on which these diagrams were drawn was a particular kind of calico, which was rather difficult to get, and if the Society could furnish the teachers with it at cost price, or aid them in getting it, it might be of use to them.

Mr. Pollard (Hitchin) said photographs were used to a considerable extent to illustrate lectures, in the form of dissolving views, and they might be obtained at a very trifling cost.

Mr. Heller suggested that possibly the Council might offer prizes for the best diagrams to teach special subjects, though he did not think illustrations of English history would be of much use. Those engaged in teaching science, or even common object lessons, felt great difficulty in this country in not having good diagrams; and it appeared to him that the Society of Arts might confer a benefit on such lecturers, if they could by some means obtain copies of the excellent diagrams which were used by the first-class men who gave lectures before the learned societies. The reproduction of such diagrams would be of immense advantage to science teachers.

The 6th question:—

How far Institutions can aid in organising systematic visits to the Educational Section of the International Exhibition of 1871, *and subsequent years?*

was introduced by

Mr. Pottie (Crewe), who suggested that the members of various institutions throughout the country should establish money clubs for the working classes, in order to raise a fund for visiting the Exhibition, and that they should then communicate with the railway companies nearest to them, in order to make arrangements for travelling at a cheap rate.

Mr. Holmes said that if the managers of the institutions in union with the Society would do as they did at Derby in 1862, there would be very little difficulty. There were four institutions in that town, and they got the secretary from each institution to wait on the secretary of the railway company, when they arranged for what was called a school train, leaving early in the morning and returning late at night. The whole journey was performed for 4s. 6d. the double journey for adults, and 1s. 9d. for children under 14 years of age. The train he referred to brought up more than 700 passengers, and one of the railway officials told him afterwards that it was one of the best paying trains they had had in the year.

Mr. Heller said it would interest those in London to know whether any special arrangements could be made for the admission of schools or similar bodies to the Exhibition.

The Chairman said if communications were made to Colonel Scott at the Exhibition, the Society would be very happy to aid such applications in any way they could.

The next question was:—

How far can Institutions encourage Instruction in Music by establishing Local Scholarships, to be open to public competition, and held in a National Training School for Music?

The Chairman said the Society had gone very much out of its usual course to get up a series of six concerts at the Albert Hall, which they had done, under a guarantee fund from some of the members (in order not to involve the funds of the Society), to see if it was possible to raise a sum of money that should be appropriated to founding a National Training School for Music. This subject had no doubt been placed amongst the questions for discussion in order to elicit the opinion of members of the Conference on the matter, and the Council would certainly be glad of any suggestions.

Mr. G. D. Hooper (City of London College) said it could not be questioned that the system of instituting scholarships was a very good mode of encouraging all kinds of instruction, and of course, amongst others, the special subject of music; but he did not see exactly why this subject should be so specially favoured, when there were other branches of instruction which, in his opinion, were more important, and some of which were certainly more necessary, but they did not receive similar encouragement. If the Society was in a position to provide funds to establish scholarships in other branches of knowledge, there could be no objection to it; but he thought there were some of these which required encouragement before music.

Mr. Heller said it was very easy to make out a special claim for music, because it was of such general application, and there was a necessity for special arrangements of this kind. He did not think it was a question at all whether other subjects were sufficiently provided for, but as to the importance of music as a study there was no doubt, and he thought it should be made as universal as possible. For that reason it would be most advantageous if they could get the institutions in union to work in accord with the Society in establishing a national training school.

The Rev. J. Curwen said he should be better able to express an opinion on the subject of the establishment of a national training school, if he knew what kind of school was proposed. He had heard the phrase frequently used, but had never seen any definition of what was intended. With reference to music, as distinguished from other arts and studies, there was this to be considered, that skill in music, although it depended to a considerable extent on intelligence, care, and study, depended also to a very large extent on natural aptitude, and it was important to pick out from the whole nation those who had the best natural capabilities for music. In order to do that there was very little use in simply establishing a college in London, which might be very little known in the provinces, and which would only be within the reach of those who had ample funds at their disposal. These natural musical endowments were to be found amongst the poorest as well as amongst the richest, and far away in remote country districts quite as much as in and about the metropolis, and therefore it seemed to him that some plan was required for picking out the talent of the country from all classes, and if this could be done, it would certainly be of great national benefit. All who loved music, not for the sake of fashion, but for the sake of the mass of the people in their recreation, church services, and school work, would heartily gather round the Society of Arts in any endeavour of this kind; but he should be glad to know more definitely what was really meant by a national training school.

The Chairman said he thought that until it was ascertained that there was a desire for such an institution, and something like a probability of obtaining the necessary funds, no definite scheme could be put forward. He quite agreed that musical talent was not confined to any section of society, or to any part of the country, and it was very desirable that those who had talent of this kind should be picked out, and have an opportunity, by means of a scholarship, or in some similar way, of undergoing a course of training in London, by which they might perfect the gifts which nature had bestowed upon them.

Mr. Norris said there could be no doubt that it would be very valuable to have such scholarships, but the institutions had really to do with the more weighty parts of education; and while they were not able to establish scholarships in the more scientific and important subjects, he did not think they would feel justified in bestowing scholarships for such a subject as music. It was evident that the idea was, that the students should devote themselves to study for the musical profession, and therefore the scholarship must be worth at least £50 per annum, and he did not think many institutions would be able to go even half-way towards that sum. Most of them had large music classes, that at the Birkbeck numbering upwards of 400, and in this way they were doing good work, but beyond that he did not think they would be justified in going.

Mr. Critchett said he was afraid Mr. Norris regarded music very much as drawing was formerly regarded, as a mere accomplishment. Drawing was now beginning to be looked upon as a real matter of importance in education, and though it would occupy too much time for him to give all the reasons why he attributed the same value to music, still he must express the opinion that it was quite as wrong to look at music as a mere accomplishment, as it was now acknowledged to be with regard to drawing. The influence of music on the happiness of the human race it was difficult to exaggerate; and, after all, the great object of education was to form character, and ultimately to produce happiness. Therefore, he considered music was of such importance that they could hardly give their funds to a better object.

Mr. Norris quite agreed that it was of great importance, and the fact which he had named, that they had 400 students in the subject, would show that it was so considered. In fact, in his Institution they gave up their theatre three nights a week, in order that it might be taught; but still it was not, in his opinion, one of the matters for which the institutions were mainly founded.

Mr. Griffiths said these institutions were probably founded at a time when music was to a great extent neglected in England, and perhaps it was on that account that provision was not made for instruction in it, as in other sciences. He might mention that in Wales, where very good voices were often found, it sometimes happened that when a young man or woman exhibited remarkable musical powers, friends in the neighbourhood had subscribed money to send them for a series of years to London, to study, either in the Royal Academy or under some eminent master. He had personally known two or three instances of this kind, and there were singers of eminence now in London who owed their musical training to help of this character. That went to show that the country took some interest in this question, and that, even if the institutions would not do it, it might be possible to get money from other quarters, when talent was found which would warrant the outlay.

Mr. Levy thought what his friends Mr. Norris and Mr. Hooper intended rather to convey, although they had not exactly expressed it, was, that music more than any other science was its own reward. If a person had a good voice, he got so much praise from those with whom he came in contact, and was so well received, that really it hardly required any inducement for him to continue his studies. The fact was, that in the institutions which those two gentlemen represented, the singing classes were so large, that it was becoming a question whether they could accommodate them or not, for they almost interfered with other branches of education. In both those institutions, there had been very considerable difficulty in providing for other classes, and in deciding between the relative claims of music and other subjects, owing to the enormous preponderance of students for the musical classes. He quite agreed with Mr. Critchett, that education consisted in forming the human character, and that the working classes and middle classes should be educated, not only for their working time, but for their leisure; for, until that was done, it would be impossible to materially improve their character. He, therefore, heartily sympathised with the object of this resolution, but he did not see how institutions which could barely pay their expenses could do much in the way of establishing scholarships.

Mr. Critchett said in the remarks he made he had not referred merely to the producing musical performers, but also to the cultivation of the science of music, and the development of the faculties of a composer. England would not have had some of her greatest composers, if it had not been that special opportunities were even now afforded, to a certain extent, for education in music, and it was the extension of such opportunities that was now desired.

Mr. Noldwritt said whatever neglect the study of music had fallen into of late—in fact since the period known as that of the four Georges—it had not been always so, as was shown by the foundation of the Gresham lectures, from which it appeared that music was one of the seven sciences provided for by the founder.

Mr. Pollard said he hoped the study of music would be continued, and as an encouragement, he begged leave to state that a candidate who took the first prize in the Society's examinations some years ago, had just taken his degree at Oxford in the science of music.

The Chairman said the subject had now been pretty fully discussed, and he thought it might be well left where it was for further consideration next year.

Lord H. G. Lennox here resumed the chair.

Mr. Levy said he wished to bring forward a subject which he hoped the Council would take into their consideration. The representatives of the institutions met there once a year, but he believed they saw far too little of one another. In a great number of these institutions, debating societies were established; but at Oxford they managed to have a Union debating society, which was found to be much better than having one in each particular college. What he desired to suggest was, that the Society of Arts should give the use of their room, say, once or twice a month, for a society which he thought should be established, and called the Society of Arts' Union Debating Society. He was quite aware that such an arrangement would be more to the advantage of institutions in the metropolis and the immediate neighbourhood than of the others; but even provincial institutions would gain something by it, for their members were constantly coming up to London, and he could not help thinking that it would be a good thing to have meetings of this kind, so that when young men came up from the country they might have some place to go to, where they might meet suitable companions, who might be of assistance to them during their sojourn. The advantages of debating societies were now so thoroughly acknowledged that it was needless to dwell upon them. They had been of great educational use in all institutions with which he had been connected, and he was quite sure, if this plan were adopted, they might get up a very influential debating society. He would move, if it were desired, that the Council be asked to see what could be done in this matter, and, if the resolution were carried, he would propose that a committee be at once selected for the purpose of seeing how far the scheme could be carried out. In the event of the Council not approving it, of course the committee would have nothing more to do.

Mr. Teulon did not think the proposition, in the shape in which it was put, would come within the scope of the Society's operations. If upon any occasion a number of institutions wished to discuss any particular subject, he was quite sure the Council would be willing to render every possible aid, and no doubt they would grant the use of the Society's hall; but he did not think it would do to lend the room to a debating society in perpetuity.

Mr. Norris thought Mr. Levy looked upon the Society of Arts as a kind of university, composed of a number of different colleges, viz., the institutions in union, and that as there were great debating societies at Cambridge and Oxford, so there ought to be one in connection with the Society. No doubt debating societies were of great value, as by discussing political and social subjects persons were able to come to a far wiser decision upon them than they could if left to their own imagination only, but still he could not altogether support Mr. Levy's proposition. There might be objections to the Society of Arts lending its hall once or twice a month for such a purpose, and he should prefer the different institutions in London and the neighbourhood lending their rooms alternately.

Mr. Hooper thought it would depend on the nature of the subjects discussed whether the Council would look favourably on the view just propounded; but if educational subjects only were brought forward, and if the Council supported the scheme, and allowed the use of the hall, he thought, probably, the debates would be of a higher character, owing to a superior class of persons attending them, than if they were held at local institutions. At the same time, such action would bind the institutions and the Society more closely together.

The Rev. J. Curwen said he never knew a successful debating society which did not discuss the two forbidden subjects of religion and politics, and he did not see how these could be properly introduced into such a society as the one proposed.

The Chairman said that, if political subjects were discussed, he thought inconveniences would arise. He thought that a debating society without restriction on the subjects to be discussed would not answer at all; but as Mr. Teulon had suggested, if any subject required to be especially ventilated, there was no doubt that an application for the use of the hall would be favourably considered by the Council.

Mr. Levy said he should hardly like to confine the range of subjects to educational ones, and if such a system were adopted, the debating society would certainly not be successful. He had, however, known very successful debating societies from which religious topics were excluded, and he could see no reason why the Council of the Society of Arts should object to aid the discussion of political subjects, for there was no doubt such discussions were of great educational value. The constant friction of opinion in a debating society was, in his opinion, of the very greatest educational use, even putting aside the practice it afforded of placing one's ideas clearly before one's fellows, which, in itself, was not a faculty to be despised.

Mr. Heller thought it would be out of keeping for the Society to be instrumental in forming a debating society, in which religious or political subjects might be brought forward. So long as there were political parties this would be most unadvisable. The Society was founded for a specific purpose, and its usefulness would be endangered by the introduction into its programme, in any possible way, directly or indirectly, of questions connected either with religion or party politics.

The Chairman said he did not think anything more need be said. At the present moment the Society worked most harmoniously, though consisting of gentlemen of all shades of political views; but if once such matters were introduced for discussion, no one could say what differences would arise. At the same time, the Council were always willing to lend the hall for any special meeting, the purpose of which was in accordance with their general objects.

Mr. Norris proposed a cordial vote of thanks to the noble Chairman for his kindness in taking the chair, and returning to it at considerable inconvenience after being obliged to leave. Lord Henry Lennox had presided for several years at the distribution of prizes at the Birkbeck Institution, and his presence was always cordially welcomed.

Mr. Holmes seconded the motion, which was put by **Mr. Teulon**, and carried unanimously.

The Chairman, in acknowledging the compliment, said that every one had certain duties to perform, according to his position in the world; and, however humble those duties might be, those who did their best to perform them worthily were doing their part in promoting the welfare and progress of the human race. This was the principle which he endeavoured to act upon, and he was always happy to render any services he could to the Society of Arts. He had now been chairman of Council for three years (an unusually long period), and his term of office was now drawing to a close; but when he retired to the comparatively humble position of Vice-President, he should still be equally ready at all times to do what he could to promote the progress of Arts, Manufactures, and Commerce, and to further the welfare of the Society.

On the following morning (Saturday), a number of the representatives who had been present at the conference visited the International Exhibition, and specially examined the Educational Section, under the guidance of Mr. C. Critchett, the Society's Educational Officer. Mr. G. C. T. Bartley kindly attended, and explained some of the principal objects.

ANNUAL INTERNATIONAL EXHIBITIONS.

The opening of the French annexe took place on Monday, the 19th inst., by invitation to a numerous and distinguished company. A very handsome collection of the products of French art and industry has been got together, under the direction of M. du Sommerard, the French Commissioner. Their Royal Highnesses the Prince and Princess of Wales and the Princess Louise, accompanied by the Prince and Princess of Teck, arrived at half past five, and remained a considerable time in the building.

The *Times* says it adds to the Exhibition greater attractions than any that the building had previously contained, and proves, alike by its contents and their arrangement, that, although France has suffered reverses in arms, her eminence in art remains unassailed. The annexe consists of a single floor only, and the general form of the ground plan is that of the letter E, the back of which is turned towards Exhibition-road, and extends from the Horticultural Gardens entrance to the south end of the eastern gallery, while the limbs abut upon the garden corridor. The part represented by the back of the letter is the chief room of the annexe, and contains a superb collection of jewelry, porcelain, enamels, metal work, tapestry, lace, shawls, and other beautiful and costly manufactures. The north limb forms the picture-gallery, and contains also a few bronzes, sculptures, and fine specimens of cabinet work. The south limb is hung round with carpets, and decorated with flowering plants. The part corresponding to the middle limb of the E contains a *café*, and opens upon the little garden or court that is enclosed between the Annexe and the corridor. Excepting the *café*, the building is lighted entirely from above, and the skylight is underhung by a velarium of unbleached calico, decorated by a stencilled pattern of *fleur de lis* in yellow. The light is amply sufficient, and extremely well tempered, and the arrangements for ventilation are admirable. During some portions of yesterday the rooms were literally crowded, but they were never overheated or wanting in freshness.

CORRESPONDENCE.

THE RESOURCES OF INDIA.

Sir,—With reference to Mr. Hyde Clarke's valuable suggestion as to the formation of an Indian Congress, in the paper which he read before the Society of Arts on the 24th March last, and also to a letter which appeared in your *Journal* of the 26th ultimo, from the able pen of Captain Taylor, at page 547, on "The Resources of India," I should like to be permitted to offer a few remarks.

On a careful perusal of the latter gentleman's letter, above referred to, I find he states that the prickly-pear thrives in the most rocky soils, &c., a remark apparently of not very great moment; but when the note is read at the bottom of the page, which runs as follows:—"In Coimbatore, during the famine, thousands lived entirely on the fruit of the prickly pear," its preservation evidently becomes an object of vital importance to such poor, afflicted natives as may, at some future period, become again dependent on its nourishing qualities. I therefore think the fact of its having saved many thousands from the pangs of hunger and death from starvation should be made widely known, and brought to the knowledge of the government of Madras, who, I presume, are altogether unaware of the circumstance, or they would surely cease to carry on the ruthless warfare that they have been now for some time waging against it, having employed numerous parties to destroy and exterminate it; and although it makes a capital hedge, they have forbidden its being utilised for such a purpose; and there are certain spots in that presidency where no trees would have been now in existence, had it not been that its friendly shelter afforded protection to their seeds until the plants were well established in those places; therefore it might be assumed that it would be but prudent to preserve its life, as a safeguard both to human beings and to vegetation; and unless the government of Madras have in view, and will point out to the natives some other natural and equally economical means of preserving life, should a famine again visit the presidency, it would seem highly injudicious to continue the war against it.

But it also appears to me, under another aspect, and that an agricultural and commercial one, that it would be beneficial to encourage its growth; for when we consider that it is the well-known residence and feeding-ground of that valuable commercial insect, cochineal, from which carmine is obtained, and which is used so largely in the production of the famous scarlet dye, and of which India itself imports considerable quantities for its own wants, it would surely not be a bad policy to utilise its presence by introducing that insect from Teneriffe, which island cultivates the growth of the cactus as an agricultural product, and derives a very considerable revenue from the exportation of the insect feeding upon it. Honduras and Mexico also export large quantities of this dye, and Java shares in the trade, but to a smaller extent.

In 1867, the Canary Islands exported a total quantity of 2,373 tons of cochineal (of three descriptions, namely, Grana, Granilla, and Polvo), of the value of £625,303. Not so bad for a few small islands; and of the above produce England alone imported 3,930,056 lbs., worth £445,549. The mother country would, therefore, be a certain consumer if India could produce a good article of the kind;—and why not?

Mr. Grattan, in writing from Santa Cruz, Teneriffe, on the 30th June, 1868, affirms the above exportations and their value, and further remarks:—"The rapid and steady increase in the production of this commodity, as shown above, is still susceptible of a much greater development; it is gradually absorbing the available capital possessed in these islands. Other branches of agriculture are being abandoned or neglected; and the prices of articles of consumption, formerly produced in great abundance, are augmenting in proportion, as also the price of labour. Should the demand for this article continue, and the present prices be maintained, great wealth will accrue to the landowners, and to other persons who are engaged in its production, and also generally to the population of these islands. But this dependence on the continual success of one branch of agriculture would lead to much distress should a chemical process be discovered to supersede this at present unequalled dye."

In 1868, these same islands exported 4,685,538 lbs., of the value of £609,027; and many new cochineal plantations were formed during that year in Teneriffe and the other islands of the Canary Archipelago. The diminution in the quantity exported in 1868, as compared with the previous year, was caused by the political and social disturbances of the country.

It would encroach too much on the limited space of your *Journal* were I to enter into its mode of culture, preparation, packing for export, &c., I shall, therefore, refrain from attempting to do so; but I think I have advanced enough to show that the cactus is a plant which ought not to be extirpated without the strongest reasons for such an act; and, although I hear that it is on presumed sanitary grounds that the government of Madras are acting as they are doing, so as to prevent the spread of fever, which I believe some think is engendered in the vicinity of the plant, and is caused in some way by it, yet I do not hear that the Canary Islands, who cultivate it so extensively, suffer to any great extent from fever; and, again, in the Bermudas, where I have seen it growing wild in considerable quantities, I never heard that fever was thought to be engendered there in any way by its agency; but if on one sanitary ground, namely, the spread of fever, we assume that it is objectionable as a neighbour, yet on a higher sanitary ground, or when famine visits its locality, it actually saves from death, it should, therefore, be preserved; and surely, as the latter kills, and the former in general only shatters the constitution, it would be well to think twice before the destroying angel of Madras receives orders to execute death upon a plant on whose existence so much depends, and from which a large revenue might be derived.

When the new Board of Agriculture is at work, I think the consideration of the claims of this plant may worthily occupy a portion of their time, especially when it is remembered that native cochineal was exhibited at Madras Exhibition in 1857, as a production from Chittledroog, and also that, many years ago, the Court of Directors offered a large reward for the introduction of the true Mexican cochineal,[*] but their desire was never accomplished. And I would humbly submit that they should speedily institute such an inquiry, in the interests of humanity, agriculture, commerce, and vegetation; and should the Society of Arts be of my way of thinking, and publish this letter in their *Journal*, I would ask the favour of their forwarding a copy thereof to each of the

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[*] The Mexican cochineal is not of the finest description, and there were good reasons for the failure of the attempt to extensively raise the proper species of cochineal in India at the latter part of the last century, when Captain Nelson imported some from Rio Janeiro, in 1793.

Presidencies of India, and one also to her Majesty's Secretary of State for India.—I am., &c.,

A. Romaine Wragge, Lieut.-Col.

P.S.—I do not participate in Captain Taylor's fears as to the difficulty likely to be experienced in forming an Indian Congress, as suggested by Mr. Hyde Clarke, and I think that the Society of Arts would be far more unfettered in its action by initiating itself such a congress, than it would be were it to throw its weight into such an undertaking in conjunction with any other association. To the Society belongs the credit of starting the idea, and from its numerous and well-informed members it ought to be able to carry out successfully its own notions, unaided by extraneous assistance.—A. R. W.

37, Maryon-road, Charlton, S.E., June, 1871.

ON THE MUSIC OF ORNAMENT AND THE LANGUAGE OF PAINTING.

Sir,—Your correspondent on "Music in Ornamental Art," in the *Journal* of May 5th, after quoting and favourably interpreting my remarks on that subject, pointed out that Mr. W. Cave Thomas had suggested a similar analogy three weeks after you had published mine.

We all know how frequently the same ideas are conceived in the minds of various thinkers far apart, and especially is such likely to be the case should the thought happen to be one of simple truth. I am, therefore, the more pleased that my definition of the difference between pictorial and ornamental art has received the corroboration of so learned and deep a thinker as Mr. W. Cave Thomas, by his own conception of the same thoughts.

But while we both agree precisely in comparing ornament to music without words, we slightly differ in regard to painting. Mr. Thomas compared pictorial art to "words set to music." I said, "The effects produced upon the mind by pictorial art and language are similar; the one communicates images through the eye, and the other through the ear—the imagery of painting being the more rapid and complete . . . . But strictly ornamental art does not convey to the mind images and emotions which language would equally convey. It may rather be compared in its effect to the emotions produced by music, or tune without song."

But Mr. W. Cave Thomas now speaks of the analogy, in the *Journal* of May 26th, as between "painting and music," and says it is a very old one, and disclaims originality for either of us. I also quite disclaim any notion of an analogy between painting and music, as seen in my remarks quoted above. I cannot even perceive that painting may be compared to "words set to music," but to words only.

Pursuing this idea, I beg to show by its aid why I think that art-writers are in error in claiming that painting, to be high art, must be largely ideal rather than imitative. Perhaps recent writers speak under the authority of Oliver Goldsmith, who, in his essay on "Cultivation of taste," says, "Not that the poet or painter ought to be restrained to the letter of historical truth. History represents what has really happened in nature; the other arts exhibit what might have happened, with such exaggeration of circumstance and feature as may be deemed an improvement on nature. . . . . . It is the business of art to imitate nature, but not with a servile pencil; and to choose those attitudes and dispositions only which are beautiful and engaging." Here Dr. Goldsmith appears to accord to all painting the license of poetry. But a distinguished living painter, and talented writer on art, appears not to consider exaggeration in painting as a licence, but insists upon it as a necessity of high art, when he says, "In its lower phases art relies more and more on imitation, seeking to give pleasure only by the reproduction of beautiful objects or beautiful combinations, until, in its lowest development, art, if it can be called art, rests contented with mere imitation."

Now, it occurs to me, as a mere common sense idea, that, according to this teaching, either historical painting is not high art, or, to be high art must be exaggerated and idealised, therefore untruthful. But certainly the mind of an observer familiar with the persons of the emperors of France and Germany and their staffs, would be shocked at any representation of the surrender of Napoleon at Sedan in which perceptible idealisation or exaggeration were introduced in the drawing of the persons. And, surely, such an historical picture might be painted faithfully, namely, imitatively, and still be a work of high art. I have remarked, in a previous letter, that any departure from simple imitation in the portraits and costumes of such a picture would be a departure from truth, however otherwise artistically executed, just as would a verbal or written description of that event which contained an inaccurate account of these matters be wanting in truth, however eloquently told. The introduction of any ideality of the artist into such a picture would be a falsity. To be true, it must be purely imitative or reproductive. It professes to represent a passage of history, and should do it faithfully.

The idealisation or generalisation which is claimed as proper to high art generally, appears to me to belong to poetic art only, it being a poetic treatment inapplicable to prosaic objects, unless at the expense of truth. And although Dr. Goldsmith may be said to include all painting in his licence to idealise, his mind was evidently intent only upon poetic art, whether of literature, painting, or sculpture, as witness the unfolding of his views. He says:—"It would be entirely difficult, if not impossible, to find a man actually existing whose proportions should answer to those of the Greek statue distinguished by the name of the Apollo of Belvedere; or to produce a woman similar in proportions of parts to the other celebrated piece called the Venus de Medicis; therefore it may be truly affirmed that they are not conformable to the real standard of nature; nevertheless, every artist will own that they are the very archetypes of grace, elegance, and symmetery; and every judging eye must behold them with admiration, as improvements on the lines and lineaments of nature." These, however, are purely poetic subjects, and not only need not, but cannot, be treated with historical truth or imitativeness. The same may be said of his next illustration, of the manner in which the painter Zeuxis, of Heraclea, chose five of the most beautiful damsels the city contained, and, selecting the peculiar excellences of each, combined them into a perfect beauty in the character of Helen.

These subjects, being entirely poetical, admit as a necessity the exaggeration and generalisation of nature, just as the poetic description of them in words requires the exaggeration of poetic language to convey to the mind their superiority over mere nature.

Thus far is to show that painting, being analagous to language, should be governed in its expressions by the same proprieties; that a subject which will not properly admit of exaggeration, idealisation, or generalisation in literature will not admit it in painting; and that he who would depart from natural truth in painting or sculpture must work only on poetic subjects.

And why should that art be condemned as the lowest which, to be truthful, must be merely imitative of nature? Such a picture may contain a group of figures which shall require even more art to render in strict imitation of nature than would be required to treat it with idealty and license, although the result of that license should be to place before us the classic types of beauty and dignity of gods and goddesses.—I am, &c.,

William H. Goss.

Stoke-on-Trent, 31st May, 1871.

GENERAL NOTES.

High-pressure Filter.—Messrs. E. Busse and Co., of Monkwell-street, have invented a high-pressure water-filter, which, from its novel construction, has been approved of and accepted for exhibition in the International Exhibition of 1871. It is constructed in the following manner:—The case (which is made of cast-iron, thus rendering it less liable to breakage, and enamelled inside to prevent it being acted on by the water) contains three distinct filtrations, through which the water is forced by the regulation of the pressure. The water first passes through loose particles of pure animal charcoal, then rising, through the pressure, into an inner chamber, also filled with loose charcoal, descends through two hollow blocks of pure animal charcoal compressed by hydraulic pressure, by which process the blocks are rendered more durable than those hitherto used of vegetable charcoal compressed by hand. This invention is decidedly superior to those where the filter is placed in the cistern, as the water for use is obtained directly from the filter itself, thereby preventing the possibility of its being poisoned in its passage through lead pipes from the filter to the tap. The filter being connected with the main pipe, the trouble of keeping it filled, as is necessary with most other kinds, is obviated, and this also produces a continuous flow of water equal to that supplied by the ordinary tap. It can be very easily cleaned without removal or expense.

Railways in Turkey.—The construction of a network of railways is an enterprise of no inconsiderable importance and difficulty in a country the interior of which is comparatively so little known, and where the means of communication are in a most primitive condition. In the first place, there being no reliable map of the country, considerable time has been expended in making the necessary surveys, to fix upon the best line for the railway. The total length of the lines to be constructed is about 2,400 kilometres (1,500 English miles), the general route of which, with the exception of a short section in Bosnia, has been approved of by the Porte. About 750 miles of the most important lines have already been surveyed in detail, and the surveys for the remaining portion are being pushed forward with the greatest alacrity. M. Vitali, the representative of a firm of contractors, has undertaken the construction of the line from Constantinople to Adrianople, a distance of 290 kilometres (181 English miles), and of another from Dedeagh to Adrianople, 140 kilogrammes (87 English miles) in length, the former of which is to be completed in two years, and the second in a year. In this manner, the second city in importance in the empire will be placed in communication with the Archipelago by the 1st January, 1872, and by 1st January, 1873, it will be united with the capital. An Italian firm of contractors have undertaken the construction of the railway from Uskub to Salonica, following the valley of the Vadar, which will open out a highway for the carriage of the products of Macedonia to the Mediterranean. This line will be about 248 kilometres (150 English miles) in length, part of which is to be opened by the end of the present year, and the remainder by the end of June, 1872. The line from Adrianople to Sarimbey viâ Philippolis, which is an extension of the line from Constantinople to Adrianople towards Servia, is already commenced, and is to be opened about the same time as the latter line. It will be about 300 kilometres (187 English miles) in length. The junction of the Ottoman railways with those of Austria, by means of the line from Novi to Banjaluka, a distance of 110 kilometres (69 English miles), is in construction, and will shortly be completed. In this manner there are already 1,080 kilogrammes (675 English miles) in construction, part of which will be opened this year, and the remainder to be completed by the end of 1872. A short section, of 17 kilometres (10 English miles) in length, following the shore of the Sea of Marmora, from the Seven Towers to Kutchuk-Tchekmedje, and forming the first link of the line to Adrianople, is just finished, and opened for traffic. The station at the Seven Towers is only a temporary terminus for the line, and the railway company, seeing that but little traffic could be expected from a line ending in one of the suburbs of Constantinople, and at a considerable distance from the centre, with no communication with the ports, or the quarters of Pera and Galata, have come to a decision to extend the line as soon as possible, and have laid before the government a project of a line traversing the city, with the terminus near the new bridge. The company are about to give an order for 100 locomotives and 1,000 waggons.

Trade of the Island of Jamaica.—The Governor of Jamaica, in a report on the condition of the island, gives the following statistics:—The total area of the island is about 2,720,000 acres, of which 492,246 acres are cultivated in the following manner:—220,791 acres meadows; 48,601 acres grass lands, with cloves and pepper; 110,705 acres canes; 47,440 acres sugar canes; 39,224 acres grain, fruit, and gardens; 16,617 acres coffee; 5,851 acres pepper; 760 acres wheat; and 150 acres ginger. The exports of the island, in 1869, amounted in value to £1,162,769, and the imports to £1,224,414. The revenue for the same year was £414,826, and the expenditure £355,247.

Clocks and Chronographs.—Mr. Norman Lockyer, in his sixth lecture at the Royal Institution, on the "Instruments used in Modern Astronomy," referred to the methods adopted for dividing and recording time. The ancients divided the day at all times of the year, from sunrise to sunset, into twelve hours of varying length; and the earliest clocks were adapted to this arrangement. Archimedes is said to have constructed a clock with wheels moved by a weight; and the first clock in England is said to have been set up in Old Palace-yard, Westminster, in 1288, by means of a fine paid by the Lord Chief Justice. After referring to other early clocks, Mr. Lockyer stated that they consisted merely of wheels moved by a weight, the means adopted to regulate the motion being successively a fly-wheel, an alternating balance, and an upright arbor, or weighted horizontal bar. An invaluable aid to astronomical science arose from Galileo's discovery, in 1639, of the isochronal property of oscillating bodies suspended by equal strings; and by Huyghens, in 1656, applying this principle to clocks, thus superseding the balance by the pendulum. Still further progress was made by the ingenuity of Hooke, Clements, Graham, and Harrison. Mr. Lockyer, by the aid of diagrams, explained these successive improvements, and then proceeded to exhibit in action a splendid modern astronomical clock, lent him by Colonel Strange, stating that the principles now demanded in such clocks are, that the weight shall be small, and the pendulum heavy, and that there shall be as little connection between the two as possible. He then adverted to the precautions necessary to be observed to preserve the pendulum from the action of temperature as much as possible, and alluded to the advantages of the mercurial pendulum. The way in which the sidereal 24-hour clock is used with the transit instrument was then explained and illustrated, especially in what is termed "the eye and ear method," by means of which the time when a star crosses a line can be ascertained to the tenth of a second. Mr. Lockyer then referred to Sir Charles Wheatstone's patent, in 1840, for applying the electro-magnetic force to the record of very minute fractions of time, and then explained the construction of a chronograph, kindly lent to him by Colonel Strange, by means of which the results of astronomical work can be instantaneously recorded by the observer himself with the greatest ease. After noticing various forms of this invaluable apparatus, as employed by Airy, Foucault, and others, Mr. Lockyer concluded by demonstrating the great importance of chronographs in the determination of the longitude of distant places, such as Washington.

The Orange Tree.—According to the *Brisbane Courier*, "the orange tree is now firmly established as one of the fruits of northern Australia, and nurserymen are endeavouring to supply the demand, which must increase, for trees. Oranges promise a heavy crop this season; the trees are loaded, and breaking down in some instances. One grower has over six acres in oranges, and, although only five years have elapsed since the trees were planted, some hundreds are now in full bearing. Every variety of orange has a place in the orchard, from the monster shaddock to the tiny cumquat, and, so plentiful is the crop, that from his orchard alone the ordinary demands of Brisbane for oranges could be supplied; but as the preservers and exporters are making arrangements to absorb a large portion of the fruit, an over-supply is not anticipated. It is found that trees of the orange kind acclimated to this part of the country do better than those brought from a distance, and the losses of former years are not likely to fall upon those who plant now."

The Marble Trade of the Apuan Alps.—The marbles of the Apuan Alps, which are chiefly quarried at Carrara, Massa, and Serravezza, are of various qualities, but that which seems to be the *specialité* of this district is the statuary marble, and almost all the statuary and white marble employed throughout Europe and America are derived from the Apuan Alps. Statuary marble, it is true, is found also in other parts of Italy, and in Algeria and America, but either from its inferior quality, or from the small quantity which is found, the marble of Carrara and of the neighbouring localities is the most esteemed, and from the richness of these quarries, and the excellence of the material produced, the trade in statuary marble is almost a monopoly particular to this district. Under such favourable conditions, it would be surprising if the marble industry in the Apuan Alps was not flourishing; and if, however, it has not attained the development of which it is susceptible, it is still one of the most important branches of Italian trade. The annual export of marble from this district is estimated by Professor Magenta, in an interesting work, lately published in Florence, entitled "L'industria dei Marmi Apuani," at 100,000 tons, its ultimate destination being the United States, Great Britain, France, Holland, Belgium, Spain, and Russia. Leghorn alone exported, in 1866, 45,000 tons of marble in blocks; 56,000 tons, in 1867; 77,000 tons, in 1868; and in 1869 and 1870 the quantity of marble shipped was somewhat less. It is remarkable that, notwithstanding the discovery, of late years, of excellent marble in America, that the exports to that country are daily increasing, in spite of the high import duties which are levied by the government in order to keep up the demand for home produce. Of the three above-mentioned localities in the Apuan Alps, Carrara occupies the first place, both as regards the quality and the abundance of its production. Upwards of 3,000 persons are employed in the quarries, and 550 at the saw-mills and *ateliers* of sculpture. The production of marble of this town is estimated at 85,000 tons, to the value of £340,000 annually, making an average price of £4 per ton. At Massa, 900 persons find employment in the quarries and workshops, and the annual quantity of marble exported is about 12,000 tons. In the territory of Serravezza, there are at present more than 100 quarries worked, producing annually 25,000 tons of marble, chiefly in slabs, for table-tops and other small pieces. Although great progress has been made during late years in this industry, there is still room for improvement. The production is still in the hands of small capitalists, who, for the want of the spirit of association, and alone, are unable to introduce those improvements which might advantageously be adopted in the getting out of the stone, as also in the process now used for working the marble after it is quarried. The education of the workmen requires to be attended to, for even the foremen are in many cases uneducated. The road communication cannot be spoken of very highly, and in many cases they are mere tracks, rendering the transport costly and often impossible, as in the Val d' Arni, which contains rich beds of marble, which are but little worked on this account.

Cultivation of Beet-root in Germany.—From a report published by the central office of the Zollverein, on the manufacture of sugar from beet-root, from 1st January to 31st August, 1870, it appears that there were 219 manufactories in Prussia, in which 13⅝ millions of cwts. of beetroot were employed; in the remaining part of northern Germany there were 64 establishments, and the quantity of beet-root manufactured was 3½ millions of cwts. Bavaria, with four establishments, manufactured 171,000 cwts.; Wurtemburg, with five establishments, 608,000; Baden, with one establishment, 615,000 cwts.; and Luxembourg, with two establishments, 48,000 cwts.

Cotton Stuffs for the Chinese.—The British Consul at Foo-chow-foo states in his report of last year that nankeens, or "Soo-chow cloths," as the Chinese call them, from their being manufactured in that important town, enter very largely into competition with foreign-made shirtings, being much stronger and more durable, since they are woven by hand-loom, and contain a greater proportion of the raw material, and they do not cost much more at first than our own cotton manufactures. The Consul is surprised that an attempt has not been made to imitate these Soo-chow stuffs, for it can hardly be doubted that steam power is a cheaper mode of production than manual labour. Woollens, such as broadcloths, Spanish stripes, &c., are not the fashion with the upper and well-to-do classes at Foo-chow, who, in winter, prefer garments made of furs of various costly kinds, which last for generations in families without renewal; or else they wear their Chinese silks and satins padded with cotton wool, both for underclothing and for leggings. Few of these grandees have more than two or three cotton shirts, and these are mainly of nankeen cloth, because of its superior warmth; they are probably changed and sent to the wash only once during the winter. As for wearing flannel near the skin for keeping themselves warm, or for warding off rheumatism, they scorn the idea, perhaps because these stuffs wear out with constant washing, and therefore cost money. A respectable Chinaman, who had spent many years of his life in Pekin, assured the Consul that the Emperor himself could not have more than one or two cotton shirts in his wardrobe. Probably he wears silks and pongees for underclothing where we use flannels and merinos. It may be hoped that, as the Chinese become better acquainted with the advantages of European habits of cleanliness and comfort, they will gradually take to using in larger quantities the cotton and woollen manufactures which the British manufacturer will be glad to supply to them. Great progress has already been made in this respect, as may be noticed in many of the Chinese, particularly the Canton people, who have dealings and come into close contact with foreigners. The working classes prefer the native cotton cloths, while white shirtings, scarlet woollens, &c., are used more for show and for coverings of furniture. The English cotton cloth, being white, is much preferred for outer garments at funerals.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal United Service Institute, 8½. Rear-Admiral A. P. Ryder, "On the Higher Education of Naval Officers."
Royal Geographical Society, 8½.

Tues. ...Royal Medical and Chirurgical, 8¾.
Society of Biblical Archæology, 8½. Mr. B. T. Lowe, "On the Flora of Palestine."

Wed. ...**SOCIETY OF ARTS, 4.** General Annual Meeting.

Thurs...Philosophical Club, 6. Annual Meeting.

Sat......Working Men's Club and Institute Union, 4. The Very Rev. the Dean of Westminster, "On the Early Christians."

Journal of the Society of Arts.

No. 971. Vol. XIX.

FRIDAY, JUNE 30, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

CONCERTS IN AID OF A NATIONAL TRAINING SCHOOL FOR MUSIC.

The Third Concert will take place on Wednesday next, July 5th, at the Royal Albert Hall. The following artistes have been engaged :—

MDLLE. TITIENS,
MADAME LEMMENS-SHERRINGTON,
MADAME TREBELLI-BETTINI,
HERR MÜLLER,
SIGNOR FOLI,
Solo Violin—SIGNOR SIVORI,
Conductor—SIR MICHAEL COSTA.

The prices of admission will be as follows :—

Unreserved Seats, for which money will be taken at the door.

	s.	d.
Organ Gallery	1	0
Orchestra	2	0
Numbered and Reserved Seats.		
Picture Gallery	2	6
Balcony	7	0
Arena	7	0
Amphitheatre	10	6
Boxes	each 3, 4, and 5 guineas.	

Tickets may be had of Mr. S. T. Davenport, Financial Officer of the Society, at the Society of Arts, 19, John-street, Adelphi, and of the usual agents.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

ANNUAL GENERAL MEETING.

The Annual General Meeting, for receiving the report from the Council, and the Treasurers' Statement of Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, was held, in accordance with the bye-laws, on Wednesday, the 28th of June, at 4 p.m., Lord Henry Gordon Lennox, M.P., Chairman of the Council, in the chair.

The Secretary having read the notice convening the meeting, the minutes of the last Annual General Meeting, and of the subsequent Special General Meeting, were read and signed.

The Chairman then nominated Mr. C. R. Carter and Mr. Samuel Harton as scrutineers, and declared the ballot open.

The Secretary then read the following—

REPORT.

In compliance with the Bye-laws, the Council now lay before the members the annual report of their proceedings during their year of office.

Ships' Life Boats.

Forty-four models and six drawings were submitted in competition for the medal, but inasmuch as one competitor sent in nineteen models, the number of competitors was reduced to that extent. After a careful consideration of the models and drawings, the Committee, which consisted of Lord Henry G. Lennox, M.P., Chairman of Council; Vice-Admiral Sir Edward Belcher; Right Hon. G. J. Goschen, M.P.; Thomas Gray; Richard Lewis; Captain Nesbit; Admiral E. Ommanney, C.B.; E. J. Reed, C.B.; Admiral Ryder; Seymour Teulon, Vice-Chairman of Council; Captain Toynbee; Captain Ward, R.N.; Lieut. C. P. Wilson, and Captain H. Tyler, were of opinion that none of them sufficiently fulfilled the requirements laid down, or had sufficient merit, either of novelty or otherwise, to justify the award of a medal. The Committee, however, expressed to the Council their disappointment that the models and plans sent in did not sufficiently meet the object which the Society had in view, viz., to get a boat which would do the work at present required by a coaster or ordinary merchant ship, having the additional advantages of a life-boat, with little or no increase of cost.

The Committee were of opinion that the subject was too important to be dropped; and they suggested to the Council that a notice, expressive of the opinions which are detailed in their report, should be circulated among builders, asking them to compete again, and calling their attention to the requirements of the Merchant Shipping Act, 1854. Accordingly, the Council issued a notice for a fresh competition, and ten communications have been received, which will be submitted to the consideration of the Committee.

Memorial Tablets.

In addition to those already announced, there have been affixed, during the present session, tablets as follows :—

John Dryden, poet, 43, Gerrard-street, Soho.
John Flaxman, sculptor, 7, Buckingham-street, Fitzroy-square.
George Handel, musician, 25, (late 57,) Brook-street.

There have already been previously fixed the following :—

Benjamin Franklin, 7, Craven-street, W.C.
Sir Joshua Reynolds, 47, Leicester-square.
Lord Byron, 16, Holles-street, Cavendish-square.
Napoleon III., 3A, King-street, St. James's.

The Council have set an example which they would gladly see followed by others, whether private individuals or public bodies.

Albert Medal.

The Council have this session bestowed the Albert Medal, instituted to "reward distinguished merit in promoting Arts, Manufactures, and Commerce," upon Henry Cole, Esq., C.B., "for his important services in promoting Arts, Manufactures, and Commerce, especially in aiding the establishment and development of International Exhibitions, the Department of Science and Art, and the South Kensington Museum."

Mr. Cole's indefatigable and successful labours for so many years towards the improvement and advancement of the arts and manufactures of this country are so well known to the members of this Society that it appears unnecessary to enlarge upon them in this room.

India Committee.

The proceedings of the Indian Committee have, as usual, contributed to awaken attention at home and in India to the development of our Indian Empire, and the Society may feel gratification that there is an increase of interest with regard to India. This shows itself in the greater sympathy for societies connected with India, which the Council has done what it could to promote. Besides its own special conferences on Indian subjects and the treatment of such at the ordinary evening meetings, the East India Association has held some of its most crowded gatherings in our hall. There, too, has been laid the foundation of two new societies, the Oriental Congress and the Society for the Promotion of Social Progress in India. The proposition for a Oriental Congress is now being seriously discussed, and has met with the approval of many leading men. By bringing together successively in our provincial capitals all those interested in the learning, the arts, and the commerce of India and the neighbouring countries of the East, it is hoped that further auxiliaries will be enlisted, and that the best interests of the home country and of India will be advanced.

The arrangements for the award of a prize for information on tea culture in India have occupied the Committee. Although the judges did not feel themselves authorised to grant the medal which had been offered for competition, they felt satisfied that more than one of the competitors had contributed valuable information, and that the sphere of our knowledge had been enlarged. As another competition is to take place in India, the Committee has postponed for a time further action on this subject. It is, however, intended to follow up this branch of Indian industry, in which the Society has long taken an active interest. It was as far back as 1841 that our Gold Medal was conferred on Mr. Charles Alexander Bruce, "for discovering the indigenous tea tracts, and for cultivating and preparing tea in Assam," and the time was approaching when, with the great development of this new industry, which has now reached a yearly value of one million sterling, the Albert Medal might have been justly conferred on Mr. Bruce. The Council, however, have to regret the receipt of news of his recent death, at an age sufficiently advanced to have seen the successful realisation of his early hopes and efforts. The Council hope to place on record in the *Journal*, at an early period, some account of its labours in co-operation with Mr. Bruce.

By the co-operation of Sir Thomas Bazley, the subject of cotton culture in India was once more brought before the members, when another tried ally of the Society, Mr. John Cheetham, President of the Cotton Supply Association, took the chair. On this occasion it was announced that the Association had determined to continue its labours, and to devote them more particularly to India. Although the Association has achieved a full measure of success, and has already conferred on this country, and on many regions of the world, great benefits by its judicious exertions, the Council would have seen with regret that the Association had considered its labours completed. Indeed, on the report that such a design was contemplated, the Council would willingly have lent its assistance for the continuance of some organisation.

The establishment of a Department of Agriculture by the India Government, in which the Society has taken a very active interest, has relieved the Council from the necessity of making further applications during the past session to the Secretary of State for India on this subject, and on this account they forbore from pressing other matters on his attention. They watch with interest the proper development of the organisation of this department.

A subject which has engaged the attention of the India Committee has been the question of coal and peat fuel, for the use of the expanding system of railways; and in the ensuing session the Committee hope to obtain further information.

The Indian press has devoted much space to the consideration of the proceedings of the Society, while to that press it has been useful to have opened a new channel for the reception and consideration of its opinions.

Apart from the general action of the India Committee, its organisation has proved useful in stimulating the exertions of individual members, Mr. Edwin Chadwick having drawn up a memorandum on the sanitary improvement of Cawnpore, for the Indian government, which has been printed and circulated. The subjects of irrigation, of sanitaria and hill colonisation, of increased cotton and agricultural crops and others, have thus engaged the exertions of members. By the appointment of Mr. George Campbell to the Lieutenant-Governorship of Bengal, which involves the administrative well-being of forty millions of our people, the Committee has lost an active and valuable member, who brought his extensive official knowledge to bear on the proceedings of the Committee and in the conferences. The opportunities thus employed by a high officer, in this and other societies, to lay before the public his own opinions for examination, and to elicit those of others, can scarcely fail to prove beneficial. In the present position of India, it is desirable the judgment of its governors should be in enlightened agreement with public opinion at home, and be able to claim the sympathy of the native populations and of the journals, which there exercise so great an influence in the formation and development of new institutions.

Cantor Lectures.

The Cantor Lectures during the present Session have been as follows:—"On Artists' Colours and Pigments," by Professor Barff, M.A., which consisted of five lectures; on "Dyes and Dye Stuffs, other than Aniline," by Dr. F. Crace Calvert, F.R.S., which consisted of four lectures; and on "Our Food-producing Ruminants, and the Parasites which reside in them," by Dr. T. Spencer Cobbold, F.R.S., which consisted of five lectures. The Council are happy to note that all these lectures were well attended, and excited much interest. The chemistry and treatment of artists' colours and pigments has hitherto been little attended to, and the sad condition of decay and fading into which so many of our pictures have fallen is strong evidence of the fact. It is encouraging, however, to find that the lectures by Professor Barff have attracted attention outside the Society, and are likely to bear fruit, Sir Francis Grant, the President of the Academy, having publicly announced that it is the intention of the Academy to found a professorship in connection with this subject. Professor Barff's lectures have already appeared in the *Journal*, and those by Dr. Crace Calvert and Dr. Cobbold will appear during the vacation.

Art-Workmanship.

The offer of prizes under this head for the present year took a different form from that which had hitherto been adopted by the Council on previous occasions. It was thought that advantage might be taken of the coming International Exhibition to bring forward the art-workmen of this country, and to place them in a position to be individually recognised in the competition among foreign nations. The Council, therefore, offered to give rewards "for special excellence on the part of all concurring in the production of works of industry of the highest character." These rewards were offered in the form of medals to manufacturers and designers, and money prizes to the workmen employed, it being a condition of exhibiting that the names of all engaged in the production of the works should be sent in. Seventy-five articles were sent to the Society's House, in response to the invitation, and the judges, Sir Digby Wyatt, Messrs. Richard Redgrave, Geo. Godwin, and H. Bowler, who kindly, at the request of the Council, undertook the duty, awarded silver medals and money prizes to the amount of over £200 in respect of them. Many of the articles thus rewarded have been admitted into the International Exhibition. The particulars of these prizes are given at page 227 in the *Journal*. These competitions have now been carried on for several years, but the Council regret to observe that, in spite of the large amount of prizes offered, there is still wanting anything like an adequate response on the part of either manufacturers, designers, or workmen. The result is, that although no doubt the articles rewarded are of a very satisfactory character, showing great skill and taste, yet the competition is small, and the amount of money awarded is far less than that which was offered, and which it was hoped would be claimed. The Council have for some time past felt that it was doubtful how far, in face of so small a response to their offer, it was right to continue these prizes. In this state of things, and looking at the fact that Annual Exhibitions of Industry are now established, where an opportunity is afforded to any one to send articles for admission, and where such admission stamps them for excellence, the Council have thought it right to suspend this offer of prizes, for the present at least, in the belief that a sufficient stimulus is given by these Exhibitions, and that the money prizes are no longer needed. The Council propose, therefore, to offer no prizes under this head for the coming year; and, watching the result, will be prepared, if necessary, to renew them if such a course shall be thought desirable hereafter.

International Exhibition.

The members will bear in mind that, at the request of the Commissioners of the Exhibition, the Council undertook the charge of Class 10 in Division II., "Educational Works and Appliances." The Council sought and obtained the assistance of committees on the various sections into which this class is divided, and they are happy to state that, by their means, a very complete and interesting display has been got together. Foreign countries have contributed to this department, and in particular Sweden has erected a model school-house, furnished with all its various educational appliances, of a highly interesting and valuable character. The Council strongly recommend all members of School Boards, and others who take an interest in education and its practical working, to pay a visit to this department.

The Council were invited to take part in the ceremony of inauguration; they have already recorded the special measures taken by them in associating the Art Workmanship Prizes with the Exhibition; and they have much satisfaction in informing the members of the Society that there is every promise that the Exhibition will be a complete success, quite fulfilling the expectations of its promoters.

Postal Reform.

The alterations which had been made in the Post-office regulations in the early part of the session, though in some respects—and especially in regard to the lowering the rates of postage for the transmission of newspapers and printed matter—an improvement on the previous arrangements, yet, with reference to the transmission of samples especially, were considered by no means satisfactory or suited to the requirements of an extended commerce, and were far behind those in force in various continental countries.

The regulations thus introduced were the source of much confusion to the public as well as to the employés of the Post-office, scarcely any two offices being able to interpret in a uniform manner what should be the conditions of transmission, or the rate of charge, in any particular case. The simplicity of the system as introduced by Sir Rowland Hill was departed from, and confusion was the result. The sample post, which under the previous regulations was largely taken advantage of by the public, and was, to the great convenience and advantage of trade and commerce, practically becoming a small parcels post, was suddenly stopped by the new regulations, restrictions being put upon transmission which involved an increase of supervision and discrimination on the part of the Post-office clerks as well as the public, which practically was impossible to be carried out, and which threw such impediments in the way as to destroy to a large extent the benefits which under the previous system were rapidly being developed. The Council referred the matter to the Postal Committee, and, acting on their advice, convened a public conference of merchants, traders, and others interested, presided over by Lord Henry Lennox, the Chairman of the Council, to discuss the question, and a petition representing the views advocated by the Committee was adopted, which the Chairman of the Council, Lord Henry Lennox, presented to the House of Commons.

This petition recommended a return to that simplicity which had hitherto characterised the postal system, as established by Sir Rowland Hill, letters and newspapers having their distinctive rates, and that all other matter, without reference to its nature or quality, should be transmitted at another. The Council are happy to state that the labours of the Committee have been attended with some considerable amount of success; for if the changes which the Postmaster-General has introduced have not taken the precise form which the Society of Arts' petition recommended, yet they have placed the system on a far better and simpler basis than had previously existed, getting rid, to a very large and beneficial extent, of those useless distinctions and conditions with which it had been encumbered. Practically, though still not so perfect as the Council would desire, the system restores to the public that which, under the title of a sample post, was made use of as—but had now become in reality—a small parcels post, an object which the Council has for many years past consistently advocated. The Council have reason to believe that the reductions which have led to the introduction of halfpenny stamps are not likely to occasion any loss to the revenue. It is hoped that, after a few years, when the system has got thoroughly into work, the restriction as to weight, now fixed at 12 ounces, will be relaxed, and the country will have the same facilities of transmission which are found practicable, and of so much advantage both to industry, and trade, and to social progress, in Germany, Belgium, and Switzerland.

National Training School for Music.

The promotion of the study of music has continued to engage the attention of the Council and the Committee specially appointed to take charge of this subject. While all admit its importance in a national point of view, and while other countries actively give encouragement to it by maintaining public institutions specially established for aiding its study and instruction, this country has nothing of the kind; for the pitiful grant which has been made from the public funds to the Royal Academy of Music cannot be said to place that institution in the category of a public establishment, still less to compare with the national schools of music in France, Belgium, or Germany. The Council are taking steps for the establishment of a National Training School for

Music; and, with a view of commencing the work, and raising a fund as a basis on which a beginning may be made, they have organised six concerts, to be given in the Royal Albert Hall, the proceeds of which are to be devoted to this purpose. Two of these concerts have already taken place, and the four remaining concerts are fixed for the Wednesdays in July. The Council strongly urge the members to help them in this great national work. In former times, some two hundred years ago, the cultivation of music was far more general among the people of this country than at present. History shows us that in those days both instrumental and vocal music were the common accomplishments of all with any pretension to a fair social position. No doubt political, religious, and social changes subsequently tended to discourage these habits, but whilst the causes which led to this discouragement have long since passed away their influence has remained, and music is not so extensively cultivated as formerly. No public encouragement or facilities are given to its study. Whilst painting and the fine arts have long and with advantage had aid from the State, why should music be excluded from participating? The Council are about to bring the subject before the great City Companies and other trustees endowed with funds devoted either for the purposes of education or the advancement of the arts, in the hope of inducing them to give their assistance to the work in hand, by establishing scholarships or exhibitions for the study of music in connection with the school, the Council having pledged themselves to do the like if a school can be established on a satisfactory basis.

Conversazione.

The annual conversazione, held, by the permission of the Committee of Council for Education, in the South Kensington Museum, was well attended. Their Royal Highnesses the Prince and Princess of Wales, the Duke of Edinburgh, Prince Arthur, and other branches of the Royal Family, honoured the Society by their presence.

Review of School Drill.

The success which attended the gathering last year, at the Crystal Palace, induced the Council to repeat the invitation to the schools to take part in a second demonstration of a similar character, it being felt that it was of the highest importance to draw the attention of the public to a branch of education which, looked upon in a civil point of view no less than in a military one, is now being recognised as of high importance in the training of the young. Its value was well pointed out in an admirable paper read before the Society at one of its evening meetings, by Major-General Eardley Wilmot, R.A., a member of the Council. The review took place with increased success, in the Royal Horticultural Gardens on Thursday last, the 22nd instant, in the presence of H.R.H. Prince Arthur, who subsequently presented, in the Albert Hall, the two prize banners to the schools which had passed best in an inspection previously made by an officer appointed by the Society for the purpose. The bands of the boys were subsequently massed together in the Hall, and performed several pieces of music with great effect. It may be well to point out that experience has shown that, in the district schools of the metropolis, the learning of music, by such of the boys as show any talent for the art, is the most advantageous pursuit to which they can be put, as there is a constant demand for such boys on the part of the army bands, which are more especially recruited from this source. It is found that, as fast as the boys can be thus trained, they are at once sure of employment.

The Council have requested the Drill Committee to prepare a full report of this review, with the particular object of inducing other schools to join in the review next year, which the Council trust will be even more successful than that which has just taken place. The Council intend to invite subscriptions of five shillings and upwards, to defray the expenses both of the past and future displays of school drill.

Medals.

In addition to the medals given in respect of Art-workmanship, as before stated, the Council have awarded a medal in respect of the paper read at one of the evening meetings by Mr. Ferdinand Kohn, "On the Machinery used in Sugar-making." They have also awarded Mr. W. H. Chubb, of Ipswich, Queensland, the Society's Gold Medal, for the importation into this country of silk cocoons grown in Queensland. In the address of the Chairman, delivered at the opening of the session, it will be remembered that allusion was made to a consignment of these cocoons which had been received by the Society, and that, under the advice of Mr. Thomas Dickins, the Chairman of the Silk Supply Association, they had been sent to Macclesfield, to be examined and reported on by the branch association of that town. There the cocoons have been reeled and thrown, and the materials woven, and specimens thus produced have been laid before the Society, with a report from the association, speaking in highly favourable terms. The cocoons are stated to have been received in good condition, and of a quality approaching more nearly to that of Bengal than those of France and China. The report recommends the Council to give such encouragement as lies in their power to promote the further cultivation of this industry in the colony, which promises so well. The association anticipates that this may form the commencement of a new industry, beneficial alike to the colony and the mother country. It has long been the desire of many engaged in the silk trade to establish the reeling of silk in this country, importing the cocoons rather than the reeled silk, it being considered that if that operation be performed in this country, there is a better chance of getting the article in a condition more suited to the wants of our manufacturers.

Institutions in Union.

For the proceedings under this head, the members are referred to the report of the Educational Officer, read to the Conference on the 16th instant. From this it appears that the Examinations have been attended by an increased number of candidates, and that they are held in high estimation by the classes for which they were instituted.

Food Committee.

This Committee has continued its labours during the year, and has presented the following report:—

Your Committee have continued their inquiries during the past session, and have to report a great improvement in meats submitted to them, which have been preserved in tins. Both as to the quality of the meat, its appearance, and retention of nutritive qualities, there has been satisfactory progress, and your Committee regard this process as furnishing a very valuable aid to other kinds of food, especially where it is desirable to have as large a quantity as possible of animal matter in a small compass.

The trade from Australia in tinned meats has very largely increased, in the exportation both of beef and mutton; and, so far as the many specimens of this and other modes have been investigated by your Committee, this one alone has as yet fulfilled the necessary conditions of bringing meat from a distance with fully-retained meat flavour, without deterioration by addition of chemical agents. No process of the latter kind which as yet has been submitted to your Committee can be said to be thoroughly successful. Either the texture of the meat has been broken down or hardened, and the flavour destroyed or altered, and in many cases such a distinct saline or mineral taste added as to preclude the adoption of such specimens as articles of general consumption.

Your Committee still look with much hope to the process of preserving meat in cold temperatures, and are now engaged in a series of experiments, by which they hope to be able to determine the conditions most favourable for the practical appliance to animal and vegetable substances of this mode of preservation.

Your Committee have had the advantage of a report by Professor Taylor, on a new specimen of desiccated meat from Brisbane, supplied by Mr. Alexander. This is a valuable preparation, and, under given circumstances, likely to be of great use, especially where it is of importance to economise space.

As yet, no successful plan has been matured for bringing live animals by sea from long distances.

Your Committee has also been engaged on the question of distribution of the fish supplies of the country, and hope that the result of their investigations in this and other branches of inquiry may be yet further to extend and improve the food of the people.

Benj. Shaw,
Chairman of the Committee.

June 15, 1871

Finance.

The Council append to their report the usual statement of receipts and expenditure, and assets and liabilities. (See p. 603, *Journal* 970.) It will be noted that there is an addition to the invested funds of the Society, of Mr. Alfred Davis's bequest of £1,800, and of Mr. Robb's bequest of £200.

The number of members has increased over that of the previous year.

Mr. Botly moved the adoption of the report, expressing his satisfaction at the successful session just closed, and that the discussions of the Society had had such practical results.

Dr. Longstaffe seconded the motion.

Mr. Lloyd Wise said that though the Society had done a great deal in the past twelve months, they were still leaving their house in disorder. The library of the Society was a most valuable one, but it was badly arranged, and it was most inconvenient to get at the books. Last year, he had brought the same subject before the annual meeting, but his influence, he supposed, was not strong enough to get anything done. He hoped, however, that if he kept on persistently complaining, some member of Council would take it up. Last year he was told that the Society would look into the matter, but no change or alteration had occurred. The useless models which were blocking up the cases were still there, though they were to have been sent away, and a great many valuable books were still inaccessible to members.

Mr. Symonds thought that a printed catalogue would be of great use.

Mr. Seymour Teulon said Mr. Wise was particularly interested in the library, as he consulted the specifications a good deal. He suggested that Mr. Wise should meet the Library Committee, who would be most glad to hear his suggestions for improvement.

Mr. Symonds complimented the Society on its success in the matter of postal reform. He hoped, however, that though a very considerable measure of reform had been introduced, it would not stop where it was. From the remarks made in the House of Commons by the noble Chairman, he thought that a further process of squeezing would take place, so as to get something more out of the government. The Council, in the report, speak of a few years, but in this fast age that was a long time; he would suggest that months be substituted for years. There was a great deal yet to be done. Foreign postage especially wanted re-arranging, and he should not be content till the unit of postage was one halfpenny. He hoped the Committee would continue its labours.

The Chairman said that at the time the postal measure was before the House of Commons he did see clouds arising which induced him to accept what was proposed, rather than to press for the full extent of what was wanted. He knew the massacre of the innocents must come, and he wanted the Bill to pass before the bloodthirsty feeling of the House was developed, and he felt thankful a short time ago to think that the Bill had passed. He did not consider it by any means a finality measure, and next session he would be glad to carry out any views on the matter the Society of Arts might have at heart.

The report was unanimously adopted.

Mr. W. Hawes proposed, in complimentary terms, that the hearty thanks of the Society be given to Lord Henry Lennox for his valuable assistance as Chairman of Council, and in the work of the Society generally.

Mr. Symonds seconded the motion.

Mr. Seymour Teulon said he most heartily and cordially supported the motion. He need only refer to the two last successful gatherings at South Kensington, and the presence of His Royal Highness the President of the Society, which was owing to the personal influence of the Chairman.

The vote of thanks was passed unanimously.

Lord Henry Lennox thanked the meeting for its approval. He must, in justice to the Prince of Wales, say that it was his own wish to attend the conversazione of the Society. Early in the year, His Royal Highness mentioned the matter to him, and expressed his readiness to forward the interests of the Society if he (the Chairman) would point out to him how he could do so. As far as he personally was concerned, he should always be anxious to forward and carry out the wishes of the Society, not only as a Member of Council, but in his place in Parliament.

The ballot having remained open one hour, and the scrutineers having reported, the Chairman declared that the following members had been elected to fill the several offices. The names in *Italics* are those of members who have not, during the past year, filled the offices to which they have been elected :—

COUNCIL.

PRESIDENT.

H.R.H. the Prince of Wales, K.G.

VICE-PRESIDENTS.

Sir W. H. Bodkin (Assist. Judge)
Right Hon. Stephen Cave, M.P.
Lord Chancellor, F.R.S.
Henry Cole, C.B.
Sir Daniel Cooper, Bart.
Rt. Hon. W. F. Cowper-Temple, M.P.
Lord De l'Isle and Dudley
The Earl Granville, K.G., F.R.S.
William Hawes, F.G.S.
C. Wren Hoskyns, M.P.
Lord Henry G. Lennox, M.P.
Earl of Lichfield
Sir John Lubbock, Bart., M.P.
Right Hon. Sir John S. Pakington, Bart., M.P.
Major Gen. Sir Henry Rawlinson
Samuel Redgrave
Rev. W. Rogers
Seymour Teulon
Thomas Twining
Rt. Hon. C. P. Villiers, M.P.

ORDINARY MEMBERS OF COUNCIL.

F. A. Abel, F.R.S.
Thomas Brassey, M.P.
Andrew Cassels
Edwin Chadwick, C.B.
Hyde Clarke
Captain Donnelly, R.E.
Maj.-General F. Eardley-Wilmot, R.A., F.R.S.
Capt. Douglas Galton, C.B., F.R.S.
Admiral Inglefield
Admiral Ommanney, C.B., F.R.S.
E. Carleton Tufnell
James T. Ware

TREASURERS.

G. C. T. Bartley
Edwin Lawrence

AUDITORS.

Jacob A. Franklin
T. R. Tufnell

SECRETARY.

Peter Le Neve Foster.

FINANCIAL OFFICER.

Samuel Thomas Davenport.

The Chairman proposed a vote of thanks to the scrutineers for their services, which was carried.

At the conclusion of the General Meeting a Special Meeting was held, when the following candidates were balloted for and duly elected members of the Society :—

PRINCE ARTHUR, HIS ROYAL HIGHNESS.
Ash, Henry Clarke, 314, Oxford-street, W.
Bromilaw, David, Battlesden-park, Woburn.
Christie, David A. T., 73, Warwick-gardens, Kensington, W.
Clarke, Miss Margaret, 26, Warington-crescent, Maida-hill, W.
Ellis, Samuel, 39, Lime-street, E.C.
Eyre, Major-General Sir Vincent, C.B., Athenæum Club, S.W.
Hodgson, Henry Tylsdon, Harpenden, St. Albans.
Legg, Charles Arthur, 14, Grafton-street, Mile-end, E.
Lister, Simeon, Great Horton, near Bradford, Yorks.
Merry, J., Surbiton-hill, Surrey.
Moseley, James, Messrs. David Moseley and Sons, Ardwick, Manchester.
Phillips, Francis M., 96, Lansdowne-road, Kensington-park, W.
Pope, Frederick, Donnington-on-Bain, Lincolnshire.
Sams, John Sutton, St. Peter's-lodge, Eltham-road, Lee, S.E.
Seaman, W. M., the Chesnuts, Clapham-park, S.W.
Seaton, Joseph, M.D., Halliford-house, Sunbury, Middlesex.
Seyd, Richard, 1A, Prince's-street, E.C.
Shipston, T. Wiseman, LL.D., Harlington-house, West Ham, E.
Smith, Colonel, 101, Hereford-road, Westbourne-park, W.
Smith, W. Compton, Ivy-lodge, St. John's-hill, Wandsworth, S W.
Tolhurst, George E., 38, Elgin-crescent, Notting-hill, W.

FOOD COMMITTEE.

This Committee met on 15th June :—Present, Mr. BENJAMIN SHAW in the chair, Messrs. F. A. Abel, Sir Antonio Brady, E. G. Davenport, C. Wren Hoskyns, J. Jenkins, W. H. Michael, Seymour Teulon, J. T. Ware, and J. A. Youl.

The Committee drew up a report, which appears on page 624, in the Council report.

The following analysis of a sample of Australian minced meat was received :—

REPORT OF EXAMINATION OF A SAMPLE OF AUSTRALIAN MINCED-MEAT.

By A. S. Taylor, M.D., F.R.S.

The sample had a brownish colour, and a smell of dried meat. There was no appearance of the red colouring matter of blood, and no trace of this red colouring matter could be detected in it by the most delicate chemical tests. Under the microscope, the meat had the characters of the dried fibrin of flesh, reduced to shreds, and intermixed with fibrous tissue. No acari could be discovered in it, nor any vegetable or mineral matter. It had a slightly acid reaction to test-paper, but there was no smell or taste to indicate that it had undergone decomposition. It had the appearance of meat deprived of the red colouring matter of blood, and thoroughly desiccated, either by exposure to heat (a low temperature), or some desiccating process.

In the dry state the meat was tasteless. When soaked for two hours in water, according to the directions for use, it became soft, but it was not so completely softened as to render it palatable for food. Even a soaking of from six to ten hours did not give to it the property assigned to it in the directions, *i.e.*, the original condition of freshly minced meat. In this softened state it was tasteless, and had the odour of dried meat. The addition of salt, under these circumstances, would give only the usual saline taste. With respect to cooking, it is difficul to understand how this would bring out a taste, or restore that which the meat originally had. A hot decoction was then made, but this failed to bring out any flavour like that of fresh minced meat.

The cold infusion and the hot decoction had a slight acid reaction. There is nothing unusual in this. There was no odour of ammonia, or of the offensive gases evolved in the decomposition of animal matter. Evidently the desiccating process had most thoroughly preserved the minced meat from chemical changes. Moistened with water, it underwent the usual putrefactive changes after four or five days. The meat macerated in cold water putrefied more readily than that which was macerated in hot water. Acetic acid formed with the softened minced-meat a jelly, just as it does with softened fibrin of muscle.

The cold aqueous infusion contained albumen, some soluble phosphate, and alkaline chloride in traces. The decoction obtained with boiling water contained gelatine, with alkaline phosphate and chloride in traces. There was no sulphuric acid or alkaline sulphate present. The dried minced-meat contained 10·6 per cent. of water, and yielded by incineration 3·4 per cent. of a perfectly white ash, in which were found phosphate of lime, alkaline chloride, and sulphate, with small quantities of potash and soda, and oxide of iron—the usual mineral ingredients of flesh. The dried minced-meat contained merely traces of oily matter, or fat. The fat had been carefully removed. When submitted to heat, it yielded nitrogen and sulphur in large quantity, the elements which are always found in good animal food.

The minced-meat, in a chemical point of view, may be described as thus constituted in 100 parts:—

	Composition.
Water (including matters volatile at 212°) ..	10·6
Mineral matter or ash (chiefly phosphates and chlorides of potassium and sodium	3·4
Gelatine and substances soluble in boiling water	8·8
Fibrine and fibrous tissue, with albumen and albuminous tissue, cellular membrane	77·2
	100·0

Conclusion.—This sample of minced meat contains all the usual constituents of dried, uncooked flesh, excepting the colouring matter of the blood. It contains 86 per cent. of dried fibrine, albumen, and gelatine, the greater part of which is fibrine. It contains from 60 to 65 per cent. less water than is usually found in fresh meat (beef). There is no appreciable amount of fat or oily matter. It contains within a small bulk all the usual constituents of nutritious animal food, and no mineral or other ingredients to affect its qualities as food. The objection to it is, that the process of preservation deprives it of that agreeable flavour of meat which stimulates appetite and creates a desire for food, no doubt owing to volatile matters lost in the desiccation process, which no art can restore. Salt would give a saline taste, but unless at the same time some such article as the Ramornie or Liebig's meat extract is used for flavouring, it would be mawkish and repulsive as food. I do not doubt that it is highly nutritious and capable of supplying the waste of tissue, like other kinds of nitrogenous animal food. It cannot be regarded as a cheap substitute for fresh meat, but under dearth or privation, when all the usual sources of animal food fail, it would undoubtedly be the means of sustaining life. Its perfectly dried state renders it as imputrescible as quill, and it might, therefore, be available as food, in a highly condensed form, on voyages or land expeditions, in which provisions, in some form or other, must be carried.

The Committee had before them some specimens of meat two years old, desiccated by a cold process, by Mr. Buchannan, which were ordered to be cooked for the next meeting.

DRILL REVIEW.

As was briefly mentioned in last week's *Journal*, the review of schools took place at the Royal Horticultural Gardens, South Kensington, on Thursday, the 22nd inst., under his Royal Highness Prince Arthur.

The following schools took part:—

South Metropolitan		312
Forest-gate		100
Marylebone		96
Goliath Training Ship.................		249
Stepney		144
Lambeth		109
Holborn		75
Mile-end		103
Islington		62
Shoreditch.............................		137
West Ham...............................		67
Strand Union		100
Royal Naval School.....................		540
Bethnal-green		80
St. Mary's Orphanage...................		172
Marine Society's Training Ship *Warspite*..		205
Homeless Boys of London:—		
Chichester Training Ship....	200	470
Refuge Farm School	130	
The Home................	140	

The St. Mark's College and the Battersea Training College companies of the 2nd Middlesex Rifle Volunteers, under Captains Radcliffe and Verity, acted as a guard of honour, and, with the band of the North Surrey Schools, received the Prince on his arrival. Prince Arthur was conducted to the daïs erected in the gardens, by Lord Henry G. Lennox, M.P., Chairman, and other members of the Council.

The boys were drawn up in 17 battalions, and the place of review was the Lower Western-terrace. Each corps, headed by its band, marched in regular military order. The *Times* says:—"Punctually at three o'clock, the Royal reviewing officer and his Staff entered upon the parade. The National Anthem was played by all the bands, and a Royal salute of cheers from the boys greeted the Prince as he moved to inspect the ranks as they stood. The rain continued with unabated violence when this ceremonial was over, but no one shrank from the task in the programme, the review itself, and, as the Prince took his position on the dais, the leading battalion of the line, having wheeled into open column, was ready to march past. The signal to march was given, and, with a good swinging step, came the first school, the boys of the training ship *Goliath*, lying off Grays, Essex. The lads were well-trained, and their excellent discipline and good physical powers were evidenced in the steadfast attention each boy paid to his dressing, and the ease with which the whole five companies and the band sustained this rigorous test in military training. They were dressed as sailors, in the white frocks of the Royal Navy. The second battalion was that of the Homeless Boys, all belonging to one institution, though in three distinct classes. The first class was that of the boys in the Farm Schools, and these were in a sort of soldierly uniform; the second was the class of boys, three large companies, of well-made young fellows from the *Chichester* ship, all in blue shirts; and the third were some lads from the Queen-street Refuge. They were all well drilled, but the Queen-street boys were wanting in the healthful look apparent in the other two classes. The Marine Society's boys, from the *Warspite* at Charlton, also in the white frock of the Royal Navy, gave six good companies, and the boys marched as well and looked as well as any body of lads on the ground. The District School lads followed, but these in general were small in numbers and in size compared with the Institution lads. The explanation given is, that the boys are now sought for by military bands, and taken away at a very early age, especially in those schools where, as at Southall, under the Marylebone Guardians, a good military bandmaster gives instruction. The other schools were the Forest-gate, the St. Mary's (Roman Catholic) Orphanage, which sent six good companies and an excellent band, the Islington Industrial School, the West Ham Industrial School, the Lambeth parish school, the Bethnal-green, the Mile-end, the Holborn District school of Upton, the Shoreditch District School, the Strand Union School, the Stepney Industrial School, the South Metropolitan District School, from Sutton, in Surrey, and, the last, the Royal Naval School, of Greenwich. The last two were each eight companies strong; but the "Royals" were perfect in step, in dressing, and in distance, as might be expected, indeed, of boys trained so highly as these have been. After the review, the Prince, company, and boys retired to the Royal Albert Hall.

Lord Henry G. Lennox, M.P., addressing the Prince, referred to the importance of training the youth of this country in the way in which those who had been reviewed had been trained, and he stated that drill had been found to have an important moral as well as physical benefit. Besides, he said, lads thus trained, even if they did not enter into one of the services of the country, were able to obtain ready employment in civil life, the discipline they had undergone being a most valuable addition to their general education.

Major-General Eardley Wilmot, R.A., F.R.S., then explained the object the Society of Arts had in view in taking up the subject of school drill. He spoke of the importance of physical training for all youths, and, having reminded the Prince of the classes to which the youths he had seen that day belonged, said the same system of drill should be introduced into every school in the kingdom, and especially should it be a part of the training in the schools of the higher orders. The Prince himself had experience of the value of physical training as a cadet at Woolwich, and all classes should be trained in youth. Non-commissioned officers from the Guards had been sent by the Society for the purpose of inspecting the schools on their own drill-grounds, as it was found impossible to organise a review in the Horticultural Gardens that would enable a proper inspection and competition to take place.

The awards were, that the first prize, a banner, should be given to the Royal Naval School at Greenwich; the second prize, also a banner, to the boys of the South Metropolitan School at Sutton; and the third, a certificate of merit, to the Central London District School, but as that school did not make its appearance, it was awarded to the Stepney Industrial School.

H.R.H. Prince Arthur, in presenting the prizes to the boys representing the schools rewarded, expressed the great pleasure it had given him to be present at the review. He said the interest of his distinguished relative, the Prince of Teck, who last year reviewed them at the Crystal Palace, was shown in his attendance again that day; and he was glad to tell them that, on the previous occasion, in the opinion of high military authorities, they had performed their drill admirably. He was sorry the ground that day had not permitted any manœuvres, but he was himself greatly pleased to see the excellent march past; and what they learnt in drill as boys they would not forget, for it would not only train them to march, but it would train them to regularity, order, and obedience, and these would be of use to them into whatever sphere of life they entered. Not only this, but if called upon to serve their country, they would more readily be of use to her. In conclusion, he hoped they would be none the worse for the "ducking" they had received.

At the conclusion of the presentation, Prince Arthur entered the Royal box, and listened to the performance of music by the united bands of the various schools, conducted by Mr. Lawson, Royal Artillery, Chatham division.

Before going home, each boy was supplied with some substantial refreshment.

In accordance with the report of Council (see page 623), subscriptions of five shillings and upwards are invited towards the expense of this and future reviews. The following amounts have been already received :—

	£	s.	d.		£	s.	d.
James Austin....	1	0	0	G. N. Hooper....	1	1	0
B. W. Bartram ..	1	1	0	Chas. Horne (will give 10s. more if required)	0	10	0
L. Biden........	1	0	0	Dr. Albert Horwitz..........	0	5	0
Sir W. H. Bodkin	1	0	0	Maj. E. W. Mathew	0	10	0
W. W. F. Bolton	1	1	0	R. Nicol	1	1	0
Wm. Botly	0	5	0	James Noble	1	1	0
H. A. Bowler....	0	10	0	John Noble	1	0	0
A. Cassels	0	10	0	John Pritchit....	0	5	0
A. S. Cole	0	10	0	Edward Rosher ..	0	10	0
Henry Cole	2	0	0	W. S. Rumsey ..	0	5	0
Sir Daniel Cooper, Bart. (will increase if needed)	1	0	0	Philip Sancton ..	1	0	0
W. Cooper	0	10	0	South Metropolitan District School........	10	10	0
Rev. B. M. Cowie	1	1	0	George Stanton..	0	10	0
Major-Gen. Croggan, R.A......	0	5	0	W. H. Tanqueray	0	10	6
J. A. Crookenden.	0	10	6	Charles Telford..	1	0	0
Thomas Dixon ..	0	10	6	W. H. Thomas ..	1	0	0
John E. Evans ..	0	10	0	E. C. Tufnell....	5	0	0
W. H. Fell......	1	1	0	Z. Watkins......	0	5	0
F. Filliter.......	1	1	0	C. Williams	1	1	0
J. A. Franklin ..	0	10	0	W. B. Wrightson	1	0	0
Samuel Harton (to be doubled if required)......	0	5	0				
Sir Rowland Hill	1	1	0		£45	6	6

COTTON CULTIVATION IN INDIA.

Amongst the subjects contained in the report published by Mr. Rivett Carnac, the Cotton Commissioner for the Central Provinces and the Berars, on the operations of this department for the year 1868-69, we gather some interesting information respecting the measures adopted to improve the culture of cotton. For some time past the great question that has presented itself for solution has been the comparative merits of the exotic and indigenous seed. Hitherto the adaptability to the climate and soil of Central India of the American plant had not been authoritatively decided, and, in the hope of securing for these provinces an improved staple, it was determined, notwithstanding the many previous and discouraging failures, to give the foreigner yet another trial, and to arrange for experiments being made on such a comprehensive scale as to ensure every hope of conclusive results. As it was quite evident that, whilst these experiments with exotic seed were being conducted, much might be done to improve the indigenous plant, it was further determined that attention should be paid to the selection of the seed of the indigenous cotton.

During the former season, one of the most promising-looking cotton fields in the neighbourhood of Hinganghat had been chosen, and a considerable number of the finest "bolls" used for the purpose of sowing, which process was carefully continued. Arrangements were also made for obtaining seed from some of the best of the fields in the Poonah Valley, and the quantity of seed thus acquired made it necessary that the experiments should be undertaken on a commensurate scale. It was believed that the natives would readily avail themselves of the superior kinds that would be raised upon the projected model farms, and that a considerable improvement in the cultivation would result therefrom. His Excellency the Viceroy and Governor-General in Council was pleased to sanction, on the recommendation of the Chief Commissioner and the Resident, the establishment of three seed farms in the Central Provinces and the Berars. To the charge of each of these farms a special officer has been appointed, who, during the slack season, from June to December, when the crop is growing, will see to the cultivation and selection of the seed on the pedigree system, and will assist generally in all matters connected with the improvement of our cotton supply. From a description of the spots, we learn that the seed farm in Wurdah Valley is situated close to Hingunghat. The soil is rich and well drained, sloping down towards the adjacent river, the Wunna. The extent of land actually taken up amounts to 52 acres; 46 of this have been sown with the best Hingunghat seed, and, taking a yield of 200 lbs. to the acre, it is anticipated that nearly 10,000 lbs. will be raised, or enough to sow 1,000 acres of cotton ground. These experiments will test the effect in the indigenous cotton, of deep ploughing, manure, irrigation, and other well-known means, and a portion of the farm will be cultivated on the native principle, by way of contrast. In a separate part of the farm exotic seed will have yet another chance, and advantage has been taken of the presence of a European officer on the spot, whose exclusive attention will be devoted during the rainy season to these experiments, to sow divi divi, Virginia tobacco seed, and other produce, which it is believed may be with advantage introduced into this part of India.

At Oomraotee, 98 acres, in a favourable position to the north-west of the town, in the village of Sooklee, have been selected for the seed garden, where similar experiments have been commenced. The land is well drained, and, as it has been but little worked during the last five years, is admirably suited for the purpose. This farm is in charge of a native of this part of the Berars, from whose experience of the country and people much assistance is anticipated in dealing with the cultivators. The largest farm is near Sheagaon, in West Berar, the railway station for the great cotton market of Khangaon, from which place it is eleven miles distant. Here 112 acres of excellent cotton soil have been chosen. The positions and other conditions are favourable, and, with a good season, enough selected seed may be raised to sow 2,000 acres of cotton land in the Berars, or, admitting the produce of the other two farms into the calculation, enough in all for nearly 5,000 acres of land. The season, although extremely capricious, promised to be favourable to the success of these measures, and Mr. Rivett Carnac expresses himself as more than ever convinced by experience, that by a system of seed farms, and by paying attention to the indigenous plant, which, even in its present state, bears no indifferent character, we have more prospect of improving the cotton produce of these provinces, and of benefiting the trade, than by almost any other means that can be adopted. Major Clarke, who claims to be an authority upon the subject, entertains a strong conviction of the improvability of the great Asiatic plant to an extent not dreamed of by those who have not been initiated into the system of well-selected seed growing. After having worked hard at the American sort for some years, he thinks that after all we shall have to look to the improvement of the true Asiatic cotton to be of real service in India.

THE TRADE WITH WESTERN CHINA BY THE BHAMO ROUTE.

The official narrative of the expedition to explore the trade routes to China, by Bhamo, under the guidance of Major Sladen, political agent at Mandalay, British Burmah, furnishes some interesting information respecting the chief objects for which the expedition was sent, and the results thus far attained. It has long been a matter of special notoriety to those acquainted with the affairs of Upper Burmah, that its commercial prosperity has depended, for many generations past, in the means afforded of prosecuting overland trade with the southern and western provinces of the Chinese Empire. Most of the gold that for centuries past has been expended in the decorative arts and adornment of the pagodas of this country, and all the silk which, from time immemorial, has helped to feed the looms of its principal industry, found its way from China to Burmah by an overland route from Yunan, which struck the Irrawaddy at the old central mart of Bhamo. In return for this wealth, Burmah exported raw cotton from amongst her indigenous products, and supplied woollen cloths and piece-goods, imported, yet sparingly, from a British market. But for more than a dozen years past internal trade with China had either entirely ceased, or was prosecuted only to a very inappreciable extent. Every merchant who has been led to establish himself in Burmah since the British occupation of Pegu in 1852, has had his attention fixed for several years past on vast fields for commercial enterprise in the fertile openings of Upper Burmah, the Shan States, and Western China.

When a substantial scheme had been set on foot for penetrating this same Western China by a route or railway which was to be projected from a Rangoon terminus, it became of significant import to ascertain whether it would not be better to revive an old overland trade, which had always been recognised as the natural outlet by which the commerce of China had hitherto worked a channel for itself into the provinces of Burmah. Hence originated this expedition, which would only have been undertaken by a party of British officers, under a full assurance that they enjoyed the confidence of the Burmese government. As regards connecting Rangoon and China by the railway, *viâ* Kyang-hung and Esmok, the only Chinese markets of importance that would be reached by such a line of railway would be those in the extreme south of Hunan, in Quangesi and Quangtung, but the foreign trade is there comparatively small, and these provinces have already easy and cheap communication with Canton. The southern portion of Hunan is very poor compared with the central and northern portions of the province, and the trade with the Shan States, also by this route, would be less than by the Bhamo route, the States to the northward being wealthier than those to the southward.

Turning to the route *viâ* Bhamo, Momeem, and Tali, we find there is a commercial highway used by Burmese and Chinese merchants from time immemorial, leading through the richest part of Hunan, and tapping Sechuen and Kwei-chow, the wealthiest and most populous provinces in China. Although Sechuen is bordered by the Yang-tse, still the difficulties of the route towards Chung-king, the great central mart on its banks, are said to be great, and the mouth of the river is so far distant that the carriage of goods is very costly. The navigation of the river between Chung-king and Hankow is, moreover, extremely disastrous to trade, on account of the total loss of many junks and their cargoes in the dangerous rapids; and, besides which, goods passing through such a great number of separate districts, in each of which heavy taxes are levied, greatly enhances the cost of produce before it quits the country.

Having regard, therefore, to the obstacles presented to an approach to Yunan by the Yang-tse, the chief object for which this expedition was sent was to discover the cause for the cessation of trade formerly existing by the Bhamo route, the exact position held by certain tribes called the Kakhyens, Shans, and Panthays with reference to that traffic, and their disposition or otherwise to resuscitate it, as also to examine the physical condition of the country. All these points, it is understood, have been satisfactorily obtained. Considerable delay occurred in the Kakhyen hills, but this enabled Major Sladen to obtain considerable information regarding the Kakhyens, who, holding the hills, must always form an important element in any scheme for reopening the route, and has given them an opportunity of learning our real intentions, regarding which they appear to be falsely imbued by designing persons.

The trade by the Bhamo route, as late as the year 1855—the commencement of the rebellion of the Panthays against the Chinese authorities—was nearly £500,000 sterling, and all previous history of this line of commerce with which we are acquainted, proves, beyond doubt, that there exists an important field for trade in these localities. The knowledge, too, acquired by the present mission, assures us that the parties most interested in this commerce desire a revival of the trade. The Panthay rebellion was, no doubt, the primary cause of the cessation of the trade, but Major Sladen considers there is some reason to believe that during the last five or six years, or since the comparative consolidation of Mahommedan rule within the province of Hunan, the non-resuscitation of trade by these routes is due to the King of Burmah, who, for political reasons, has restricted the trade to a long overland journey of two months, *viâ* Theinnce to Mandalay. The causes which have actuated the Burmese government have arisen, in a great measure, out of an instinctive and almost superstitious fear that the extension of British influence beyond the capital of Burmah would prove fatal to Burmese supremacy. A studied exclusiveness has been the characteristic of the Burmese government, but this must gradually wear out, as it has done and is doing elsewhere. There are now at Mandalay many Burmese who have been to Europe and India; there are also great numbers who can compare the state of the province of Pegu under Burmese and British rule. The comparative prosperity of the towns, and wealth of the peasantry, the stimulus given to cultivation and manufactures, and the great activity of our export and import trade, all are exercising an influence in favour of the administration that has produced such results.

The expedition having only reached the frontier town of Momeim, Major Sladen has been precluded from speaking with any authority regarding the trade of Hunan. The great mineral wealth of the country is, however, known, as also the enormous wealth of the neighbouring provinces of Sechuen and Kwei-chow, and their gigantic trade in tea, silk, rhubarb, tobacco, sugar, hemp, oil, varnish, and other commodities, and the vast capacity of all those provinces to consume European manufactures, a large proportion of the whole of which trade we shall gain when once the route by Bhamo is fully reopened.

EDUCATIONAL NOTES.

The Scheme of Education of the London School Board.—The first report of the committee on this subject was presented to the Board on the 21st inst., by the chairman, Professor Huxley. It would occupy too much space to give this important document at length, but the following is an abstract of it:—The committee placed under two heads the questions referred to it. 1. The nature of the schools which it is desirable that the School Board should provide. 2. The methods of instruction which should be conducted in such schools. Dealing with elementary schools, these are divided into three classes—infant schools for children below seven years of age; junior schools for children between seven and ten years of age; and senior schools for older children. By mixed schools are understood schools in which male and female children are taught in the same classes; by separate schools, those in which boys and girls are taught in separate rooms. The committee was of opinion that infant schools should, and junior schools should not, be mixed. In the case of junior schools they lay down no general rule. With regard to the size of schools, a Board school should contain under one management an infant school or schools, a junior school, a senior boys' school, and a senior girls' school. Large schools are preferable to small. The proportion of teachers to pupils should be sixteen teachers for a junior or senior school of 500 children; and four teachers to every additional 120 children. In infant and girls' schools, female teachers should, as a rule, be employed. In many cases women might advantageously take charge of junior mixed schools. It is not advisable that they should be employed in senior boys' schools. Children ought to be under actual instruction for five hours daily for five days in the week. It is recommended that arrangements should be made by which, during the time of religious teaching, any children withdrawn from such teaching should receive separate instruction in secular subjects. The necessity of the occasional and exceptional employment of corporal punishment is not denied, but it is recommended that every occurrence of corporal punishment should be formally recorded in a book kept for the purpose. The teaching of music and drill is recommended in every school. With regard to moral and religious instruction, such instruction should be given under the conditions, and with the safeguards recommended by the Board, namely, that there should be no attempt to proselytise, and that the Board should have power to determine upon an application to except a particular school from the operation of the resolution ordering religious instruction. With regard to infant schools, the committee declares it cannot insist too strongly upon the importance of schools for children under seven years of age. The subjects of instruction recommended are—1. In infant schools (*a*), morality and religion; (*b*) reading, writing, and arithmetic; (*c*) object lessons of a similar character, with some such exercise of the hands and eyes as is given on the "Kinder-Garten" system. 2. In junior and senior schools (*a*), morality and religion; (*b*) reading, writing, and arithmetic; English grammar in senior schools; mensuration in senior boys' school; (*c*) systematised object lessons, embracing in the six school years a course of elementary instruction in physical science; (*d*) the history of Britain; (*e*) elementary geography; (*f*) elementary social economy; (*g*) elementary drawing; and (*h*) in girls' schools, plain needlework and cutting out. To advanced scholars, algebra and geometry, Latin, or a modern language may be taught, at the discretion of the authorities of the schools. A similar course of instruction is recommended in the case of evening schools. The establishment of science and art classes in connection with the schools would not involve the Board either in trouble or expense; the formation of such classes should be encouraged and facilitated. The report finally deals with the subject of secondary schools—a subject on which, it says, the Elementary Education Act is silent. "The practical difficulty," the committee observes, "in the way of the passage of boys and girls from an elementary into a secondary school is the cost of their maintenance, and the best way of meeting that difficulty appears to be to establish exhibitions equivalent to the earnings of boys and girls from 13 to 16 years of age, tenable for the period during which they may remain under instruction in the secondary schools. The funds out of which such exhibitions may be created already exist, and the machinery for distributing them has been provided by the Legislature in the Endowed Schools Act." As the Endowed Schools' Commissioners have recognised the claims of scholars in public elementary schools to share the advantages of the endowed schools, it is recommended that the Board should enter into official communication on the subject with the commissioners. The report is signed by all the members of the Committee, but three of them attach certain exceptions to their signatures, the most important being one by Lord Sandon, who objects to pronouncing "any opinion in this report upon the appropriation of existing endowments to the public elementary schools of London," as he does not consider that it is "competent to a committee appointed by the School Board to consider and report upon the scheme of education to be adopted in the public elementary schools to consider, or make recommendations upon this important subject." The committee propose that the major part of the recommendations should be binding on schools which the Board may bring into existence, but they do not propose to make the recommendations absolutely binding in the case of schools taken over by the Board. A considerable margin is left to the managers of schools. Professor Huxley moved the adoption of the various recommendations *seriatim*, and, so far as they have been discussed, they have been agreed to with very slight alterations, the principal amendment being one proposed by Mrs. Anderson, "that domestic economy shall be included in the discretionary subjects to be taught in the Board schools." This was carried by a majority of 34 to 4. The appendix to the report gives the evidence of thirteen witnesses, principally masters and mistresses of schools.

What is a School?—It is evident that the application of the powers of the Act, compelling "children (unless there is some reasonable excuse) to attend school," will render it necessary to define the word "school." The Liverpool Board recognised the difficulty and declared the word "school" to mean "a public elementary school as defined by the said Act, including a free school, but not an industrial school," and every provincial Board which has transmitted bye-laws for the approval of the Department, with the single exception of that of Oxford, has adopted this definition. The London School Board, however, were not quite satisfied with this view and consulted Mr. Forster on the subject, who (according to the *School Board Chronicle*) said he quite appreciated the difficulty under which the Board laboured, but he begged that it might be understood that the word "school" was purposely left undefined in the Act, in order that school boards might have a discretionary power, and be in a position to act according to local circumstances. It was not the business of the Department, Mr. Forster intimated, to interpret the Act, as a court of justice would not be bound by their interpretation. It was a question of policy, on which the School Board for London and other boards must exercise their discretion. In the case of putting in force the compulsory bye-law, it would be for the magistrate to declare whether or not a particular school attended by the child was efficient. The above-named journal believes that no school board can "escape the difficulty of having to judge whether or not a school is 'efficient,' whatever definition of school they may adopt. There will, no doubt, continue to be schools which give no public guarantee of their efficiency; and to such schools—unless evidence of their inefficiency can be produced before a magistrate—it is not likely that school boards will be able to prevent parents from sending their children."

The Endowed Schools Act.—An attempt was made by Sir John Lubbock, in the House of Commons, on the 14th inst., to pass a Bill giving even greater powers than they now possess to the Endowed Schools Commissioners. It will be remembered that the original Act gives the Commissioners power to make schemes for the application of educational endowments, and for the reconstitution of their governing bodies, providing in the case of day scholars, for their exemption, at the request of their parents or guardians, from attending prayers or religious worship, or from lessons on a religious subject; and in the case of boarders, for their being enabled, on the same request, to attend the school as day scholars. They are further to provide that no person shall be disqualified for membership of the governing body of any educational endowment by reason of his religious opinions, and that no person shall be disqualified for being a master in an endowed school by reason of his not being in holy orders. To these enactments there are two principal exceptions. The first removes from the operation of the Commission any endowment originally given to charitable uses less than fifty years before the passing of the Act, unless the governing body of such endowment assent to the scheme. The second excepts from the provisions respecting religious worship and instruction—other than the conscience clause in favour of day scholars—and from the provisions respecting the qualification of the governing body and masters, all schools in which the scholars are "required by the express terms of the original instrument of foundation, or by the regulations made by the founder in his lifetime, or within fifty years after his death, to be instructed according to the doctrines of any particular church, sect, or denomination." Sir J. Lubbock's Bill modified the first of these exceptions by limiting it to endowments originally given to charitable uses less than 50 years before the making of the particular scheme, and abolished the second exception altogether. The bill was opposed by the government, and rejected by 222 to 64. Indeed, after the strong opposition, however undeserved, which the proceedings of the Commission have already provoked, it was certainly not an opportune moment for an attempt to increase their powers. On the other hand, a memorial in favour of the views of the Commissioners relative to open competition, has recently been presented to the Committee of Council by a large number of the head and assistant masters of many of the leading schools in this country. This document, after reciting the regulations issued by the Commissioners, and founded upon the principle of the eventual prevalence of the maxim that there should be "no gratuitous education except as the reward of merit," goes on to say, "whereas, in a statement recently published in opposition to a scheme issued by the Endowed Schools Commissioners, it has been maintained 'that the admission of children at the discretion of the governors will be as effectual for the accomplishment of true charity, and the advancement of education, as any plan that can be suggested, and infinitely more so than as the result of competitive examination;' we, whose names are here subjoined, desire to state our opinion that the advantages of educational endowments are far better given on the grounds of merit only, as above provided and explained by the schemes settled by the Endowed Schools Commissioners, than by the unrestricted selection of the governors, and that to give the privileges of foundationers by open competition, so far from 'thwarting the desire of the founders to benefit the poor, is now' often 'the only method of really fulfilling that desire,' and still more 'of furthering their other and more important purpose, the promotion of education.'"

National Technical University.—A meeting for the formation of a technical university was held on the 20th inst., at St. James's-hall; Colonel Hogg (Chairman of the Metropolitan Board of Works) in the chair. Mr. Brassey, M.P., in a speech of some length, said that he would not venture to advocate this cause on the somewhat narrow grounds of the trade of this country. He would rather prefer that this university should be formed on the higher ground of the duty of developing the human mind to the greatest possible degree. He should like to see technical schools for the benefit of artisans instituted all over the country. Sir Antonio Brady, Mr. Morgan Howard, Alderman Gould, Mr. Webster, Q.C., Mr. Peter Catterall (a working man), Mr. George Bullen, Captain Charles Mercier, Dr. Mill, and Colonel Money Carter, addressed the meeting, and resolutions were adopted, setting forth that "the establishing of this proposed national university is the best and only plan by which an efficient and comprehensive system of technical education may be attained by the people." On the 23rd inst., a meeting for the same object was held at the Horns, Kennington, the Earl of Shaftesbury in the chair.

The College of Physical Science at Newcastle.—Upwards of £22,000 has been subscribed towards the £35,000 which, it is estimated, will be required for this college. The appointment of the Professors is to be made to-day, and the North of England Institute of Mining Engineers have placed their hall at the disposal of the new college.

The Teaching of Geography.—In reply to the remarks of Mr. Francis Galton, recently quoted in the *Journal*, Mr. William Hughes, the Society's examiner in geography, writing to the *Athenæum*, says:—"The results indicated by Mr. Galton—in reference to the recent offer of medals, to be competed for amongst certain schools, on the part of the Royal Geographical Society—in no degree surprise me; nor can I apprehend that they will occasion any surprise on the part either of the heads of schools or of practical workers in the class-room. They are precisely such as might have been anticipated, and such as (I can vouch from personal knowledge) were anticipated by some at least among the soundest and most advanced of educators. However high may be the estimate placed on proficiency in geographical knowledge—and I, at least, shall not be suspected of undervaluing its claims—it is manifest that the conditions under which its rewards can be sought must (if they are to bear any practical issue) be in harmony with other, and in no degree less important, objects claiming the teacher's attention. In other words, the geography which, in common with many fellow-workers, I earnestly wish to see introduced into the curriculum of our higher class schools and colleges, must take its proper place in the well-considered and matured scheme of education as a whole. To claim for it an undue and all-absorbing regard—or what, in the working of the class-room, such as the practical educator alone can know it, amidst the multiplied claims on the attention of the learner at the present day, may prove to be such—is to incur the risk of frustrating the entire aim and of doing injury rather than service to a good cause."

Education in Scotland.—The Census of 1871 shows 503,986 children in Scotland between five and thirteen years of age stated in the householders' schedule to be receiving education—that is to say, one in 6·66 of the total population. The children constituting this number are those who were at least five years of age and not more than twelve at their last birthday.

CORRESPONDENCE.

DECIMAL AND METRIC, OR METRIC-DECIMAL SYSTEM OF WEIGHTS, MEASURES, AND MONEY.

Sir,—I am sorry I cannot admit that the response of your correspondent, Mr. Hendriks (*Journal*, June 2, pp. 569-570) to my queries is candid, or otherwise satisfactory, although it is sufficiently wordy and confirmatory of the objection to this kind of controversy to which I alluded, viz., the danger of its being encumbered with "vain repetitions."

I have not formed so low an estimate of your correspondent's acuteness as to believe that he is serious when he pretends not to comprehend that my allusion to "repetends," as inseparable from decimals, was meant as an illustration of the wearisome reiterations of the same arguments and the same assertions, which seem to be almost as inseparable from discussions on the merits and demerits of his favourite metric-decimal system. But it is curious to observe that, in apologising for this inherent defect, your correspondent can find no escape from it, except by resorting to vulgar fractions, which, I thought, were to be compulsorily abolished, and superseded by uniform decimals.

Mr. Hendriks and his coadjutors must not, however, imagine, in the height of their contempt for the supposed ignorance of everyone who ventures to differ from them, that there are not some people in this country who are aware of the consequences which must attend the compulsory abolition of every weight and measure, involving alterations in prices or quotations of every article used in this country. For example, the yard must become the metre, the yard being 36 inches and the metre 39·37079 inches. How is the equivalent alteration in the price of any article now sold by the yard to be made in the present money, without either the buyer or the seller losing some fraction of a penny on every metre? And so it must be with every other measure, whether of weight or capacity, for not one of the proposed units or standards has equivalents in our present units or standards. Then, again, all the terms are French, or Greek and French, or Latin and French, so that foreign terms and definite ideas of (at present) unknown quantities* would have to be stamped on everybody's mind and the old ones obliterated all at once, under a penalty of forty shillings for every offence of using plain English terms.

The change would, there can be no doubt, afford profitable employment to the manufacturers of weights and measures, but those who have to suffer the loss or inconvenience of it—and that comprehends the whole of the population of this kingdom—may not unnaturally wish to be satisfied that the benefits they are to derive outweigh the evils of the change, or, in other words, whether they are not asked to pay too much for this metric-decimal whistle.

Mr. Hendriks insinuates that I am one of those bigoted people who object to any change in any English law. This is a mistake on his part. But, on the other hand, I am not one of those who are ready to accept offhand any and every change of law or custom that may be advocated merely because it is foreign. I agree that we should "follow truth whithersoever it may lead us," but I like to be satisfied it is truth, and not an *ignus fatuus*, before I run after it.

Another point I must notice. Although Mr. Hendriks appeared to consider it a great triumph for his cause that (as he asserted) the Association of Chambers of Commerce, as practical men, had adopted Mr. Lowe's idea of reducing our sovereign to 25 francs, yet now, when he finds that such was not the case, he sneers at the bodies constituting the association as "Little Pedlingtons"—that is, I suppose, those who differ from Mr. Hendriks and his "magnopolis"—the "International Decimal Association," in which the metric-decimal system "lives and moves, and has its being," but which consists of but a hecto or centum, or 100 members.

In conclusion, Sir, I take the liberty of hinting to the very small number of very zealous advocates for the adoption of this system in this country that they are too confident in their own infallibility; too intolerant towards those who differ from them; too unscrupulous in their assertions with regard to matters of fact; treat with too much contempt, as "ignorant and narrow-minded," those who do not see with their eyes; and they are altogether too impatient in their propagandism. They should have a little more reliance on education. If they have found a great truth, it will ultimately prevail; we are taught, but not by compulsion. Thirty millions of people cannot have the laws and customs—the growth of centuries—rased from off the tablets of their memories, and have impressed theron instead "uniform metrical decimals," in Franco-Greek and Latin terms, all at once, by compulsion of forty

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* For what idea does the word "metre" convey? It is only a general term, meaning simply measure. But it seems to be supposed that when the unscientific are told that metre means "the ten-millionth part of the quadrant of the meridian of the terrestrial globe," they will at once have a definite notion of the length of a metre, and can as promptly apply this fundamental idea to all the decimal multiples and sub-divisions expressed by the Greek-French and Latin-French terms, dekametre, hectometre, kilometre, myriametre, decimetre, centimetre, and milliometre. And the same may be said with regard to the measures of surface, capacity, and weight. Fancy all the people of England, Ireland, and Scotland being compelled to use these terms under a penalty of forty shillings!

shilling fines—the fiat of a centum of "international" metrico-decimatists to the contrary notwithstanding.—I am, &c.,
LEONARD BRUTON.

Bristol, 26th June, 1871.

THE RESOURCES OF INDIA.

SIR,—I have read the strictures (on my letter by the *Asiatic)* which appeared in your last *Journal*. It strikes me that my views have not been fairly or correctly represented. No one is more anxious than I am to see an oriental congress established, and if I have "peculiar views" it is simply because I wish to see the association so started as to ensure success, and consequently I still hold to my "absurd argument" that a congress in its infancy would be acting wisely in restricting its efforts within certain defined limits. As it grows older, it could easily extend the sphere of its labours. Whether Mr. Clarke and his friends would do well in "throwing in their strength with the East India Association" is a secondary consideration, and one on which I have formed no opinion. Regarding the Madras Presidency, I must say I have failed to see the "good" done by that body. I know something of the languages of India, and for the last ten years have been collecting information regarding the customs, history, and religions of the natives of that country, but, as the *Asiatic* has tersely expressed it, my "notions are still crude;" will that paper therefore condescend to enlighten me on the following points?—

(1.) The origin, laws, and customs of the Ghonds, Chensus, Brinjarees, and Wodders.

(2.) What about the Bhraminical Trinity. Is it to be in anyway traced from, or connected with, the Platonic or Christian Trinity?

(3.) Is the Nama symbolical of Divinity? and if so, why do the right and left castes wear different marks; the one putting but one streak and the other three streaks on the forehead?

(4.) Why do natives object to the census? and why is it they will never give you the exact number of their children?

(5.) Can any satisfactory account be given of the cause or causes which led all Hindoos to divide themselves into right and left castes?

With your kind permission, I will in addition, make the following remarks on Colonel Wragge's letter on "The Resources of India." I lived at a place called Bhowain during the Coimbatore famine. I saw hundreds of natives daily gather the fruit of the prickly pear;* and ryots at the time assured me that, if planted in a rocky or barren spot, it (*i.e.* the prickly pear) in three or four years completely altered the nature of the soil; and as far as I could judge, the cactus I refer to exercises a disintegrating and decidedly beneficial effect on stony ground.

I hope that Mr. H. Clarke will not abandon his project.† I must say, I should have preferred seeing the congress started on a moderate scale, but I would rather that the Americas were added to the scheme than that it should be altogether abandoned.

India has a peculiar charm for me; I should like to see her resources thoroughly developed. In my small way, I have been experimenting (with fair success) in wool-cleaning, seed-husking, &c., and shall be happy to further Colonel Wragge's proposals by taking cochineal insects to India. I go out next year, and take poultry, sheep, and cattle with me.—I am, &c.,
R. F. TAYLOR, Captain.

30, Cave's-terrace, Shepherd's-bush.

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* Been eaten for years in Malta; was introduced forty years ago into Coimbatore and Salem by Mr. Fischer (a coffee-planter). He little thought at the time of the good he was doing.

† I agree with Colonel Wragge's postscript. The Society of Arts is quite capable of carrying out its own idea.

EXHIBITIONS.

The Channel Islands Exhibition.—The Channel Islands Industrial Exhibition was opened on Wednesday last, by his Excellency Major-Gen. Grey, C.B., Lieut.-Governor of Jersey, with an imposing ceremony. His Excellency was received at noon precisely, at the entrance to the grounds of Victoria College, by a guard of honour, composed of two companies of Jersey Militia. The President and Exhibition Committee met his Excellency, and a procession was formed, composed of the civil and military authorities and members of Jersey States, Sir Stafford Carey, bailiff of Guernsey, and others taking part in the procession. His Excellency having been conducted to the inaugural pavilion, the Old Hundredth Psalm was sung by a choir numbering nearly two hundred. An address having been next presented to his Excellency by the president of the committee, and reply given, Handel's "Hallelujah Chorus" and a chorale for the occasion were sung, and his Excellency declared the Exhibition opened. A coronation salute was then fired in honour of her Majesty's Coronation. The weather was favourable, and the proceedings passed off satisfactorily.

Exhibition at Milan.—The exhibition that is to be held in the coming autumn promises to be most successful, if one can judge from the support that it has met with from the industrial classes, as well as the various institutions and chambers of commerce of all parts of Italy. A considerable grant of money for this purpose has been obtained from the government, and from the province and city of Milan. In addition to the "Salon" of the public gardens, which has an area of 3,500 square metres, a special building is about to be erected, so as to give an area of 8,000 square metres. The general plan of the building has already been approved of by the municipality of Milan, and the contractor will probably begin the work in the course of a few days.

Fair and Exhibition of Oils at Terni.—The following is a programme of the exhibition of oils and apparatus used for the manufacture of oil, which is to be held at Terni from the 1st to 6th September of the present year:—Section I.—Olive oils, classed as follows:—1st, sweet oils; 2nd, table oils; 3rd, common oil for lamps; 4th, oil obtained by fermentation. Section II.—Apparatus and utensils used for the manufacture of oil. This is divided into two classes, the first comprising presses and crushing machinery, tubs, &c.; second, utensils for keeping oils and for their carriage such as barrels, weighing machines, and measures. All oils brought to this fair will be free from octroi duty.

NOTICES OF PUBLICATIONS.

Kelly's Post-Office Guide to London in 1871, Visitors' Hand-book to the Metropolis, and Companion to the Directory, with map and plans; 424 pp. Kelly and Co. —This work, just published, forms a complete history of London, in which all the statistics are brought down to the present time. The headings of the various chapters into which it is divided show the range of subjects treated of:—Rise and Growth of London; Amusements; The Exhibition, and the Art and Industrial Pursuits of the Kingdom as Illustrated Therein; The Population and their Dwellings; Food; Local Government; Religion; Wealth; Official and Legal London; Charity; Education; Literature and Science; Architecture and Fine Art; Military and Naval Administration; Commerce and Trade. All these sections are elaborately filled up, and may be consulted with advantage for detailed information.

GENERAL NOTES.

Mining School at Iglesias.—A proposal has been made by the Minister of Agriculture to the provincial council of Cagliari, and to the municipality of Iglesias, with the view of establishing a mining school at that town. The importance of such an establishment in the centre of the mining district of Sardinia is very evident. The annual expense is estimated at from 12,000 to 15,000 francs, including the chemical laboratory which will be attached. It is to be hoped that no difficulty will be met with from the local authorities in carrying out this scheme.

Cinchona Bark.—Although the bark shipped at Santa Martha, and which is brought from the States of Tolima, Boyaca, and Cundina Marca, is not so highly appreciated in the European markets as the bark from the State of Canco, known as Pitayo bark, and exported through the port of Buenaventura, yet its value has of late greatly improved, and the quantity shipped at Santa Martha has nearly doubled in the last five years, having increased from 6,000 or 7,000 serons to upwards of 12,000. The quantity shipped in 1869 was 1,326,883 lbs., valued at £52,076.

The Census.—The abstract of the census returns for the United Kingdom shows that the population on April 2, 1871, amounted to 31,465,480, in the following proportion:—England and Wales, 22,704,108; Ireland, 5,402,759; Scotland, 3,358,613. This is an increase on the returns of 1861, for England and Wales, of 2,637,884, being 1,264,144 males and 1,373,740 females. The population in England and Wales is divided into 11,040,403 males and 11,663,705 females. The religious census in Ireland shows that, of the population of 5,402,759, the Roman Catholics number 4,141,933; the Protestant Episcopalians, 683,295; the Presbyterians, 558,238; and other religious denominations, 19,283.

Spurious Tea.—The subject of the importation into this country of spurious and unwholesome tea again engaged the attention of the City Commissioners of Sewers at their meeting on Tuesday. The Sanitary Committee, to whom the matter had been referred, with a view to some action being taken, reported that, after inquiring into the proceedings which had been instituted by them in similar cases in 1866 and 1870, and the unsatisfactory of the various efforts made to bring the offending parties within the power of the law, they deemed it useless to attempt any like proceedings against the persons who had offered the spurious tea for sale last month. They accordingly determined to lay the matter before the President of the Board of Trade; and, at an interview with him recently, they described the difficulties in which they were placed, and endeavoured to impress upon him the necessity for empowering the Customs' officials to take steps for the seizure and destruction of spurious tea, on receiving a certificate from persons duly authorised that it was unfit for food. Mr. Chichester Fortescue, after affording them every opportunity for the expression of their opinions, requested them to furnish him with a written statement of all the facts in connection with the previous cases, and with copies of the reports of the solicitor and medical officer of health, which they had done. These, the committee believed, were required to be submitted by the President to the Treasury for consideration, and they hoped in the end such steps would be taken by the government as to put a stop to the discreditable traffic, which still continued, a large cargo of rotten tea having recently arrived in London, under consignment to various persons for sale in this country. Mr. Daw, the chief clerk, read a communication to the effect that on the 21st inst. a ship arrived in the docks from Shanghai with 5,000 chests of this poisonous mixture. The Commission, in the result, approved of the steps taken by the committee, and referred the matter back to them for further consideration.

Swedish Method of Making Peat Charcoal in Pits.—In the middle of a pit fourteen feet long, four feet deep, and four feet wide, lined with stone, a fire is made, and the pit filled with peat; this is then allowed to get thoroughly alight throughout, and then the pit is covered with fir branches and earth, when, after three days, the coke is ready for use. Two and a-half or three tons of peat charcoal is said to be equal to one ton of pit coal, and excellent for the manufacture of iron.

Railway Communication with Rome.—Some important alterations are likely to be made in the railway service in Italy, by which the length of journey between France and Rome will be considerably shortened. It is proposed to run an express train, stopping only at the principal stations from Turin to Rome, *viâ* Bologna and Florence. This train would leave Turin at 6 p.m. for the present, until the Mont Cenis tunnel is opened, and would arrive in Rome at 12.30 p.m. on the following day.

Manuscripts of Leonardo da Vinci.—It is intended at Florence to reproduce by photography the autograph manuscripts of Leonardo da Vinci. Unfortunately 11 volumes of the 12 which contain these manuscripts, and which were presented to the Biblioteca Ambrosiana at Milan, by Galeazzo Arconato, are now at Paris, and it will be difficult, under the present circumstances, to have them copied. The twelfth volume, which, however, has remained at Milan, and which is the most interesting one, on account of the autograph drawings of Leonardo, can be commenced at once.

Sugar Duties.—Returns relating to the sugar duties, and the mode of assessing them, have been laid before the House of Commons, in pursuance of an order made on the motion by Mr. J. B. Smith. The gross amount of duty actually received upon refined and raw sugar and molasses entered for home consumption in the United Kingdom in the financial year 1870-1 was £3,532,930, under the classified rates of duty; and the drawbacks paid on British refined sugar exported amounted to £231,821. At one uniform duty of 4s. 8d. per cwt. on the same quantities, the product of the duty would have been £3,500,642, and the drawbacks £172,894. But the Department, while making this return, as ordered by the House, states that these calculations are not estimates of the sums the sugar duties might have been expected actually to produce, or that would have been paid for drawbacks, because such alterations in the rates of duty and drawback would have materially effected both the home and export trades, and thereby produced very different results.

Telegraphs in China.—A report on the telegraphs in China was read by M. Tietgen, director of the Danish "Great Northern China and Japan Extension Telegraph Company," at the last meeting of the Company at Copenhagen. M. Tietgen said that the line between China and Japan is now open, and that there is every reason to expect it will be much used. The number of telegrams sent last year to China from Denmark, Sweden, and Norway, was 140,000, and they are transmitted with far greater rapidity than was at first expected. The Russian and Chinese governments have shown themselves very favourable to the undertaking; the former has given great facilities for extending the line to Vladivostock, which is to be the new Russian naval station on the Pacific, its harbour only being closed during two months in the year. M. Sick, who was sent by the Danish government to Japan on a political mission, put the Company's agent in communication with the Japanese authorities, the result being that a telegraph cable has been brought to Nagasaki, and a telegraphic line will be established between the Japanese ports which are open to Europeans. The telegraphists who have been sent to China have, says M. Tietgen, acquired such a mastery over the Chinese language that they now accept and send telegrams in Chinese from place to place in the empire.

Cultivation of Tobacco in Hungary.—The Lower House of the Hungarian Parliament lately passed a ministerial Bill for the prolongation of the tobacco monopoly, by 186 votes to 125. Herr Kerkapoly, the Minister of Finance, defended the measure as financially indispensable, but promised in the next session (1871) to bring in a Bill for the abolition of the monopoly in Hungary, which was received with loud cheering, as it is one of the favourite ideas of the free-trade and liberal party. The climate and soil of that kingdom are admirably adapted for the cultivation of tobacco, which might, and no doubt would, be greatly increased if no longer subjected to the irksome regulations and control of the government monopoly. But it is such a productive tax that it is difficult to understand how, in the present doubtful state of the Austrian finances, it could be dispensed with as a source of revenue, or replaced by any other tax that would be less onerous to bear, for it brings in a clear sum of 26,000,000 florins for the western division of the empire annually, and has been steadily rising for several years. In the last Cis-Leithan budget, it was estimated to produce for their share the gross sum of 45,235,276 fl., and, after deducting the enormous percentage of 19,285,271 fl. for charge of administration and working expenses, a clear revenue of 25,950,005 fl. No details have been published of the revenue derived from this source in Hungary, but it is considerably less than in Austria proper, and may perhaps amount to 15,000,000 fl. or 16,000,000 fl. What hope, then, can the Minister of Finance entertain to make anything like a balance between the revenue and expenses, in a country where the former so notoriously outweighs the latter, and where the other half of the monarchy will be quite safe to keep up the monopoly, for good financial reasons. If Hungary insists on this one-sided measure, it will impose the necessity of establishing a line of custom-houses between the two sister territories, as they existed previous to 1850. The government manufactories in Austria proper are the principal purchasers of the Hungarian raw tobacco, for, with the exception of a very limited district in South Tyrol, the plant is not cultivated anywhere, the climate being far too cold, and the ground too mountainous and rocky. If the Hungarians abolish the monopoly, the Austrian factories will, of course, be released from their present obligation to buy their supplies in Hungary, and the free producers may then fall between two stools, and not know where to find a market. Notwithstanding all these difficulties in their way, the Hungarians are fully convinced in their own minds that the abolition of the monopoly will be beneficial to them, and enable them to increase their export trade, and compete with other producing countries in the markets of the world. Whether this is an illusion of theirs or not remains to be seen. In his valuable annual report for last year, the North German Consul-General at Pesth makes the following remarks on the subject:—"Very prejudicial to the export trade in Hungarian tobacco is the high rate of duty levied in the Zollverein, which, at the low prices of production, amount to about 70 per cent. on its original value, and therefore the importation is limited to a very small quantity of the finest tobacco in leaf and some snuff. The American war created a temporary demand for Hungarian produce, as it prevented for a time the usual shipment of supplies, but this passed over with the cause. In 1866, the exports to France were 40,000 centners; to Italy, 32,000 do.; and to Germany, only 6,000 do.—together, 78,000 centners. In 1867, to France, 40,000 centners; to Italy, 32,500 do.; and to Germany, 3,500 do.—together, 75,500 centners. In 1868, to France, 40,000 centners; to Italy, 32,000 do.; and to Germany, 3,000 do.—together, 75,000 centners. In 1869 the crop was a very small one, as compared with previous years, and the business done was of a very limited character, though the prices, in spite of the failure of the crop, were ridiculously low. Thus, unsorted parcels were offered at 8 florins per 100 lbs., and sorted of inferior quality, fit for cutting, might be had at from 6 fl. to 7 fl., deliverable at the railway station. It was only when these low descriptions had been cleared off, about the month of June, that a demand ensued, and an improvement in the prices to the tune of from 50 to 75 per cent. took place. It was in the face of this rising market that the French government stepped in to secure their usual annual requirements of 40,000 centners, but were obliged to pay 82 fr. to 84 fr. per 100 kilos.; whereas at an earlier period they might have bought the same tobacco at 60 fr. At the same time, purchases were made for Belgium and Holland, which greatly reduced the stocks on hand; for, whereas, at the beginning of the year they were estimated at 150,000 centners, they had now fallen to less than 24,000 centners. The Hungarian tobacco is generally appreciated in Europe as a cheap and useful substitute for better and dearer produce, and there might be a large margin for increased exports, provided there is no falling off in the cultivation of the plant. But many of the growers, discouraged by the low prices they have been obliged to submit to during the past three years, feel inclined to abandon the cultivation of the article, unless they can secure themselves from loss by making contracts of several years' duration, to which, however, the dealers are unwilling to accede; and thus a once flourishing branch of commerce is threatened with gradual decay, and eventually dying out."

Borneo Commerce.—The demand that sprang up last year for gutta-percha, and which has gone on steadily increasing, has infused a great activity into the whole country, and so long as the present high rates are given, the native dealers and collectors will continue to bring it to market. The difficulty of obtaining it is now much greater than in former years, as, owing to the reckless way in which trees are felled and the gutta-purcha extracted, they have almost entirely disappeared from the neighbourhood of the rivers, and collectors have now to penetrate much further into the forests in search of the trees than was formerly the case. This is one of the reasons that have caused the price to rise so high in so short a time, but probably the chief reason is the competition which that has lately arisen. Formerly, one firm was the large purchaser, but now agents for Singapore firms have entered the Sarawak market. The price of gutta-percha, which, in the early part of 1869 was from 25 dollars to 25½ dollars the picul of 133 lbs., has more than doubled, having gradually risen to 65 to 115 dollars the picul. The Cinnabar mines, worked by the Borneo Company, may now be considered fairly started. Retorts have been erected during the past year, and a fair quantity of quicksilver has been obtained. The great difficulty of transport, however, enhances the cost of working very considerably. The antimony mines are yielding good ore, in fair quantities.

Italian Trade in the East.—A prize has been offered by the Minister of Commerce to Italian shipowners for the first large sailing vessel that lands a complete cargo of Italian marble at Calcutta, *viâ* the Suez Canal. It is satisfactory to observe such attempts on the part of the government to revive the trade in the East, which, in former times, was entirely in the hands of the merchant princes of the Venetian and Genoese republics.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Entomological Society, 7.
Royal Institution, 2. General Monthly Meeting.
Royal United Service Institution, 8½. 1. Lieut. H. J. Clanchy, R.N., "Our Naval Officers." 2. Col. F. R. Aikman, V.C., "Aikman's 'Instruction Rifle' and 'Practice Tester' of Ordnance."
Asiatic Society, 3.

Wed. ...Obstetrical Society, 8.

Fri.......Geologists' Association, 8.
Archæological Institute, 4.
Royal Botanic Society, 4.
Social Science Association, 4. Annual Meeting.

Sat... ...Working Men's Club and Institute Union, 4. Lecture by Mr. Rupert Kettle at the Royal School of Mines.

Journal of the Society of Arts.

No. 972. Vol. XIX.

FRIDAY, JULY 7, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

COUNCIL MEETING.

At the first meeting of the Council after their election, Lord Henry G. Lennox, M.P., was unanimously re-elected Chairman for the ensuing year, and his Lordship has expressed his willingness to accept the office.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The Third of the Series of Six Concerts in aid of a National Training School for Music was given by the Society, at the Royal Albert Hall, on Wednesday evening, July 5th.

The following is the Programme of the Music performed :—

Overture.................."Il Flauto Magico"..................*Mozart.*

Aria............" Qui sdegno" (Il Flauto Magico)............*Mozart.*
Signor FOLI.

Aria............ "Nobil Signor" (Gli Ugonotti) ....*Meyerbeer.*
Madame TREBELLI-BETTINI.

Violin Solo..."Fantasia on Lucia di Lammermoor"...*Sivori.*
Signor SIVORI.

Duet........"Crudel perchè" (Le Nozze di Figaro). ......*Mozart.*
Madame LEMMENS-SHERRINGTON and
HERR JACOB MÜLLER.

Song..........................
Mademoiselle SINICO.

Overture........................ "Oberon" ....*Weber.*

Part II.

Overture.................. "Guillaume Tell" ....*Rossini.*

Song............"The Shadow Song" (Dinorah) ....*Meyerbeer.*
Madame LEMMENS-SHERRINGTON.

Trio............ "L' usato ardir" (Semiramide) ....*Rossini.*
Mademoiselle SINICO, Madame TREBELLI-BETTINI,
and Signor FOLI.

Violin Solo.................. "La Clochette" ....*Paganini.*
Signor SIVORI.

Song..........................."Nazareth"...........................*Gounod.*
Herr JACOB MÜLLER.

March..................... "Le Prophête" ....*Meyerbeer.*

The next Concert will take place on Wednesday, the 12th July. The following is the Programme of Music to be performed :—

Overture.................. "Euryanthe" ....*Weber.*

Aria............... "Sorgete" (Maometto) ....*Rossini.*
Signor AGNESI.

Aria... "Come vorrei costringere" (Anna Bolena) ...*Donizetti.*
Mademoiselle FERNANDEZ.

Pianoforte......"Andante in F, La Cascade" ...... { *Beethoven & Pauer.*
Herr PAUER.

Duet......... "Parigi o cara" (La Traviata) ....*Verdi.* ...
Mademoiselle NATALIE CAROLA & Mr. W. H. CUMMINGS.

Cavatina "O luce di quest' anima" (Linda di Chamouni) *Donizetti.*
Mademoiselle ILMA DI MURSKI.

Overture............ "Occasional Overture" ....*Handel.*

Part II.

Overture.............. "La Gazza Ladra" ....*Rossini.*

Song........................"Dove Sono".........................*Mozart.*
Mademoiselle CAROLA.

Quartet............ "Mezza Notte" (Martha) ....*Flotow.*
Mademoisselle ILMA DI MURSKA, Mademoiselle
FERNANDEZ, Mr. W. H. CUMMINGS, and
Signor AGNESI.

Duet, pianoforte and clarionet { "Adagio and Finale in E flat." } *Weber.*
Herr PAUER and Mr. LAZARUS.

Song.........................
Mr. W. H. CUMMINGS.

Finale.................. "Wedding March" ....*Mendelssohn.*

The prices of admission will be as follows :—

Unreserved Seats, for which money will be taken at the door.

	s.	*d.*
Organ Gallery	1	0
Orchestra	2	0
Numbered and Reserved Seats.		
Picture Gallery..........................	2	6
Balcony	7	0
Arena..............................	7	0
Amphitheatre	10	6
Boxes ....each 3, 4, and 5 guineas.		

Tickets may be had of Mr. S. T. Davenport, Financial Officer of the Society, at the Society of Arts, 19, John-street, Adelphi, and of the usual agents.

DRILL REVIEW.

In accordance with the report of Council (see page 623, *Journal* 971), subscriptions of five shillings and upwards are invited towards the expense of the last and future reviews. The following amounts have been already received :—

	£	*s.*	*d.*		£	*s.*	*d.*
James Austin....	1	0	0	G. N. Hooper....	1	1	0
B. W. Bartram ..	1	1	0	Chas. Horne (will give 10s. more if required)	0	10	0
L. Biden........	1	0	0	Dr. Albert Horwitz..........	0	5	0
Sir W. H. Bodkin	1	0	0	Maj. E. W. Mathew	0	10	0
W. W. F. Bolton	1	1	0	R. Nicol	1	1	0
Wm. Botly	0	5	0	James Noble	1	1	0
H. A. Bowler....	0	10	0	John Noble	1	0	0
A. Cassels	0	10	0	John Pritchit....	0	5	0
A. S. Cole	0	10	0	Edward Rosher ..	0	10	0
Henry Cole	2	0	0	W. S. Rumsey ..	0	5	0
Sir Daniel Cooper, Bart. (will increase if needed)	1	0	0	Philip Sancton ..	1	0	0
W. Cooper	0	10	0	South Metropolitan District School........	10	10	0
Rev. B. M. Cowie	1	1	0	George Stanton..	0	10	0
Major-Gen. Croggan, R.A......	0	5	0	W. H. Tanqueray	0	10	6
J. A. Crookenden.	0	10	6	Charles Telford..	1	0	0
John Cubitt	1	1	0	Seymour Teulon	1	1	0
Thomas Dixon ..	0	10	6	W. H. Thomas ..	1	0	0
John E. Evans ..	0	10	0	E. C. Tufnell....	5	0	0
W. H. Fell......	1	1	0	Z. Watkins......	0	5	0
F. Filliter.......	1	1	0	C. Williams	1	1	0
J. A. Franklin ..	0	10	0	W. B. Wrightson	1	0	0
Samuel Harton (to be doubled if required)......	0	5	0				
Sir Rowland Hill	1	1	0		£47	8	6

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

OUR FOOD-PRODUCING RUMINANTS, AND THE PARASITES WHICH RESIDE IN THEM.

By T. Spencer Cobbold, M.D., F.R.S., F.L.S.

Lecture I.—Delivered Monday, April 17, 1871.

General Structure and Affinities of Ruminants, and their importance as a Food-producing Group.

Ladies and Gentlemen,—If I rightly understand the motives which have induced the authorities of this Society to honour me with their confidence on the present occasion, they have, I presume, taken this step because they think I have something both new and interesting to communicate to you. Not only so, they apprehend that I am in possession of certain facts, bearing on questions of real practical and commercial value. They are aware that I have devoted some years to the study of the phenomena of parasitic life, and also that I have written rather extensively on the subject of ruminants, as you see by the treatises on the table. I merely mention this, in order that you may have the more confidence in any statements I am prepared to make. It is also perfectly well understood by your secretary that helminthologists, that is, men who study parasites, whether abroad or at home, have arrived at the conclusion that this subject of parasitism, both as regards mankind and animals, has an important bearing on questions relative to the public health. Not merely have we been able to show that our food, as respects quantity and quality, is seriously affected by the prevalence of parasites (which we term entozoa, because they live inside other animals), but that, in the absence of necessary precautions, human life itself becomes endangered by the spread of parasitism. Now, for the promulgation of information on this subject in this country I am, it is allowed, chiefly responsible; nor, perhaps, need I be ashamed to own it, seeing that I have not hitherto advanced publicly any conclusions which are not based on facts either ascertained or verified by myself; facts, too, be it observed, of such an order, and related to one another in such a way, that they have legitimately allowed of the formation of sound conclusions or deductions, such as you are entitled to expect from any man who pretends to class himself with scientific persons. Surely, in these days, it is desirable that the public should be in possession of clear and precise data on all matters more or less intimately connected with our social welfare; and no one will deny that the food question, in its various bearings, and especially in connection with public health, can be too carefully looked into.

With these preliminary remarks, I pass to the consideration of the subject immediately before us to-night, and I observe first, that the ruminating animals, or Ruminantia, as a food-producing group, are of more importance collectively than all the other food-supplying animals put together. I mean by this, that if we take the whole animal class, from the lowest to the highest, and split up that series, as we may well do, into 150 tolerably distinct groups or categories; if, I say, we thus take their food-supply relationship, so to speak, to the whole human family, then, this single group, the ruminantia, is of as much importance as all the other 149 groups collectively. Obviously, this subject is neither a small nor unimportant one; nay, it is so large that, had we time to pursue it in all its ramifications, it would be necessary to ask for fifty discourses. However, having now an opportunity of bringing this subject before you, in the limited number of five discourses, I hope to bring out all the really essential facts of the case.

In general terms, it may be said that the ruminants, as a group, produce a wholesome kind of food. There are but very few of them which supply a meat which is positively unpleasant to the taste, or which is rejected on that account. Very few are discarded by uncivilised tribes, for even certain species, presenting a meat which to our own fastidious and cultivated tastes is positively disagreeable, are eaten by them with avidity. There are, in fact, only two or three animals commonly rejected from this cause. Throughout the entire mammalian series there is not a single order which presents characteristics so well marked as the group of ruminants. That was the opinion of Cuvier, and no classifications or researches since his time have in the least degree set aside the generalisation which was established by him. It is desirable, at the outset, to give a few of the characters of a group which we have so closely to consider in other particulars, and, therefore, I must so far trespass on your patience.

Those of you who desire to enter upon minuter details, can obtain in the library references to the works which I before referred to; and I may be allowed to mention especially my article on the ruminants, in the late Dr. Todd's "Cyclopædia of Anatomy and Physiology." In the first division of a large popular treatise, entitled the "Museum of Natural History," I have also given an outline of the general structure and character of this order. All the ruminants are characterised by the circumstance of their feet having two toes or digits, that is to say, the foot rests on two toes, or rather on the last phalanges of each toe. The final phalanges of the toes present what is called a split appearance. You must have noticed the split hoof of many ruminants. Here, for instance, is a representation of the under part of the hoof, as observed in two or three different ruminants. One is that of an animal termed the cabrit, which lives in Canada; and another is that of an American bison. In each case the final phalange is split; and we know it is split, not only because we see that it apparently is so, but when we go farther up the limb and examine the bones, we find they have a longitudinal division. Thus, if we cut in two what is called the cannon-bone of the horse, or the corresponding bone in any ruminant, we see that it is made up of two bones conjoined in one, and there is a central septum indicating the original line of partition. Now, the cannon-bone corresponds with the central metacarpal bone of the hand. In the horse, which is not a ruminant, you call the bones which come next below it the pasterns, the greater and the lesser; whilst the last phalange is termed the coffin-bone. In the horse, however, you do not see any indications outside of the toe being thus split, but if you cut up the toe you will find that it consists of two elements united together and consolidated into one. In the giraffe you observe it is quite distinct, because this animal is a ruminant; and I may also remark, as a further ground of ordinal distinction, that the inner surfaces of these approximated toes are flattened.

Again, when we turn to the teeth of the ruminants, we find other features equally noticeable. For instance, if you look at this canvas drawing of the head and a large part of the skeleton of a cow, you will notice that there are no teeth in the front part of the upper jaw; and there never are any. That is the case with all the ordinary ruminants, such as oxen, sheep, deer, antelopes, and even giraffes. With three exceptions, all the ruminants are devoid of teeth in the front of the upper jaw, *i.e.*, of what are called the incisors. The camels and llamas have teeth in this situation, and there are just two true ruminants which are similarly furnished.

If I wish to express what we call the dental formula of this group, I should say the teeth are 32 in number, and arranged thus:—Incisor teeth $i\,\frac{0\,0}{3\,3}$; canine teeth, $c\,\frac{0\,0}{1\,1}$; premolar teeth, or front grinders, $p\,m\,\frac{3\,3}{3\,3}$; molars, $\frac{3\,3}{3\,3}$; making the total which I mentioned. That is the typical arrangement, as you will see if you look into the mouth of any ox, sheep, or deer. In the camels, however, you will find one incisor above in each jaw, $i\,\frac{1\,1}{3\,3}$; and also the canines, thus, $c\,\frac{1\,1}{1\,1}$; and the premolars would stand thus, $p\,m\,\frac{2\,2}{1\,1}$; the whole number in the camels being 30. None of the ruminants have canine teeth in the upper jaw except the camels, and the two animals which are represented here, namely the Moschus, which has two enormous tusks (although it is a true ruminant, and has no incisors in the upper jaw), and the Muntjak deer, which, as you observe, has also two canine teeth. So much for the arrangement of teeth. We have no time to speak of their intimate structure; but they are complex on their surfaces, because the food with which they have to deal is of a nature requiring an enormous amount of of mastication. The molar teeth have double crescent-shaped folds, and these, as they are worn out (the enamel being harder than the dentine), project upwards, to form a rough surface for grinding the vegetable materials.

By far the most interesting characteristic of ruminants is that which appertains to the structure and functions of their very remarkable compound stomach. Here we have a most beautiful instance of the conversion of a simple organism into a complex mechanism; and I do not know throughout the whole range of the animal kingdom a more perfect example illustrative of teleology, or the doctrine of final causes. That doctrine of finality has been entirely abandoned by many of our most powerful reasoners; but, if you fairly enter into the matter, I do not think there need be any difficulty in holding what we call an evolutionary hypothesis in association with the doctrine of design in nature. I hold both views. To some minds that may seem inconsistent, but I have my reasons for so doing, and if anyone can show me I am wrong, I shall be very happy to give up any notion that is proved to be erroneous. You are all aware that food passes from the mouth down the gullet until it comes to an opening which leads into the stomach. You are familiar with the common arrangements which exist in man; for instance, the œsophagus, terminating in a simple stomach which has an opening at the other side, the pyloric, leading into the alimentary canal. But in the ruminants, in place of this one simple stomach, you have four, as figured in the diagram. These four stomachs are neither more nor less than dilatations of the canal which leads to the true or fourth stomach; and in the early lifetime of these animals (as in the case of the calf, for instance, just after its birth) you do not encounter these four well-marked cavities, but you find little swellings, which are the rudiments of them, only the fourth stomach being rather largely developed; but, by-and-bye, these, as the animal grows, form the four so-called stomachs, having the arrangements and connections which I now roughly sketch. I must say a few words about these compartments. Here, observe, to suit the special wants of a singular group of animals, we have an evolutionary process, accomplished by the formation of a complex from a simple structure, that is, by the expansion of the œsophagal tube. The first great stomach which was thus evolved is termed the paunch, or rumen. It is an enormous cavity, a sort of macerating tub, occupying a very large portion of the general cavity of the body. The shape is somewhat like the letter S, and its interior surface is covered with a number of little projections, or villi, of a club-shaped form, but flattened like a racket-bat. In the folds between these little projections a number of parasites take up their residence, and, curiously enough, their form corresponds very much with these villi, so that they may be easily overlooked. Some people may think it a very useless thing to look about for parasites, but there is a great deal of instruction to be got out of this kind of research. The entozoa to which I refer are called *Amphistomata*, and belong to the family of flukes. This large paunch communicates at the upper part with another cavity, which is very small when compared with the first stomach. This second one is called the water-bag, or reticulum, being so designated because the interior is marked by a number of beautiful little reticulated processes, and it usually contains a certain amount of water, for the further maceration of the materials received as food. The third stomach, on the other hand, is very differently constructed to either the first or the second, seeing that it consists of an enormous number of folds, although it is in itself a very small organ. The folds of membrane referred to are beautifully disposed, lying parallel to each other horizontally; and by means of these reduplications the surface of the interior is necessarily extended to an enormous degree. This is called the psalterium; like a book consisting of a number of leaves. Last of all, we come to the fourth or true stomach, which is termed the reed. This fourth stomach is the one in which the essential act of digestion is performed, by the process which obtains in all other animals having a true stomachal cavity.

I must now say a few words respecting the manner in which this highly distinctive ruminating function is accomplished. An ox grazes with its head swinging, as it were, easily, and crops the grass with each motion; the sheep grazing in the same way. The head of an ox is supported in this swinging action by a large ligament attached to the vertebral processes, and also to the occiput, enabling the animal to move its head without the slightest strain or effort. Not having any incisor teeth in the upper jaw, nor any canines, their place is supplied by a very firm, callous pad. You would think it inconvenient, perhaps, to have to crop the grass without any upper teeth; but their place being thus supplied by a hard pad, and the incisor teeth being at the same time arranged in a continuous and even series, whilst the canines are also pushed forward in such a way as to increase the breadth of that cutting surface, the act of grazing is thus carried on with the utmost ease and the least possible expenditure of muscular energy. The grass, therefore, is not bitten off, as it would be by other animals, rodents, for instance, but it is simply pressed against the pad, and, the weight of the head being carried forward, the grass is merely nipped off, so to speak. This food, being thus received into the mouth in the raw condition, is rapidly carried down, in the form of pellets or boluses, until it arrives at the lower part of the œsophagus. When it has arrived there, it next passes into the great paunch or macerating tub, where it remains for a considerable time. It is acted upon by the secretions from the interior lining of this large cavity, and after it has become pretty well distended, the animal drinks, part of the water passing into the second stomachal cavity. The remainder enters this great macerating tub, and by-and-bye, when the animal is resting, and generally lying down, successive portions of this raw material are transferred to the reticulum or water bag; and there, being rendered much more moist, these portions are, by what we call a reversed peristaltic action, carried upwards along the gullet until they again arrive at the mouth. Here they undergo the process of remastication. This is technically termed, as you know, chewing the cud. Now, animals do not all chew the cud exactly after the same fashion; ordinary ruminants moving the jaw from right to left, or from left to right, and that goes on continuously for a time, perhaps for the whole day. Whichever way the motion is originally transmitted, it remains for a considerable time in that direction. But some of the animals, instead of chewing the cud in this continuous way, alternate the action of the jaws, making a single movement first in one direction and then in another. This method occurs in the camel tribe. When the bolus has been remasticated, and is nicely soft, it goes down again; but this time, instead of going into the stomach, there is an excito-motary agent, so to speak (acting like an intelligent person), placed at the common opening of the stomachs, to direct it where it should go, and instead of passing into the first or second stomach, it takes a turn in the other direction, and is transferred to the third stomach. How does it perform this feat? There is a most beautiful mechanism expressly constructed for that purpose; yet not arbitrarily formed, but differentiated or evolved by a process of development. There is, in short, a little canal, which is half closed and half open; and this so-called demi-canal, instructed, as it were, by certain reflex sensations, acts in such a manner as to ensure the passage of the bolus into the third stomach. In other words, it closes the lips of the orifices leading into the first and second stomachs. That is, I repeat, a most beautiful illustration of adaptation to a useful purpose. When the bolus has gained access to the third cavity, it is further acted upon by certain juices there secreted, and eventually passes into the fourth stomach, where, by the secretion of the ordinary gastric juice (and by the aid of other remarkable arrangements, into which we cannot now enter) it is finally reduced to such a condition as to be allowed to pass into the alimentary canal. Here the food is assimilated, being taken up by the lacteals, whence it passes to nourish the animal; and eventually, it may be added, to nourish ourselves. However, in this legitimate desire on our part to nourish ourselves at the expense of the ox we have formidable competitors, in the shape of those little animals called entozoa, which are also on the look-out to get hold of the nourishment that we think we alone ought to have. In concluding this portion of my subject, let me remark that there are many other structural features of great importance; but I do not propose to trouble you at further length with such details as belong rather to zoology or comparative anatomy than to the special object proposed in the delivery of these lectures. I may, perhaps, on a future occasion, have to point out one or two peculiarities in connection with the camels; but, in the meantime, I will only ask you to bear in mind the enormous length of the alimentary canal in the ruminants. It is twelve times the length of the animal itself in the camel and in the deer tribe; it is 22 times the length of the ox, and 28 times the length of the sheep. It is over 130 feet long in the giraffe. Having dissected three of these animals, I can speak with some confidence as to their remarkable anatomical peculiarities.

So much for the general structure of the ruminants, as a whole. Now, let me say a few words respecting the classification of these creatures, whose affinities are well illustrated by the drawings suspended on the wall.

In the table I have represented the Ruminantia as divided into the half-dozen groups, generally called families. We have the *Bovidæ*, or oxen; the *Ægosceridæ*, or sheep and goats; the *Antelopidæ*, or antelopes and gnoos; the *Camelopardidæ*, or giraffes; the *Cervidæ*, or deer; and the *Camelidæ*, or camels and llamas. If one could believe (and I am not otherwise inclined to think) that they have all been evolved from some pre-existing types, it might, perhaps, be shown that their ancestral arrangements, so to speak, were much of the character represented by my diagram. And allow me to say that this scheme of homotaxy and descent is not copied from Mr. Darwin's or any other book, but it is one which I worked out some fifteen years ago, long before the theory of natural selection was made public. This diagram shows a series of branching lines from a common centre; the variously-coloured stems represent different natural groups, whilst the names which are written at the ends of those branching lines indicate the ultimate forms into which the stems, so to speak, have severally resolved themselves. For instance, here are the oxen, sheep, and antelopes, all springing from one stem; having, therefore, their affinities expressed as in the diagram. Here again is a little branch going off which represents the gnoo, which you perceive looks something like a horse. It has certain equine characteristics, and very little resemblance to either a deer or an antelope; still, it is one of the latter family, and is what we call an aberrant type. The cabrit, as you perceive, is another aberrant form of antelope. Then we come to the cervine stem, which, besides the ordinary deer, includes the giraffe, the muntjak, moschus, and the fossil forms called *Bramatherium* and *Sivdtherium*. Lastly, we have the llamas and camels, which are very closely associated, and come from a single stem, branching out, the camels in one direction and the llamas in the other. I have mentioned these facts, not merely to show you that the intermutual affinities of the groups may be thus expressed diagramatically, but that these separate families themselves also present affinities with other groups of creatures which do not belong to the ruminant series. Thus, if you ask what animals come nearest to the bovine group and the gnoos, the reply is in favour of the *Solidungula*, or horses; whilst, to complete the circle of affinities expressed in the diagram, you have to pass successively in review the anoplotheria, palæotheria, nesodon, toxodon, mastodon, dinotherium, elephants, tapirs, the hyrax, even-toed pachyderms, and fossil macrauchenia, until you arrive at the camels, completing the circuit.

With this brief exposition of the general structure and affinities of the group, I am now prepared to explain in detail what ruminating animals and what parasites are usually associated together. Here are larger diagrams, for the purpose of facilitating your understanding of all the primary divisions of the ruminantia. Here, for instance, are the camels and the llamas, constituting a single group, the *Camelidæ*. There is some dispute amongst naturalists how many species of llamas we have; some say there are but two, and others that there are at least three or four. The drawing before you represents the dromedary with one hump; and it is necessary to mention this simple fact, because there are persons who are continually making mistakes on this point. Some few years ago, I was looking through the Ipswich Museum, when I found, greatly to my astonishment, that the Bactrian camel was very carefully marked dromedary, and the dromedary was equally carefully marked Bactrian camel; the record being in the handwriting of a learned Cambridge professor. This error has come down to us in books; and even in comparatively recent publications, as, for example, in Cassel's huge Bible (page 716) you will find that the two-humped, or Bactrian camel, is called dromedary. It is very important that in a book which is so highly appreciated you should find the truth; but you see this is not always easy to obtain.

Here, again, is an animal intended to represent a very characteristic and interesting form of the bovine series, viz., one of the humped oxen of India, the Brahmin bull. All these humped creatures may have descended from an animal which had no hump; at all events, there is the greatest possible amount of variation among existing forms, several of which have become naturalised in this country. Here is the figure of an eland, which is an antelope, though, instead of being exceedingly graceful, like the ordinary antelopes and gazelles, it is rather a heavy animal. You are, no doubt, familiar with the fine examples exhibited in the Zoological Society's collection, whence many have been transferred to our English parks, where they have become thoroughly acclimatised. In regard to the giraffe, this canvas-drawing of the skeleton very accurately represents the general characteristics of that remarkable animal. If you compare the skeleton of the giraffe with that of the ox, you see what an immense difference there is in the general build of the two, especially as regards the neck. You know that Mr. Darwin has referred to this particular feature, and that he is of opinion that the animal acquired that length of neck by the necessity for cropping the branches of trees which are high up. I think there must have been other causes than those of natural selection to account for such a development.

I shall next proceed to explain the importance of the ruminants in relation to the subject of food, and more especially with regard to parasitism. On the wall at the other end of the room is placed a table, which represents the various parasites that happen to live in the ox and sheep. I have only recently constructed this table, and you will not find a similar one anywhere else. It is the result of much labour, and I think I can answer for its truthfulness. You will notice that in the list of the entozoa of the ox and sheep there are some 30 names of parasites, opposite which there are placed asterisks or dots; two dots indicating that the entozoon is common to both oxen and sheep. For instance, you see opposite the *Fasciola hepatica* two dots, meaning that the parasite lives in both of these animals. I think there are altogether seven varieties of entozoa common to both species. When we speak of one creature residing in another, we must be a little precise in our conception as to what all this means. You must not regard, as many people seem inclined to do, the presence of parasites in any animal as a matter of mere accident. Even in our own case, you must not suppose that the creature has no business inside our bodies. It is quite otherwise, seeing that the parasite's organization especially implies that it is adapted to take up its residence there, and we technically call the person who thus entertains any parasite the "host." It is quite true that man may thus become an unwilling host; nevertheless he is the host, and in virtue of his office has to entertain these creatures accordingly. We also speak of mankind and animals holding this singular relationship as "entertainers" or "bearers" of the parasite. At other times, and in a larger and wider sense, the "bearer" may be spoken of as constituting a "territory." All these parasites in this list, for example, reside in the ox and sheep "territory." The "host" thus forms, as it were, the temporary area of distribution and place of residence of these parasites, in a sense similar to that in which Great Britain may be said to form our territory. We may be disposed to quarrel with that arrangement, but you may depend upon it that the parasites themselves are entirely satisfied with this allocation of territory in their favour. Sometimes they cause us a great deal of inconvenience from overcrowding, and the same thing will, I am afraid, in the course of years, happen to the English territory if our numbers continue to increase so rapidly. Our territory will be inconveniently parasitised, so to speak, by ourselves, and we shall have to seek—as indeed many have already sought—a home in some other territory abroad. It is precisely the same with these parasites. They take up a residence in a territory, but when their numbers are numerous they not only put the territory to great inconvenience, but they are uncomfortable themselves, and have to make their escape and find other quarters where they will be more happy. That seems, I allow, a rather unusual way of putting the matter, but I believe it to be really the correct way; and, therefore, I have no hesitation in thus expressing my views. Cast your eye down that list, and you will see that I have represented some words in one colour and some in another. You will see four or five of a red colour, which means that all the parasites having names there indicated belong to the particular group termed collectively flukes. Their scientific ordinal title is *Trematoda*. Then you see a series represented by green colours. Those are what we call round worms, because they generally have the appearance of an ordinary garden worm; some, however, being so small that they cannot be seen with the naked eye, whilst others again are three or four feet long. These round worms are termed *Nematoda*. Below, there is a series in light blue, which is very largely represented in the ox and sheep. They belong to that remarkable group of creatures commonly called tape-worms, because they are drawn out to a length of 10, 20, or 30 feet, and resemble in that respect a piece of tape. These are entitled *Cestoda*. Below these, again, there are several names of a darker blue colour, which are the larvæ or the young of tape-worms, so they may be placed in the same category. They used, it is true, to have a special name, being called cystic worms, or *Cystica*, but they have turned out to be only the juvenile forms of the adult *Cestoda*. Lastly, there are two names, coloured brown. These do not belong to the entozoa, properly so called, but they have to be referred to a very peculiar kind of creature, representing a totally distinct class of animals, namely, *Acanthotheca*. They are covered with spines (but I need not now go into their characters). The ox and sheep, therefore, rejoice in the privilege, so to say, of entertaining all these various parasites. Some of these parasites are perfectly harmless, whilst others are dangerous. Some are harmless to the animal bearers, and some are harmless to ourselves; others, again, are dangerous to the ox and sheep, and not a few are particularly dangerous to the human bearer.

As I shall subsequently prove, we may obtain parasites from the consumption of meat; but any exposition of the subject, without a complete set of illustrations, would, at the present moment, be exceedingly puzzling to you, and therefore I hope, at the next meeting, to have a special series of drawings representing these parasites; you will then be able to form some notion of the number and prevalence of these extraordinary creatures, whose prerogative it is to take up their residence in the bodies of mankind and the higher animals.

And, if you please, whilst we are discussing this subject, you must put aside all pre-conceived ideas, and deign to look at the matter philosophically; having no sentimental feelings in harmony with the views of certain stupid people who think this a horrible subject. At all events, I hope to make it as agreeable to yourselves as I can assure you it is to myself. Possibly, before the close of this course of lectures, I may also be able to convince you that some of those gentlemen who kindly devote leading articles to this subject, and who regard all my researches as of little or no value, are altogether in the wrong. It would, of course, be a monstrous thing on my part to come forward and put forth statements which might be legitimately called those of an alarmist. No man who has any earnestness or rightmindedness in him, would knowingly propagate a statement which was false, or in any sense untrue, on a matter of this importance. This subject is not one to be trifled with, and we are not to look at it simply with the view of ascertaining whether it favours or does not favour certain proposed systems of sewage distribution. The question before us is, what is the truth; and after ascertaining the truth, let the facts be made more widely known in the most clear and explicit manner, leaving it to men of common sense to judge whether or not the truths enunciated are of any practical importance.

As I stated at the outset, I am not conscious of having put forward a single statement in this connection, which does not rest upon a broad basis of ascertained facts, admitting of sound deduction; and it will be found that this knowledge of parasitism, if rightly viewed, so far from producing the great alarm which some people seem to entertain, will, on the whole, be capable of producing good and valuable results. And I further venture to affirm that any trifling with the known causes concerned in the production of these parasitic diseases, will prove injurious to the community. We who have worked at this subject may take some credit to ourselves that we have already checked parasitism to a marked extent. We think it is in our power to prevent an epidemic of parasitism; and it is quite possible for us to produce epidemics if we be so minded. I could decimate the population of any given town by means of parasitism; and I could give you the knowledge necessary to enable you to do the same thing. Allow me further to observe, in perfect good humour that, since all these evils might be accomplished by some person without the possibility of your detecting the culprit, it is manifestly desirable for helminthologists to be kept in good temper. To judge, however, by the spirit of certain critics, this good-will is not very carefully nurtured. No doubt it is a very easy matter to sit down at a desk and dash off a philippic against scientific investigators, but to work steadily at a subject, involving personal sacrifices, requires qualities of a very different order.

If you will allow me a few more words, I would say that there is yet another aspect of this question, having an important bearing on our food supplies. We are constantly talking of the dearness of meat, everybody saying that the price is constantly going up, but never coming down. When, however, we consider the multitudes of diseases to which animals are liable (quite apart from the question of parasitism), and when also we consider the different classes of people who are concerned in getting a livelihood out of the rearing of these animals, such as farmers, landlords, daily labourers in the field, butchers, cattle drovers, and what not, then, instead of being astonished at the dearness of meat, we may well be surprised that we get it even at the price we do. In countries where irrigation is carried on to a great extent, as in some parts of India, for example, the presence of these little parasites has induced the authorities to slaughter valuable animals by the score and hundred. I do no hesitate to say that these parasites have been spread over our Indian territory to a large extent by the system of irrigation there in vogue; and I believe that a similar state of things may occur in this country, if the whole land become deluged with sewage abominations. Therefore, I say, let us have our senses sharpened in this matter of parasitism; let us see clearly where we are, which we can only do by going straight into the matter, investigating and explaining the structure and functions of these creatures, and the conditions under which they are propagated. Having done this, good results must follow.

I think I have now pretty nearly concluded the observations which I have thought it incumbent on me to make to-night. It will be generally understood, no doubt, that this lecture has been partly of an introductory character. At our next meeting we shall consider certain parasites of the ox. As a foretaste of what is to come, I may point out one set of facts. I have here a drawing of the heart of a calf. You see that it exhibits on its surface a number of little spots, each about the size of a comfit. Those little spots are termed "measles." This has nothing to do with the measles of children, being only the same name given to a mere appearance. Each spot has in its interior a little parasite, which is the larva of a tape-worm. If this heart were presented to us at dinner, and if it had not been thoroughly cooked, any one of these larval parasites, if structurally perfect, would, when eaten, become transformed in our interior into an entozoon twelve feet in length. I respectfully submit that this is a fact of some practical importance. I hope to make this matter more clear to you afterwards; and I shall have on the table some slices of beef, affording occular evidence of the truth of what I am describing. There will be no fear whatever of your contracting any of these parasites if you observe certain very simple precautions; and provided also you do not exercise your influence and lend your assistance to those who seem determined—unintentionally, no doubt—to spread these parasites over the land in every direction. On the other hand, do not take unnecessary alarm, and, like certain people who have attended my lectures elsewhere, go away fancying you entertain such guests. Only the other day I saw a person who, for the last six years, had been endeavouring to get rid of a parasite, which parasite she never had, and probably never will have. On that point I had the pleasure of setting the host's mind entirely at rest. Thus, you see what a great advantage it is to know a subject thoroughly, especially when it concerns the public health.

ANNUAL INTERNATIONAL EXHIBITIONS.

Foreign Exhibits at the International Exhibition.—It is interesting to observe the estimate of the value of the present series of International Exhibitions which is formed in various countries of Europe. The unfortunate events of the past twelve months absorbed the entire attention of Prussia and the Germanic Confederation, and it is, therefore, a matter of no great surprise that these countries should be but slightly represented in the Exhibition. France has, in a miraculous manner, put in a blooming, though tardy appearance. Russia, however, is virtually absent from the Exhibition, why, it is perhaps somewhat difficult to conceive, as any impetus to her commerce might have been supposed to have been to her welcome rather than otherwise. The press of Russia—at least one of the leading journals of St. Petersburg—expresses its opinion strongly upon the absence of Russia. The article, quoted from the *Gazette de St. Petersburg*, says:—"Many among us have complained that Russian journals and gazettes have given scarcely any account of the International Exhibitions of recent times. We also find that the fact is one which is not only regretable and difficult to be accounted for, but even absolutely disgraceful, especially if we compare the universal obstinate silence of Russian travellers with the animation of the press of all other parts of Europe on the occasion of each universal exhibition." And, therefore, the writer goes on to say, he has collected a number of articles which have appeared in various English journals on the subject of the present International Exhibition, and purposes to extract from them a general account of it. About Russia, he says, he finds nothing in these articles, and he proceeds to criticise the conduct of his countrymen in neglecting to contribute to such exhibitions. "If at any time the history of universal exhibitions gets written, it will contain many lines which will be unpleasant to Russians. There it will be said that when these great undertakings were first attempted, the Russians—alone of all people—many times distinguished themselves in a very unseemly manner; they never put in an appearance at that mustering of the nations; they maintained an absolute silence at that very moment when it was most to the purpose for them to speak out in their own behalf." In the year 1855, he goes on to say, there was some apparent excuse for their conduct. "They were at war with the French (and not with them alone)," and so they might have thought it fit to "go parading in the French capital." But at all events no such excuse can be pleaded now. "We are not, thank God, at present engaged in any war, and our profound and jealous patriotism might well have been put out of sight for the time." The Russians, says the writer, might well take a lesson from the French, seeing what the latter have done. As it is, foreigners may well say, "They are always just like that, these Russians. To protest that they are not a jot behind any other people whatsoever, and that the place of honour ought to be reserved for them—that is their style of thing. But when it comes to setting their work in evidence, then they are nowhere." There are some among his countrymen, he says, who will try to excuse themselves by saying that all such exhibitions are of no worth. "But who," he says, "except a Russian, can look upon Universal Exhibitions as being mere empty material for the amusement of gaping tourists? Who, except a Russian, does not see and foresee what vast results these exhibitions have brought, and will bring to pass for each land?" And he concludes his remarks as follows:—"The difference between the two halves of Europe will, perhaps, long continue to exist; but, in the meantime, let us at least boldly and clearly recognise it, and do not let us search for Russia there, where she has forgotten, or has not thought fit to go. But let us not forget one thing; the present London Exhibition is an exceptional phenomenon, even when compared with other exhibitions, and must be considered as something of genuine importance for the history of new Europe." Every other country has sent specimens of the particular productions which form the main portion of the Exhibition for this year. In 1872, in the attractive classes of jewellery, musical instruments, and cotton fabrics, it is to be hoped that the number of foreign exhibitors will far exceed that of the present year, especially in the case of countries which are remarkable for peasant jewellery.

Indian Annexe.—On July 6th, the court that has been built for the exhibition of the various articles relating to India was opened by the Duke of Argyll, Secretary of State for India, in the presence of a distinguished company, including the Duchess of Argyll, Lord Lyveden, Major-Gen. Sir Henry Rawlinson, K.C.B., Major-Gen. Sir Vincent Eyre, Major-Gen. Sir Arthur Cotton, &c. Of the collection of articles thus got together by the energy of the various committees, under the valuable superintendence of Dr. Forbes Watson, a further account will be given.

The Band of the Garde Republicaine, sent by the French Government to perform for a few days in the International Exhibition, reached London on Tuesday evening. Early on Wednesday they gave an *aubade* at the French Commissioners' residence in Onslow-square; and for a short time will play daily, either in the French court or Albert Hall.

ON THE NECESSITY FOR A PERMANENT COMMISSION ON STATE SCIENTIFIC QUESTIONS.

The following extracts are from a paper read by Lieut.-Col. A. Strange, F.R.S., at the Royal United Service Institution:—

The duty of the government with respect to science is one of the questions of the day. No question of equal importance has, perhaps, been more carelessly considered and more heedlessly postponed than this. And, now that a hearing has been obtained for it, neither the governing class nor the masses are qualified to discuss it intelligently; the governing class, because it is for the most part composed of men in whose education, as even the highest education was conducted 30 to 50 years ago, science occupied an insignificant place; and the masses, because they may be taken to be virtually destitute of scientific knowledge. Those who wield, and those who confer, the powers of government being alike incapable of dealing with this question, it devolves on another section of the community to urge its claims to attention.

A tangible acknowledgment of the claims of science consists in the recent appointment of a Royal Commission "On Scientific Instruction and the Advancement of Science," which is now sitting. The problem which this Commission is expected to solve is one of very great complexity, delicacy, and difficulty. It has to survey the whole world of scientific thought, and to construct a chart on which the districts that it is the duty of the State to occupy shall be clearly delineated, with boundary lines so drawn as not to trench upon tracts which may be best left to individual or corporate management. It has then to devise a form of government of which not a trace at present exists, fitted to administer the affairs of the newly-acquired territories. It will be for the Royal Commission now sitting to point out the relation of instruction to investigation, and to decide how far, and by what agency, the government may beneficially aid each.

The first report of the Royal Commission has been published. It deals with certain limited matters of detail only, relating to the occupation of some new buildings at South Kensington. Possibly the settlement of these details may have claimed immediate attention with reference to the arrangement of the buildings in question. This first report has, therefore, not touched the great problems above adverted to, which await the deliberation of the Commission, and an authoritative solution of which at its hands is anxiously expected by the scientific world.

It may be asked why, as a Royal Commission is investigating the relation of science to the State, the subject of the present paper should be brought forward independently of that body. The reply is, first, that discussions of any of the questions on which the Royal Commission is deliberating can hardly fail to afford light and assistance useful to the inquiry; secondly, that the problem submitted to the Royal Commission is, "How should the State aid science?" whereas the question on which I am to address you is totally different, namely, "How can science aid the State?" Although this latter question may be considered by the Royal Commission, it is certainly not necessarily a part of their programme, and, as it is a question of at least equal importance with the former one, it is most undesirable that it should be overlooked.

To the question, "How can science aid the State?" I reply, "By means of a permanent scientific commission or council, constituted for the purpose of advising the government on all State scientific questions." In order to apprehend the aim of this proposal, its practical operation and probable results, it must be examined systematically and in detail. I propose to do this under the following heads:—

1. The scope implied by the term State scientific questions, and the importance of those questions.
2. How are such questions at present dealt with, and with what results?
3. What should be the constitution and functions of the proposed council of science?
4. What objections can be raised against the proposed council?

1. *The scope implied by the term State Scientific Questions, and the importance of those questions.*

In this term I include, first, everything relating to the construction of ships of war, and of their armaments, ammunition, and equipments—to naval sanitary arrangements, and to the employment of the naval service on explorations and scientific researches generally. I include, secondly, everything relating to military ordnance, small arms, ammunition; to army equipments of all kinds, to the sanitary arrangements of barracks and hospitals, to the construction and protection of fortifications, and to the employment of the army for purposes tending to advance purely scientific knowledge. And I include, thirdly, all those questions of science which affect the civil life and well-being of the community, such as drainage, sewage, ventilation, contagion, telegraphy, meteorology, astronomy, surveys, and the physical sciences generally, so far as they are promoted by the government. Many fiscal and commercial questions of great importance, which have a scientific basis, must also be included.

I have not attempted to specify all the scientific questions that come, or should come, before the government of a civilised country. They are almost innumerable, and their simple enumeration would occupy the whole of my available space. They may all be comprised under the three great divisions—naval, military, civil. As to their importance, what need be said? Are an efficient navy and army important? Are the health and welfare of the community important? And, if they are, then let me ask, have we an efficient navy and army at this moment? Have we ships of war that command the confidence of sailors? Is our naval ordnance beyond any improvement? Are our land artillery and our military small arms perfect? I wish to avoid exaggeration. I will not say, as some do, that all these things are, with us, execrably bad; I will not even say that in many of them we are behind other nations; my case does not require the support of such extreme opinions. I shall, I believe, be able to maintain my ground by the statement, which few will attempt to controvert, that practical and well-informed men consider all our naval and military armaments, equipments, and ammunition to be susceptible of improvement, and that such improvements can, in most cases, be effected only by attention to scientific principles. I must add to this another opinion, in which all competent judges will concur, that so long as human knowledge advances, in other words, so long as the world lasts, there will be an incessant demand for improvement in these things.

The importance of civil and social questions into which science enters is at least as great as that of the questions to which I have adverted. If it is important that a community be protected from foreign invasion, it is equally important that the health, welfare, and commercial and intellectual progress of the community, for whose benefit costly naval and military forces are kept up, should receive due attention.

We have witnessed an example on the grandest scale of the successful application of science to war so recently, that before a naval and military audience it must be quite unnecessary to dwell upon it. But these events have confirmed a conviction previously held by many who had seriously studied such subjects, namely, that in the present stage of human progress science is indispensable to national greatness, that the arts cannot flourish, trade cannot prosper, knowledge cannot advance, war cannot succeed with a nation that neglects science. Other things also are necessary, a strong, just, and wise government, constitutional and religious freedom, love of order, and respect for the laws. Without these, also, there cannot be national greatness, but, even with these, the nation that is not foremost in science cannot be foremost in civilisation. Assuming these questions to be sound, it is no rash assertion to say that "State scientific questions" are of immeasurable importance.

2. *How are such questions at present dealt with, and with what results?*

How then are State scientific questions now dealt with? The answer is, desultorily, capriciously, inefficiently, irresponsibly, when they are dealt with at all, but in many instances of the greatest moment they are absolutely neglected. The number of questions involving science on which government has to decide are innumerable and never-ending. Every day adds to their number and their urgency. What are the official arrangements by means of which the administration of the day can successfully apply the discoveries of science to the developing and perfecting of our naval and military appliances, not to speak at present of the multitudinous wants of civil life that clamour for attention? The reply is that our official arrangements are substantially the same now as they were in the pre-scientific era—they may be more extensive in degree, but they are the same in kind—the butter may be spread further, but there is not more butter. The enormous scientific activity of the last 30 or 40 years does not seem to have struck the official world as a fact having a bearing on the humdrum routine of the departments. More secretaries, more clerks, more subordinates of various kinds have been appointed to prevent accumulation of arrears; more committees of inquiry have sat, more scientific witnesses have been examined, more reports published, if not read; but not a single step has been taken towards the creation of an organisation capable of concentrating and directing all this scattered effort.

The example of foreign nations, the pressure of the public, and the demands of inventors, daily set before the government scientific puzzles, which they are often, if not generally, at their wit's end to solve. It never seems to occur to them that these puzzles will never cease, and that they will increase in difficulty as a matter of absolute certainty. The attempt is made to stave off by temporary expedients work of a permanent character. The puzzles are guessed at, and the guess is oftener wrong than right. Problems too deep for guessing are either pushed out of sight or submitted to methods of investigation that end in a blunder, perhaps a catastrophe.

I will briefly indicate the provision that does exist for the solution of State scientific questions. It is of three principal kinds. First, official subordinates in various departments. Second, temporary and special committees. Third, consultation with individuals eminent in science, or with scientific bodies. I omit debates in Parliament, because no scientific question ever was or will be solved by such an assembly; and I omit also the press, which is so influential in other respects, as altogether unreliable for such inquiries.

The objections to the first kind of provision, viz., official subordinates, are that such persons have almost invariably other duties of an executive nature to perform, and have not, therefore, the leisure necessary for scientific investigation. Science, moreover, is now in a stage in which scarcely any one problem can be adequately grasped by a single mind; this remark particularly applies to State scientific problems, which are invariably of a mixed order, requiring a great variety of attainments for their perfect comprehension. Lastly, subordinates are disqualified for the office of advisers by the very fact that they are subordinates. No inferior can be expected to urge distasteful counsels on a powerful superior; and no superior can be expected to abandon his own preconceived ideas in consequence of the timid and feeble remonstrances of an inferior under his orders. Subordinates, then, are unfitted to be counsellors, because they must in the majority of cases be deficient in leisure, attainments, and independence.

One clear, decided example of the inadequacy of this source of scientific advice is as good as a thousand. There can be no more apposite example than that of the ill-fated ship *Captain*. The design of this ship came from without. Captain Coles, though a naval officer, must be considered as a typical independent inventor. He urged his ideas on the Admiralty by every available means, by papers and lectures at this and other institutions, by articles and letters in the public journals, and by interpellations in Parliament. He was, no doubt, actuated by excellent motives. He was of a most ingenious turn of mind, and had a very persevering, energetic nature. But no one has said that he was a man of science. It was perfectly well known to those who knew him at all that he was nothing of the kind. His inventions were precisely of that order that required strict scientific investigation. They were novel; they involved complex and even contradictory conditions, and they touched the most vital interests of the nation—her naval supremacy. So difficult is the problem which they represent, that, although perhaps no such problem ever underwent so much anxious and able investigation, no generally-accepted solution of it has yet been arrived at. This tremendous issue was left in the hands of the Admiralty and its subordinates. We know with what result. It is not my purpose to fix the blame of that result on any individual. It has not, in my opinion, indeed, been brought home to any one in particular. But there stands this indisputable fact, that the most recent specimen of English naval architecture, given to the nation under the auspices of the Admiralty and its advisers and subordinates, went to the bottom in an average squall. It is idle to say that no responsibility rested in this particular case on the Admiralty officials. One thing of three must have happened. Either the design was not thoroughly investigated by the Admiralty subordinates; or, if investigated, it was not objected to by them; or, if objected to by them, their advice was disregarded by their superiors. Whichever of them was the true cause, the imperfection of the system is equally established. The Admiralty wished to adopt Captain Coles's design, and either the knowledge or the authority necessary to prevent so fatal a mistake was wanting. Can it be for a moment supposed that had an established, competent, and independent adviser of the government pronounced an authoritative "No," any minister that ever lived would have dared to act in opposition thereto? But there existed no such adviser, and the ordinary official advisers were either supine or overridden; for the purposes of my argument it matters not which.

The second expedient, temporary committees, has been very largely employed for the purpose of guiding the government through their scientific difficulties. There are very serious objections to this expedient. First, there seems to be no rule either for their appointment or for their composition. If the government is much pressed by public opinion (which on such subjects is not over-well informed), or if it sees a difficulty a-head, which, however, it often fails to do, a committee is the result. But there is no guarantee for the proper composition of the committee. There always lurks about some of the names a suspicion either of incompetence or of leaning towards the supposed foregone conclusion of the government. But, passing by these suspicions, there remains the fact that the members are selected either by some minister who, not being a scientific man, probably knows nothing about the qualifications necessary for conducting the proposed inquiry, or by some outside and irresponsible person to whom the minister has applied for help. It is quite overlooked that the selection of the proper persons for conducting any given inquiry can only be made by some one having a knowledge of the subject of the inquiry or subjects cognate thereto; the selection is in itself a scientific question. Though some temporary committees have done good service, it may be safely declared that, on the whole, they have failed to give reasonable satisfaction.

A second objection to such committees consists in the fact itself that they are temporary. As such they necessarily commence their labours, however well they may have been selected, with but a partial and confused knowledge of the question at issue, and much time is lost in gaining some insight into it. After much work and expense, they reach a certain stage in the inquiry at which a report is possible. Perhaps by that time the public pressure or other cause that led to their appointment has died out, or action is necessary; in either case, the committee is considered to have served its purpose, and is broken up, the members disperse, take up other duties, the knowledge of a particular subject which they gained in the course of their inquiry is lost to the country, and a scientific problem is left half-solved, until at some future day it must be taken up again for completion, and all the old work gone over *de novo*. The system of temporary committees, in fact, implies a belief that finality is attainable in those mixed scientific problems in which chiefly the State is interested, or that such problems can advantageously be taken to bits and studied piecemeal; whilst the fact is, that no one such problem that can be mentioned ever has, or ever will, as long as human ingenuity survives, come to an end. Permanent arrangements alone can deal with the unbroken continuity and unceasing change of scientific development.

A third objection to such committees consists in the fact that much of the investigation carried on by several committees may be common to each. This involves the repetition of the same work, and great consequent waste of time, effort, and money, besides sometimes leading to perplexing contradictions in the respective results. This would be avoidable if the various committees were subject to one common authority, and were instructed to avoid needless repetitions of the same or similar researches. But no such common authority exists in England. Scientific committees work, therefore, as independently of each other as if their respective inquiries could be of no use to any but themselves.

I now come to the third source from which the government draws its scientific inspiration, namely, individuals eminent in science and scientific bodies. Recourse is had to such sources without any system whatever; there exists no rule, for instance, defining what cases should be submitted to an individual, what cases to a scientific society, and what cases to a temporary committee. Nor is it possible to assess the degree of responsibility attaching to an individual or to a scientific society advising the government. If the advice so obtained is rejected, nothing about it is known publicly; if it is adopted, and turns out unsound, the right to blame the adviser is absent. It is impossible to ascertain when such consultations have occurred, and with what results. The probability is that they are not frequent. During the two years that I served on the Council of the Royal Society, I only remember one application from government for advice. It was on some point connected with coppering ships. A committee was formed of the most competent persons, and probably very sound counsel was afforded. But it is evident that this is an expedient that cannot be frequently employed, as it would occupy too much of the time of the society, which should be devoted to its legitimate objects. Advising the government is certainly not one of these, nor should the government of a great, powerful, and opulent nation like England be reduced to make such makeshifts as private societies for direction in matters of such tremendous national moment.

Having shown, I trust, that government is without recognised scientific advisers, I proceed to discuss—

3. *What should be the constitution and functions of the proposed Council of Science?*

The ground requires to be cleared before approaching this question. I have heard it urged that the various departments of the State should be complete in themselves, each with its own consultative element as distinct from its executive. This appears at first sight a plausible arrangement, but it will not bear examination. Many of the scientific questions that devolve on the government affect several departments, and in such cases it would be wasteful to have numerous repetitions of the same investigation when one would do; and if, under the supposed arrangement, one investigation of a given class of subjects was decided on, the selection of the particular department to which it should be referred would cause endless bickerings and jealousies, the co-operation of departments being, like universal peace, a somewhat remote hope. Again, several departments would require identical scientific advisers. For instance, few departments could dispense with a chemist; a number of chemists would have to be employed where one or two would suffice. And, further, it would be found necessary to provide for each of the departments requiring scientific advice representatives of several branches of science. The aggregate number of scientific advisers would be enormous if each department were independently efficient. Finally, such a system would not be homogeneous, and would be found very difficult to work practically, on account of the diversity of decisions that would occur on questions more or less identical. There would then arise, just what has now arisen, want of a final court of scientific appeal to reconcile discordances and give certainty to the action of the executive.

For these reasons I discard this suggestion, and revert to the proposal which forms the subject of this paper, namely, that there should be one permanent great council for advising and assisting the government on all State scientific questions. This council should be purely consultative, not executive. All departments should equally be entitled to its assistance. The council should not be expected to initiate questions, though it might occasionally see fit to propose certain investigations to the government, without whose sanction, however, they should not be undertaken. The government should not be bound on all occasions of scientific difficulty either to resort to, or be guided by, the opinion of the council, but it would, of course, become in either case absolutely responsible for all consequences.

The proceedings of such a body would embrace a vast field. Since there is no branch of science with which the government does not, at some time or other, come in contact, every well-defined branch of science should be fully represented on the council. There would require to be pure and mixed mathematicians, astronomers, surveyors, chemists, physicists, engineers, physiologists, physicians, surgeons, naturalists, geologists, meteorologists; for some of these subjects two or more representatives of their different subdivisions would be needed. The naval and military services of all arms and the commercial element should also be present. Probably not less than 50 members would be required for thorough efficiency. The Council of the Royal Society numbers 21 members, and this body takes little or no cognisance of naval and military questions, nor of those relating to public health, except indirectly, as illustrating philosophical views.

The council would conduct its business by means of working sub-committees, into which it would divide itself for specific purposes. The reports of such sub-committees should be submitted to the whole council for general discussion, and the responsibility for the advice ultimately tendered to the government would rest on the council as a whole, not on the section or sub-committee with which it might have originated. This mode of working would insure dispatch of business, special aptitude in the investigators, and large views derived from a great variety of attainments and habits of thought. Decisions thus matured could not fail to command public confidence.

The duties that would devolve on this council, stated broadly, would be—

1. To advise the government on all questions arising in the ordinary routine of administration submitted to it by the various departments.
2. To advise the government on special questions, such as the founding of new scientific institutions, and the modification or abolition of old ones; the sanctioning of scientific expeditions, and applications for grants for scientific purposes.
3. To receive, consider, and decide upon inventions tendered to government for the use of the state.
4. To conduct or superintend the experiments necessary to enable it to perform the above duties.

As to the first branch of its duties, little need be said. The number and variety of questions involving scientific considerations entering into the current work of the different departments are almost unlimited. A large proportion of them could be answered at once by competent persons, but there would remain many that would require investigation, discussion, and often experiment.

The second branch, special questions, would not perhaps be so extensive, but it would be exceedingly important. At present there exists literally no provision for dealing with such questions. Sometimes one person, supposed to have a knowledge of the matter at issue, sometimes another is consulted, sometimes no one. At present the Royal Commission now sitting is probably dealing with the subject of existing and required scientific institutions. But supposing this body settles all such matters in the most satisfactory manner at the present time, a reconsideration of them will very soon be demanded by the rapid advance of science, and the perpetually changing relations of different lines and modes of physical inquiry. But the Royal Commission is a temporary body. Its functions will, sooner or later, cease, whilst the mutations and permutations of scientific thought are incessant. Questions relating to State scientific institutions require ceaseless watching—never-ending modification. A permanent body, such as I propose, alone can preserve the national scientific establishments in a condition of vigorous efficiency on a level with the existing state of physical knowledge.

The sanctioning of special scientific researches and expeditions will be a very important duty, which there is at present no one qualified to perform. Last year, when the aid of government was desired for the solar eclipse expedition, this want was strongly felt. The men of science went first to one department, and were snubbed by it; they then tried another, from which they did not receive even a snub, their communication being totally ignored. Ultimately, a private individual obtained by personal influence an interview with the Chancellor of the Exchequer, and succeeded in inducing that minister to sanction an object with which his particular department had no concern. Had there been a department for science, none of this fumbling would have occurred; but as it was, the expedition was almost rendered impracticable by delay, and its object was only attained through the strenuous exertions of a few energetic private individuals voluntarily devoting their time to the purpose.

Analogous to this is the case mentioned last year at a conference of the Society of Arts* by Lord Henry Lennox, that recently "wishing to ask a question in the House of Commons as to the national collections, he found that, if he put the question at all, he must put it to four or five different members of the government, and perhaps to one gentleman who was not a member of the government at all. He therefore was obliged to put his question to the Prime Minister, as representing the collective wisdom of the government, although those who really had to supply the answer were sitting around him." I question whether the state of things here described exists in any civilised country but our own.

Sanctioning of grants of money for aiding scientific objects comes under the same head as sanctioning expeditions. At present, £1,000 per annum is granted by government for such purposes, and it is distributed by the government grant committee of the Royal Society. As a member of this committee, I can testify to the extreme care, fidelity, and impartiality with which it performs this gratuitous duty. The amount of the grant might with advantage be much increased, as at present only small sums can be given out of it to each applicant; these are often quite insufficient, and as they must unavoidably be small, no application for aiding extensive and costly researches can expect efficient aid from so narrow a source. The proposed council would be a public body, precisely qualified to perform the duty now imposed on private individuals.

The third branch of duties devolving naturally on the council would be the dealing with inventions tendered for the use of the State. Perhaps my views on this point will not lose force from the fact that I have never tendered inventions to the government, and am not personally interested in any such. No duty which I propose to assign to the council is more important than this. At present the different departments are inundated with inventions which there is no one possessing both the needful qualifications and the requisite leisure to grapple with. They should be relieved of this oppressive labour and responsibility. It is quite notorious that both the departments and the inventors have great ground for complaint,—the departments because they do not possess machinery adequate to cope with the flood of inventions, and inventors because their proposals often do not and cannot receive fair attention.

Inventions offered to government may be classified under two principal heads—the mature and the embryo. The mature inventions require judgment to be exercised as to their acceptance or rejection—a contrivance good in itself may be unsuitable to the policy of the government, or to the conditions with which it would, if adopted, have to be combined, as for instance, a particular kind of gun might not suit the class of ships then building. With this order of invention only a mixed body of professional and scientific men could satisfactorily deal.

The second order—the embryo inventions—include every imaginable conception, from the utterly valueless crotchets of visionaries to germs of the most magnificent promise. Can any one pretend for a moment that we possess the means of sifting patiently and discriminatingly the heterogeneous mass of suggestive ideas that the most inventive people in the world are daily accumulating?

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* *Journal of the Society of Arts*, 8th April, 1870, p. 454.

The ordinary official view of the matter is, that individuals must be left to work out their own ideas. In many, perhaps in the majority of cases, that may be true, but now and then a suggestion may come from one too poor to work it out, which, if the powerful resources of the State were applied to it, would turn out to be of priceless value. Should we despise the pearl because the search for it is laborious?

All inventions offered to the State should come before the Council of Science, who should advise the government as to the adoption of some, and as to aiding in the development of others. The examination to which such a body would subject such proposals, though it would probably not satisfy each individual projector, would certainly satisfy the nation that this wide and creative sphere of its intellectual supremacy was receiving fitting attention. No such satisfaction at present is felt.

Again, though many inventions are adopted by the State, the inventors do not always receive liberal treatment. At present, as the law stands, the State has a right to the free use of a patented invention, and this seems necessary. But the State properly admits that the proprietor of a useful patent thus adopted, should be remunerated. Theoretically that seems very fair, but practically the amount of the remuneration is fixed by the government or by the department using the invention, and this amount is often niggardly in the extreme. If it were fixed by an independent and highly-qualified body like the proposed council, a nearer approach to an equitable arrangement of such matters would probably be arrived at.

It is impossible to speak of inventions without suggesting thoughts of patents. I propose to say very little regarding these monopolies, because a discussion on our Patent-laws is very far from being the object of my present address. Though very divergent views are held on the subject, all are, I think, agreed that our present patent system is glaringly defective, neither affording to inventors due encouragement and security, nor to the community generally adequate legitimate advantages. The question how to improve this most unsatisfactory system is one of extreme difficulty, involving a multitude of nice legal points, and of equally subtle scientific considerations. The judges say that the problem cannot be solved by themselves singly, and that special scientific aid must be afforded them. Where is this to come from? Whence could it come with such authority and impartiality as from the council, whose creation we are now considering?

The fourth class of duties which the council would have to perform would relate to the experiments and investigations necessary to enable it to perform the duties previously enumerated. Regarding the necessity for providing the council with the agency, appliances, accommodation, and funds requisite for these purposes, there can hardly be two opinions. They are absolutely indispensable. I need not here attempt to define what would be wanted. Such details would follow naturally the affirmation of the great principle involved in the creation of the council.

I come now to a question on which opinions may differ, namely, the question whether the council should be a paid or an unpaid body. I say, unhesitatingly, that it should be handsomely paid. If the heads of duties to be performed, of which I have given but an outline, be duly considered, it will be seen that they will be laborious, responsible, and beneficial in the highest degree, and that they can only be adequately performed by highly-qualified persons. It is idle to expect that such men as will be necessary will devote themselves almost exclusively, as they will have to do, to such labour from pure love of science and of their fellow-creatures. The delights of philosophical speculation are one thing, carrying with them their own reward—a reward beyond any money consideration; downright official routine work is quite another thing. In no other professional field is it unpaid, nor is it ever worth much if not paid for. It has hitherto been too much the custom to treat men of science as exceptions to all other professions; to assume that whilst it is quite proper to enrich and ennoble soldiers who fight for pay, lawyers who evade or apply the law according to circumstances; physicians, who kill or cure as seemeth best to them, and even divines, whose mission to save souls might be deemed a sufficient privilege; the man of science, who contrives the arms with which the soldier won his fortune and his coronet, who surrounds the lawyer, the physician, and the divine with the luxuries which their superior privileges enable them to command, should work for love, and die, as he too often does, in poverty.

If the council, the creation of which I now advocate, does its duty, it will confer benefits untold on every member of the community, from highest to lowest; from the military and naval appliances necessary to protect our unequalled national wealth, down to the smallest and least regarded necessaries of our ordinary life, the influence of this council will be felt; and is it either just or wise to expect such benefits for nothing?

The salary that I should recommend as appropriate would be £1,500 per annum to each member of the council. It may be urged that there will be no guarantee that these offices will not become sinecures. Of course, neglect of duty may happen here as elsewhere; but care in selecting the members will afford some hope that they will be men of honour; and, as a rule, true men of science are seldom idlers. But an incentive to work may be given by the principle adopted on boards of public companies, namely, payment according to attendance. I need not, however, dwell on such matters of detail.

My sketch of the proposed council will not be complete without some indication of the mode of constituting it.

The two characteristics which it is most essential to ensure are high qualifications, and the most entire freedom from political bias. The members would probably be of three classes:—1. *Ex-officio* members, being heads of certain existing State scientific institutions, such as the Astronomer Royal, the Director of the School of Mines, the Mint Master, &c. 2. Military and naval members. 3. Scientific members, not of either of the two first classes.

Regarding, first, the *ex-officio* members, nothing need be said. The election of the second class might be initiated by that part of the corps to be represented then serving in England, as, for instance, the engineers, the artillery, or the navy. The arm of the service requiring a member should select four names; these should be sent up to the council, who should reduce them to two; and of these two the government should be bound to appoint one, without power to reject either of them, or to substitute a nominee of their own. For class three, the scientific societies would form the best constituencies; and the election might be conducted in the same manner as that of class two—four names being first selected by the society whose branch of science had to be represented, these reduced to two by the council itself, of whom one should be appointed by the government. In this way each arm of the service or branch of science would be represented by a person in whom they had confidence; the council itself, powerfully interested in the efficiency of its colleagues, would have a voice in their election, and the government would also participate to a moderate extent in the ultimate result. I do not give this as the only or the best form of election, but as one of many feasible forms by means of which an efficient body, free from suspicion of subserviency to the government of the day, may be constituted.

I come now to the last division of my subject.

4. *What objections can be alleged against the proposed Council?*

Difficulties innumerable can of course be conjured up in this as in every case of reform, but I have only heard three definite objections raised that seem to me to deserve any notice. They are:—

1. That this is a system of centralisation, and therefore objectionable.
2. That it will be liable to jobbery.
3. That it will be too costly.

I will touch on each of these briefly.

As to centralisation, I admit the impeachment, but claim it as an advantage, not an evil. Those who are scared by centralisation forget that it constitutes the very basis of civilisation and of stable, efficient government. In primitive, savage life there is no centralisation, no united effort for a common purpose. Each individual struggles single-handed for his rights. Civilisation teaches us to set apart certain members of the community for purposes beneficial to the whole, to form them into distinct bodies, having definite duties, to be executed under the direction of a head central authority. The army, the navy, the police, the post-office, are examples of such bodies, the animating and ruling law of which is centralisation. In the case of the police, we have local, in the other cases imperial centralisation. The body we are considering will have to perform duties of a strictly imperial character, contributing directly to the efficiency of the defensive power of the empire, and to the security and well-being of every member of the community. It is a body which not only would not be effective, but which could not exist, but in a centralised form.

As to the second objection, that the arrangement I have proposed would be liable to jobbery, I must own that, as I contemplate the employment of human beings only, I do certainly expect to see the operation of human motives. But if jobbery be a fatal objection to the scheme, then, on the same principle, we ought to have no army, navy, church, bench, magistracy, municipalities, or parliament, for in each of these the discovery of some traces of jobbery will probably reward a diligent scrutiny. It is not apparent why a degree of purity not dreamt of in regard to any other profession should be insisted on when science is in question; nor is it clear why men of science should, *à priori*, be deemed more corrupt than their neighbours. Of course every precaution should be taken against corruption in so important a body, and the rest must be left to that sense of honour to be found in all other professions, and of which even men of science are perhaps not entirely devoid.

The third objection, undue costliness, is, in my opinion, as invalid as the other two. My proposal has two main objects—to increase efficiency, and to diminish blunders. Both are in the strictest sense economical objects. If it does not seem calculated to attain these objects, it should on no account be adopted. If it gives satisfactory promise of their attainment, no expenditure that it is likely to occasion will be too great in order to secure them. Let any one who is terrified by the cost visit our ports, dockyards, and arsenals, and there see the ships that have been built which should not have been built, the cannons made that should never have existed, and the useless arms and equipments of the pre-scientific ages. Let him count the cost of these, and compare it with the probable cost of substituting for the reign of hap-hazard ignorance, a reign of systematic intelligence. To take one example, that of her Majesty's ship *Captain*. This vessel, with her armament and stores, probably cost the nation three or four hundred thousand pounds. Who shall assess in money the value of the 500 noble lives that perished with her? Would not the nation willingly give a million to have them back? If so, we have as the cost of one single blunder committed by one department something like a million and a half of money, a sum that would go a long way to permanently endow a body which, had it existed a year ago, must have prevented that blunder. But if I dwelt on the preservation, prolongation, and increased comfort of civil life which such a council would certainly tend materially to secure, the cost of its maintenance would appear absolutely insignificant in comparison with the blessings it would shower on the nation. Against the cry of costliness I oppose the assertion, easily established, that nothing is so ruinous as disregard of the laws of nature, and nothing so profitable as intelligent obedience to them. Science, looked at in the driest commercial spirit, must, in the long run, pay.

I must guard myself against the supposition that the proposal I have here advocated comprises all that is necessary for the efficient administration of scientific State affairs. It is only one part of a great system that has to be created. Other parts of the system will, no doubt, receive due attention from the Royal Commission now considering them. But there is one part so important that I feel called on to name it—I mean the appointment of a Minister of Science. He need not necessarily be exclusively devoted to science; he might, perhaps, with advantage, have charge of education and fine arts also; but some one in Parliament, directly representing the scientific branches of the national services has become absolutely indispensable. Another urgent want which, as its scientific character is not purely physical, will probably not be dealt with by the Royal Commission on Science, is that of a high war council—a council of naval and military officers of the greatest professional attainments and distinction, constituted for the purpose of advising the government on the highest problems of strategical science. At present we have not a vestige of anything of the kind, and are consequently, as a military nation, almost destitute of the basis of the military art.

When we have all scientific national institutions under one Minister of State, advised by a permanent, independent, and highly-qualified consultative body; when we have a similar body to advise the Ministers of War and Marine in strategical science, then the fact that, in accordance with our marvellous constitution, these ministers must almost necessarily be men without pretension to a knowledge of the affairs which they administer need cause us no alarm. When these combinations have been, as they assuredly will be, sooner or later, effected, the wealth, resources, and intelligence of the nation, having due scope, will render us unapproachable in the arts of peace, and unconquerable in war, but not till then.

My proposal, therefore, I maintain, aims at the creation of no new principle, but only at the extension of one already existing, and universally approved after long experience. Nor do I aim at creating new labours. The work of which I have been speaking is now being done, or supposed to be done, and it is paid for heavily by the nation; but it is not well done. I propose to improve its quality, by improving the agency to which it is assigned. I propose to substitute concentration for scattered effort, system for chance, organisation for disorder. I propose neither to exact from the Queen's advisers new duties, nor to fix upon them new responsibilities. The end and aim of my proposal is to lighten their labours and anxieties, by putting into their hands better arms than those with which they now vainly strive to uphold the power and the glory of the nation.

MR. FORSYTH'S MISSION TO YARKAND.

The correspondence relating to the mission of Mr. Douglas Forsyth to Yarkand, besides many interesting particulars about the route taken by himself and party, contains certain important information gained, during a short stay at Yarkand, respecting this remote portion of Central Asia. It appears that Atalik Ghazee, ruler of Kashawar and the country known as Eastern Turkistan, preferred a request through his Envoy to the Viceroy of India at Calcutta, that a British officer might be sent on a friendly visit to his court, as an evidence of the friendship existing between the two governments, and with a view to strengthen and cement it. Accordingly, Mr. Forsyth received his instructions to go to

Yarkand merely in a friendly capacity, and for the purpose of opening up and giving an impulse to the trade of that country. Whilst avoiding all political objects, he was directed to give his attention to obtaining the fullest and most reliable information possible regarding the Indian staples most in demand, the nature and resources of Yarkand and neighbouring countries, their past and present history, and, generally, any facts that might be considered of interest.

At the outset the route was taken across the Himalayan Mountains by the Bunihall Pass to Cashmere from Leh; the march was accomplished with comfort and expedition, the Cashmere officials being particularly attentive throughout this part of the road. From thence the onward march required great care. The road from Leh to Yarkand, by the new or Chang-chemo route, passes for twenty-seven marches over completely uninhabited country, and the party numbered altogether sixty souls, including camp followers, &c., and one hundred and thirty baggage animals. The preparations being completed, the expedition started from Leh, and having reached the farthest point to which the Maharajah of Cashmere has extended any sign of his authority, a halt was made to overhaul all camp arrangements, and prepare for crossing the great plain which separates Central Asia from Hindostan. After many difficulties, from the inhospitable character of the country and the scantiness of the herbage, the journey was terminated by the arrival of Mr. Forsyth at Yarkand. Within about thirty-five miles of the capital, instead of dreary desert, the roads lay through orchards and corn-fields, under shady trees, or across luxuriant meadows. The rich verdure of these meadows, and the thick vegetation on the slopes, with here and there well-wooded copses, and the constant streams of water, imparted a civilised and English look that reminded the traveller of scenes at home. Farmsteads, too, scattered in pleasing irregularity over the plain, with cattle, commending themselves to English eyes by the absence of the Indian hump, flocks of fine sheep, with thick white fleece, and well-fattened poultry, added greatly to the scene. In all directions the signs of a progressive rigorous government were observable in the construction of new canals, and in the care bestowed on the roads. The impression was that the Yarkand territory is to a very high degree flourishing. The houses, though built of mud or of sun-dried bricks, look fresh and tidy, and the mosques and serais, or places of public resort, are kept clean and in good order. The dry-earth system of conservancy is carried out in the houses of the upper classes. Rows of poplars and willows are planted by the side of water-courses and along all lanes, and the surface of the country presented a variegated mass of green or yellow colour, according as the crops were fresh springing up or just ripening to the harvest. The cotton plant was to be seen in abundance. The plant is small, but the bolls are plentiful, and the staple is longer than that found in Northern India. Flax, too, is grown for the oil; the plant is too small for using the fibre. Wheat of the finest quality is produced, and Yarkand is justly famous for its beautiful white bread. Barley, rice, maize, millet, and vegetables are to be seen, but weeding seems to be quite unknown, and rank vegetation too often chokes the more valuable crops. The costume of the villagers was extremely simple, consisting generally of a neatly-worked skull-cap, or perhaps a white cap, trimmed with sheep's-skin, on the head; the more well-to-do classes, the Kazees, Moollahs, and all government servants wear chogas, or cloaks, of variegated colour and of superior material, either of silk or cloth, or more generally of mushroo, a mixture of silk and cotton dyed with bright colours intermingled, after the pattern of marble-stained papers on our walls at home. The language spoken by these villagers is Toorkee, and scarcely any of the more educated agriculturists know Persian, but with all the higher government officers the conversation was carried on in that language.

Although the absence of the Atalik Ghazee upon some distant warlike expedition necessitated the early return of the party, what perhaps may be considered the main object of the visit, the promotion and facilitation of commercial intercourse between India and Eastern Turkistan, was secured. The movements of Mr. Forsyth were entirely unfettered during his stay, and he has been thereby better enabled to furnish a short *resumé* of the growth of trade in that quarter. We learn that in 1863, when Mr. Davies submitted his report to government, the total amount of trade *viâ* Ladakh with Turkestan amounted to £23,604. At that time the Chinese held possession of the country, and one great article of commerce was opium, which was smuggled into the towns, and its export increased in spite of the Imperial prohibition of 1839. Goat skins, dyed red, from Noorpore, were sent to Leh, where they are manufactured into boots; other skins, piece goods, cloths, spices, and drugs, indigo, and saffron formed the staple of commerce. These figures, owing to the expulsion of the Chinese and the extortions of the Maharajah's officials in Ladakh, had fallen considerably, until the attention of the British Government, being directed to the subject, a British officer was appointed to reside at Leh to watch and protect trade. The good effect of these measures soon became apparent, since the trade in 1869 had increased to £130,000 in value. It appears that Kashgar, Yarkand, Khoten, and all the cities and towns of Eastern Turkestan, being thickly populated, and having scarcely any manufactories of their own, are entirely dependent on foreign imports for everything except food. Cotton is grown to a small extent, but of a good quality, and a few coarse kinds of cloth are made up. But this is a very infinitesimal item of supply to meet the great demand there is for garments of all kinds; and the inhabitants of that country look to the caravans which yearly come from Kokand or Budakshan, and latterly from India, to replenish their markets.

The exports from Yarkand to India are confined to three or four items, the most important being churrus, known to all Englishmen as "hashish." This intoxicating, or rather exhilarating drug, is extracted from a very fine quality of hemp, which is grown on the borders of every field in Yarkand, and, when sent to Hindostan, yields to the importer a profit varying from 50 to 200 per cent. Silk is cultivated in Gooma and Khoten, and exported to India. But the process of winding the silk from the cocoons is clumsy, and the threads are not sufficiently carefully separated, in consequence of which it has a coarse appearance, which completely spoils its value in the Indian market. Shawl wool of the very finest quality is brought from Oosh and Turfan, and usually is exported to Cashmere. Owing, however, to the war on the frontier, trade with Aksu and Turfan has been interrupted, and this cessation of supply saved the merchants from heavy loss, for the outbreak of the war in Europe at the same time has stopped the shawl looms in Cashmere, and consequently there was no demand for the wool. The remainder of the export trade from Yarkand is divided between gold dust, felt rugs, carpets, ponies, &c. With the object of removing all obstacles in the way of intercourse, a fair was established at Palumpore, in the heart of the tea-growing district of Kangra, and has answered its purpose well. In future, now that the Yarkand merchants have found their way to our Indian markets, and have seen, in the presence of English officers amongst them, a proof of our earnest desire to promote commercial and friendly intercourse with them, the necessity for securing their attendance at the fair is no longer so urgent, though its continuance is on every account most desirable.

The total estimated distance from Lahore, the point of departure, to Yarkand, is 1,000 miles, so that the expedition travelled 2,000 miles in six months, over the highest tract of country in the world, and that without losing a single follower, or having to part with a load of baggage. Though some of the servants had never seen a mountain before, not one failed in the long marches, or grumbled at the hardships they had to undergo. Many missions undertaken with more pomp and greater exhibition of symbols of powers have sometimes resulted in disappointment, while it admits of no question that the march to Yarkand, the stay there, and the return from Yarkand by so unpretentious a body of English and native officials is, in itself, a success creditable to them, alike as enterprising travellers and as public servants, who have ably sustained the honour and reputation of the government which sent them.

MORTALITY IN PARIS DURING THE SIEGE.—DISINFECTANTS.

The dreadful sacrifice of life which occurred in Paris during the siege is patent to all the world, but there are some details of importance connected with it which deserve attention. The condition of the population also gave rise to many important discussions and experiments in the scientific societies, which were overlooked during the siege, but which it is important should not be neglected.

First, it is well to record the actual facts—the last results connected with the mortality of the city; the total number of deaths, exclusive of those which occurred in the field or in the military hospitals, during the twenty-five weeks commencing with the 18th of September, 1870, and ending on the 24th of February, 1871, was .. 64,154
And the total for the previous corresponding twenty-five weeks of 1869-70 was 21,978
42,176

showing an access in the former case of 1,687 on the average of the whole period. The highest number was reached in the week ending the 3rd of February, 1871, when the mortality was 4,671, against 980 in the corresponding week of the previous year.

The mortality began to diminish from that date, and in the week ending the 3rd March it had fallen to 3,500, a diminution of 1,171, more than an average week's mortality of the city in a month; this fact places the cause of the extraordinary mortality beyond doubt. Moreover, in the last-named week the deaths from small-pox were only 134, the lowest total from that disease during ten months; the two great causes of death were pneumonia (410), and bronchitis (557), generally the results of the excessive cold, to which the soldiers and National Guards had been exposed. The fearful suffering endured in this way is indicated by the terrible fact mentioned the other day in the Assembly, namely, that in one night more than nine hundred men were reported as frozen to death. The most disquieting fact at the date already mentioned was the prevalence of typhoid fevers, which produced 301 deaths, but in this number were included 141 soldiers or National Guards belonging to marching battalions, leaving 160, not a large number of deaths in a population of two millions.

Taking all these facts into consideration, we must infer that the insufficiency and bad quality of the food, together with the effects of the severe cold and want of fuel, and diseases brought on by fatigue and exposure, caused the death of nearly 40,000 individuals in twenty-five weeks, thus tripling the mortality of the city for that period.

When the number of deaths in Paris amounted to about six hundred a day, and all the hospitals, and hundreds of ambulances and private houses, were filled with the sick and dying, the attention of scientific men and others should occupy themselves seriously with the subject of disinfectants. The Academy of Sciences has since appointed a commission to inquire into the best means of disinfecting those places which had been occupied by persons affected with contagious diseases. The commission consisted of MM. Payen, Brissy, Langier, and Nélaton. Starting with the recognised fact that infection is transmitted by living germs, spores, or animated ferments, and that the great object was to ascertain which were the most proper chemical substances to destroy the vitality of these rudimental organisms, and thus arrest the transmission of the maladies, the consultation committee of hygiene and of the medical service at the hospitals, discussed the question at great length, and made numerous experiments with chlorine, hypochlorites, phenic acid, and certain very energetic oxydants, capable of killing the microphites and microzoaires. A sub-commission was appointed by the Direction of Public Assistance, to inquire into the methods adopted in the cholera wards during and after the epidemics of 1865 and 1866. M. J. Regnauld, of the Academy of Medicine, was appointed to report on and draw up a form of instruction on the means to be taken for the disinfection of contaminated places, and the purification of articles of furniture.

Taking these several reports as a basis, and checking them by decisive experiments, the commission—of which M. Payen was reporter—arrived at the means apparently to be recommended in purifying infected places, linen, and furniture. In the first place, it is declared that the persons employed to disinfect the hospitals and rooms did not contract the maladies, and that those engaged in purifying the furniture and linen generally escaped infection. In the first rank of disinfectants is placed hypoazotic acid; in its rapid action this agent is converted into neutral bioxide of azote, which immediately takes from the air of the place to be disinfected two equivalents of oxygen, in order to reconstitute itself in the form of nitrous vapour, and recover all its former energy. These transformations continue without cessation so long as any organic substance remains to be destroyed, and any free oxygen is still in the place. Unfortunately, nitrous vapour is poisonous to man, so that it can only be employed with great precautions. All orifices and fissures, door and window joints, &c., must be carefully stopped by means of strips of paper and paste. The following are the quantities of the disinfectants prescribed:—For each bed, or corresponding space, that is to say, from thirty to forty cubic metres, water, 2 litres; ordinary nitrous acid of commerce, 1,500 grammes; copper filings or turnings, 300 grammes. An earthen vessel, capable of containing from eight to ten litres, must be provided for the space of each bed. The acid and the water are placed in these vessels, then a small bag of thick paper, containing 300 grammes of the copper, is placed without precipitation in each vessel, commencing with that which is farthest from the door. As soon as this is done, the door must be carefully closed and rendered air-tight, and so left for forty-eight hours. The products of the mixture are azotate of copper and bioxide of azote which transforms itself into vapour. At the end of the forty-eight hours the room is entered with the aid of the Galibert apparatus, which, by its provision of air, allows the wearer of it to penetrate into all parts of a room or ward filled with noxious gas, and remain there if necessary for a quarter of an hour. The windows are opened, and the ventilation does away with all trace of the acid vapour.

This method seems a sovereign remedy, and it must not be confounded with the fumigation by means of chlorine or hypochlorites, which simply disinfect by destroying the odorous gases; but it must be admitted that it is somewhat complicated for ordinary applications, and can only be entrusted to those who are pretty conversant with chemical operations. It is well, therefore, to call the attention of the public to a far more convenient plan, and of which the efficiency has been perfectly demonstrated. The agent employed is pure phenic acid, of which a given quantity is poured upon silicious powder or saw-dust of three times its own weight. This mixture, placed in earthen vessels, fills the ward or apartment spontaneously with the vapour of which the smell is so characteristic. The quantity used may be even greatly reduced, the floor of the apartments and the bed clothes of the patients being sprinkled daily with water containing from one-twentieth to one-thirtieth of its own weight of the acid.

The report refers to the successful use of this disinfectant in England, and then proceeds to give the results in certain special cases. Some years since, during a very hot summer, it was found impossible to purify the air of the Morgue, the quantities of gas disengaged by the corpses being so great that ventilation, chlorine, and hyperchlorates were all insufficient. It was proposed to arrest the putrefaction itself by killing the germs. A litre of liquid phenic acid was dissolved in a reservoir containing 1,900 litres of water used for sprinkling the bodies; the suppression of the putrid fermentation was complete. The disinfection was afterwards effected with only half the above quantity of acid. Phenic acid is, therefore, recommended for the purification of apartments, either by moistening the floor, stairs, &c., with water containing one-twentieth or one-thirtieth of its weight of acid, or by means of sawdust, or any silicious powder, with about a third of its weight of acid, the room being carefully closed as above described for forty-eight hours, and afterwards left open twenty or thirty hours before being inhabited.

The purification of furniture and bedding is thus conducted by the Service of Public Assistance in Paris. The mattresses, having been corded, are submitted to nitrous fumigation, and then cleaned in the usual way. All woollen as well as linen may be immersed for several hours in vats containing one part of chlorine of sodium, representing 200° chlorometric, and three parts of water. Bedsteads, oil painted tables, &c., are first submitted to fumigation, and afterwards washed with the solution of chlorine of lime. The chlorine fumigations, by means of which linen, mattresses, &c., are purified, are managed in the following manner:—500 grammes of chlorine of lime (composed of hypochlorite of lime and chlorine of calcium of commerce at 100°) are introduced into a strong linen bag as large as a bed; the bag is then hermetically closed and plunged into an earthen vessel containing one litre of ordinary chlorohydric acid and three litres of water; chemical action takes place, the room is closed, and kept so for twenty-four hours, after which the windows must be kept open for twice that period. Ten pans, disengaging 500 litres of chlorine, are sufficient to disinfect from 20 to 25 mattresses more or less contaminated. Such are the measures which the Scientific Commission considers most efficacious for removing all traces of miasmatic infection.

THE RIGI RAILWAY.

The *Organfür die Forschritte des Eisenbahnwesens* gives the following particulars of the railway that has been lately opened (23rd May) on the Rigi. The line commences at Vitznan on the Lake of Lucerne, and terminates for the present at the baths of Mont Rigi, situated at 4,000 feet above the level of the sea, but will be ultimately extended to the top of the mountain. This bold undertaking is chiefly due to Messrs. Naef, Zchoke, and Riggemback, who, previous to commencing the works, made a series of experiments at Olten for the purpose of testing the various systems of mountain engines, amongst which may be mentioned that of Mr. Fell, which is adopted on the Mont Cenis tunnel railway, the Welti engine, &c. The engine of Mr. Riggembach was found to be the best suited for the purpose, and was therefore adopted.

The line commences at a turntable 12 metres in diameter, situated at a short distance from the lake, and, ascending with a gradient of 6½ per cent., reaches the village of Vitznan. Here the gradient changes to 25 per cent., which is retained (with the exception of some short lengths of 22 per cent.) to the summit. The curves are numerous, and are principally of 180 metres radius. At 1,000 feet above the level of the sea the line passes through a tunnel in the rock 67½ metres in length, and immediately crosses a ravine 30 metres in depth by a viaduct, consisting of three spans of 24½ metres each. The piers for supporting the girders are of iron work, strongly braced together and firmly fixed in foundations of granite; these piers are 10·80 and 8·10 metres in height respectively. The girders are placed 2·10 metres apart, and the distance between the parapets 4·20 metres. To add to the difficulty of the undertaking, the viaduct is situated on a curve of 180 metres radius, and with a gradient of 25 per cent. On the viaduct the rails and rach are fixed to longitudinal sleepers.

About half way up the mountain, near the Freibergen station, the line is provided with a siding to allow the up and down trains to pass each other, and at the lower end of the line there are also sidings communicating with the engine sheds. There are three watering stations on the line, supplied by natural pressure obtained from the mountain springs.

Several deep cuttings through the rock, and high retaining walls in various places on the line, were found necessary to be made, and as, from the steepness of the locality where the line had to be made, it was found impossible to employ carts for the transport of earth, sledges were used. A sufficient quantity of stone, fortunately, was near at hand for the construction of the various works in masonry, and had only to be hewed into shape and rolled into place. The workmen employed on this line were chiefly Italians.

With such steep gradients, and on such rough ground, which in places was almost inaccessible, it may be easily supposed that the setting out of the line was a task of no slight difficulty. On leaving the lake the railway takes a south-westerly direction towards the rocks of Vitznan, and on leaving the tunnel the course of the line is north-west, and on this part of the line the passengers will not fail to enjoy the magnificent panorama of the lake at their feet, with the Alps in the background, with the valleys of Lucerne, Alpnach, Buochs, and Weggi.

The permanent way consists of light rails, of the form known as "vignoles," weighing only 33 lbs. per yard. The guage is the ordinary 4 ft. 8½ in., the rails being fished at the joints. The sleepers are of oak, 8 ft. in length, and placed 2 ft. 6 in. apart. The end of the sleepers are bolted to longitudinal timbers, thus forming a strong framework; besides this every fourth sleeper is firmly fixed to the rock by masonry, so as to prevent any chance of the line slipping in a longitudinal direction. In the centre of the line between these rails is a rack, fixed to the sleepers by angle irons, weighing about four cwt. per yard.

The passenger trains consist of a four-wheeled engine, and of a carriage with an upper story, capable of accommodating eighty persons. This carriage is pushed up by the engine, instead of being drawn, as on other railways, and in descending the mountain the engine is in front, so as to sustain the carriage, which, however, could descend entirely by itself, and is entirely under control of powerful breaks.

The speed on this line is certainly not great, occupying about 1¼ hours from the lake to reach the summit, a distance of 5,500 metres (rather under 3½ English miles. The engine is of 120-horse power, and the steam is produced in a tubular boiler, which is vertical when on the steep gradient. The weight of the engine is ten tons. A toothed wheel is fixed on the driving-angles, and makes one revolution to three of the steam-engine. This wheel works into the rack, which is placed in the centre of the line, and it is in this manner that adherence is obtained for overcoming the gradient. The engine is prevented from running off the rail by strong angle-irons, which are fixed to the under part, so as to prop it on each side of the rack. In descending, a powerful new break is used.

The carriages are composed of two stories, with nine seats each, and are capable of accommodating forty-five persons on the lower story, and thirty-six on the upper.

The cost of the line, including three engines and three carriages, was 350,000 thalers (£56,000).

EDUCATIONAL NOTES.

The Endowed Schools Commission and the House of Lords.—The proceedings of this Commission have received rather a serious check, by the vote of the House of Lords on Friday last, when the Marquis of Salisbury moved that an address be presented, praying her Majesty to withhold her assent from the proposed scheme of the Commissioners for the management of Emanuel Hospital, recently described in the *Journal.* Lord Salisbury asserted that this scheme was a violation of the spirit of the Act, which was passed on the understanding that good schools should not be interfered with, and that obsolete and defective foundations only should be remodelled. The Commissioners, he complained, treated the deliberate intentions of the founders with contempt; and, utterly ignoring the claims and rights of the poorer classes, for whom these charities were founded, proposed to give the lion's share of the endowments to the middle classes. The scheme was defended by Lord Halifax, who maintained that the Commissioners had faithfully observed the intentions of the Legislature, and that the scheme complained of was part of a general plan to complete the educational system of the country. The elementary education of the working classes was provided for out of local rates by the Act of last session, and by another Act due provision had been made for the management of the higher public schools. The Commissioners were, therefore, justified in keeping in view the education of the middle and lower middle class, with the addition of such of the children of the working class as showed peculiar merit or aptitude. Lord Lyttelton, Chairman of the Commission, in the course of his speech, strongly urged that they were not restricted by the Act to cases in which abuses were proved. The object of the Act was that the Commissioners should administer these endowments so as best to promote the education of boys and girls generally, and to bring a liberal education within the reach of all classes. In the case of Emanuel Hospital the Commissioners were giving effect to the real intentions of the founder; but in many cases it was absolutely necessary to depart from them. Quoting the memorial of the head masters and assistant masters (recently referred to in the *Journal*), that there should be no gratuitous education, except as the reward of merit, he defended his recent declaration that the lion's share of certain endowments ought to go to the middle class, and to those who are just above the poorer classes in the social scale. There was no class for which, relatively to their means, so little had been done. Lord Lawrence, as Chairman of the London School Board, defended the scheme of the Commissioners, as offering a great incentive and impulse to the primary education of the country. He believed that a large majority of the working classes approved the scheme, as offering a great opening for their children. Not less than sixteen out of eighteen members of the London School Board approved some such destination of public educational endowments. On a division, Lord Salisbury's resolution was carried by 64 against 56. Upon the second resolution, relating to the Grey-coat Hospital, the Lord Chancellor deeply regretted that the House should have done so disastrous a thing for Westminster as to stop a grand and useful scheme for the education of the children of the poor of that city; and the Bishop of Exeter, having had great experience in schools, and speaking also as an Endowed Schools Commissioner, affirmed that nothing was more truly beneficial for the poor than to give precisely the kind of stimulus to education proposed by the Commissioners' scheme. The second resolution was then carried; and her Majesty has formally signified her intention to dissent from the schemes of the Commissioners. The *Times*, however, thinks that "the friends of education need not be discouraged at the result of this debate. The time has long passed when the House of Lords could impede any system of policy on which the government and the nation are resolved—and the criticism of the House only serves to make reformers aware of the objections they will have to meet, and of the details which it is incumbent on them to explain." It points out that "the Act was passed, not merely to enable the State to deal with schools where the public or the proper recipients of its bounty were actually robbed, but for the great multitude which, without presenting any grave scandal, fell short of the proper standard of efficiency;" and it urges that the only question with regard to Emanuel Hospital is whether the Commissioners have abused their powers. This it denies, and says the "only difference between Emanuel Hospital and any other institution in the country is that the former has a great corporation to make interest for it."

The London School Board and Compulsion.—The report of the committee appointed by the Board to consider section 74 of the Act was presented at the Board meeting on the 28th ult. In reference to the payment or remission of fees, the committee express an opinion that the power "should be most cautiously and sparingly used, and that the utmost care should be taken to avoid conveying to the poor the impression that they are to be relieved from the obligation of paying for their children's schooling;" and they "submit that the encouragement of anything like a general expectation on the part of the parents that, as a matter of course, and on the untested allegation of inability to pay the fees, they will be relieved, at the cost of the ratepayers, from their duty to their children, would be a great evil, as tending to pauperise a class of the population who should rather be stimulated to a sense of their duty and to a manly spirit of independence. It is but justice to express the conviction that a large proportion of the wage-earning classes concur in these views." In reference to the mode of carrying out compulsion when required, the committee "have aimed at devising a machinery which shall take cognisance of all the children to be dealt with, and which shall only reach the last resort of legal proceedings in extreme cases of parental neglect, after passing on gradually through the stages of inquiry, remonstrance, and formal notice of the consequences of such neglect if persevered in. In pursuance of this view, they have recommended the appointment of visitors to assigned districts, with defined duties. They suggest that, as a general rule, but not exclusively, these agents be women who have had experience in similar work, as district visitors, &c. There is reason to believe that there are ladies who would gladly give their time to this work at a comparatively small cost; and the committee are of opinion that by employing women it would be possible to secure the services of persons of a higher class than could otherwise be obtained, while the advantage would be gained of making a distinction between this class of officers and those employed in looking after the street children under the Industrial Schools Act. It is also recommended, on the grounds (1) that the chief part of the work will consist in visiting the mothers of truant children, and in considering such excuses for non-attendance as want of clothes and other domestic difficulties, which can be most fitly dealt with by women; and (2) that the visits of a class of persons with whom the poor are already familiar will be the least likely to excite resistance."

Payment of School Fees.—Dr. Stallard, in a letter on this subject to the *School Board Chronicle*, questions the propriety of the matter being undertaken by School Boards at all. He says:—"Inability to pay for the education of children has been already determined to be a form of destitution, and the Act (Denison's) which legalises such payments was left to the proper destitution authorities—viz., the guardians—to carry out. It is quite true that School Boards have also had the power conferred upon them; but I venture to think that they will find it impossible to discriminate between the parents who are able and yet unwilling to pay, and those who really cannot do so, without a large staff of inquiring officers and local boards of management having the functions now enjoyed by boards of guardians. Without such means of investigation, great imposition will be practised; and the laxity would be increased if the school managers, acting under a great desire to secure general education, should take a very liberal view of the case. I would suggest that the guardians are the proper persons to determine the question of "destitution"—that is, whether or not the parents are able to pay the school fees. They have relieving officers whose business it is to make inquiries as to the income, mode of life, &c., and who know, or should know, the circumstances of each family from month to month, and even from week to week; for it may be that the parent who is not able to pay in winter may be able to do so in summer; and it is certain that a man who can well afford to pay when well and in full work, would be unable to do so when ill or out of work. There is no occasion to have two boards with similar powers; and if the fees are to be paid from rates, the guardians are the proper persons to pay them, because they are most likely to prevent imposition and force the responsibility on parents who can afford to pay."

The Education Department and the Bye-laws.—The bye-laws of Manchester, Burnley, Barnstaple, Rochdale, and Blackburn have been considered by the Education Department, and returned to the respective boards with suggested amendments. Among the points remarked upon by the Department are the following:—In some of the compulsory bye-laws, the words "reasonable excuse" are qualified by such words as "satisfactory to the board." School boards are advised to omit such qualification, as not warranted by the terms of the Act. The boards are not constituted the judges of what is a "reasonable excuse." That rests with the magistrates. It is the same with respect to the "efficiency" of a school or of education outside school board schools. Some boards proposed to limit the power of parents to remove children from one school to another, but the Department advises that the Act gives no such authority to school boards. Also the boards have no authority to demand of parents a reason for not sending their children to school. The Department further recommends a uniform stipulation that children be sent to school within fourteen days from the date of an order.

CORRESPONDENCE.

ORNAMENT.

Sir,—Having read the lecture of Mr. Dresser on this subject, and the correspondence which ensued, I was in hopes someone, with time and ability at command, would have given us some practical principles to guide us to true and elevated thought.

From evidence which could be produced, it does not appear that any progress has been made in this useful science for 3,000 years. Ornament, perhaps more than any subject of human progress, waits for classification and intellectual expression. Capabilities of mind in form, somewhat like what nature gives us in the animate and inanimate life of the universe, are quietly resting in the bud, for coming minds to expand into full-blown richness. It will be that development which will leave no thought or sentiment of the soul unrepresented; that representation will have a unity or harmony with the purpose for which the building, object, or manufacture is intended. For instance, the solemnity of the religious Gothic (I make a distinction between this and civil Gothic) supplies the thought of massiveness and allowed impressiveness, necessary for church and mausoleum ornament, and the misfortune or bad taste of surrounding a raised edifice or cemetery with fairy-forms, which would have been more appropriate round a toy manufactory, is obvious.

The distinctions or divisions of the subject seem self-evident. There is the ornament of the human form and the superior animals, so largely and exquisitely given in the ancient temples of Nimroud and the Konyunjik. There is also an almost infinite source in the inferior animate forms of nature, richly referred to by the Babylonian sculptors, such as fishes, trees, feathers, weeds and numerous examples of the fauna and flora of creation. There is also the most general resort of artists and decorators, efforts, the form of line, without reference to anything in nature, such as the Alhambra, the Vihara, and the Hylas of Eliora. Again, one of the greatest mysteries of the science is, that those are often the most beautiful patterns where there is no pattern at all. Turkey carpets and Indian shawls are often extremely rich in this singular principle. It may be described as a multifarious and almost infinite variety of indefiniteness; nature gives it us in many instances, as in marble, the grainings of wood, &c.

It may seem paradoxical when I state that order, precision and definiteness are the weakest points of ornament, as they are of painting, poetry, music, and the drama. The stars would not be half so beautiful or interesting set in order in rows of lines or squares; it is their apparent confusion which causes that ceaseless wonder which has its foundation in mystery.

When will a Turner arise in the science, who will point the way to intellect instead of the square and rule.

I am, &c. W. G. Herdman.

West-villa, St. Domingo-vale, Liverpool.

MONTHLY NOTES ON SCIENCE.

The scientific world will feel an interest in some recent experimental investigations by Mr. William Crookes, F.R.S., of a new force. It is now a year ago since he contributed to the *Quarterly Journal of Science*, of which he is the editor, an article in which he stated, in the most emphatic manner, his belief in the occurrence, under certain circumstances, of phenomena inexplicable by any known natural laws, and indicating several tests which men of science had a right to demand before giving credence to the genuineness of these phenomena. Since that time, Mr. Crookes has had opportunities afforded for pursuing the investigation, and, by availing himself of them, has arrived at results so definite, that he considers it right they should be published. This he has done in the July number of the scientific journal above mentioned. In presence of several scientific observers, including Dr. William Huggins, of Upper Tulse-hill, and Serjeant Cox, of 36, Russell-square, both of whom write to verify the statement, Mr. Crookes has seen sufficient to warrant him in making the assertion that the existence of a new force is established—a force in some unknown manner connected with the human organisation, and which for convenience he designates the psychic force. He finds that in presence of certain persons in whom this psychic force is powerfully developed, singular phenomena occur, some of which can be tested with scientific accuracy, such as the alteration in the weights of bodies, and the using of musical instruments, "without direct human intervention, under conditions rendering contact or connection with the keys impossible." When it is mentioned that, in addition to the scientific gentlemen mentioned, the well-known Mr. D. D. Home was present, the force designated by the learned and talented *savants* as "psychic" will be recognised as one which is popularly known by another name. It is, however, gratifying to learn that this matter is now receiving investigation at the hands of cool and clear-headed men of recognised position in science.

At a recent meeting of the Royal Astronomical Society, a full description was given of the apparatus and arrangements devised by Mr. Rutherford, of America, for producing photographs of the sun and fixed stars. In connection with this subject, Dr. Mann has, still more recently, read a paper before the Photographic Society, in which he described, in popular language, although not in technical detail, the means by which Mr. Rutherford obtains such admirable photographs of the heavenly bodies as he produces. To render this capable of being properly understood, it ought to be stated that the conditions for obtaining visual accuracy in the definition of an object in the telescope are different from those required in securing a photographic representation of the same. In the former case it is enough that the luminous rays are converged to a focus; in the latter, the merely luminous rays are of little consequence, provided they do not carry with them chemical or actinic force, or that power, by whichever name it is known, of causing such a change in the nature of certain sensitive bodies as shall produce a visible and permanent record of such changes, as in the case of photography. The most luminous rays, viz., those in the yellow region of the spectrum, are not the most chemically active; hence a correction of an object glass, whether telescopic or microscopic; for actinism differs somewhat from that required for visuality. For the latter quality the violet and blue may be left outstanding, seeing their luminousness is low; but quite different is it when chemical action is concerned; then, the bright luminous rays are of little consequence, the blue and other rays of higher refrangibility being those of the greatest power. A good telescopic object glass gives a sharp visual image, but an imperfect chemical one; and there is often a considerable distance between the foci in each of these cases. To rectify the "over-correction" of the telescope, Mr. Rutherford has added another lens to the combination, which being under-corrected for colour in itself, causes a coincidence of the visual and actinic foci of the objective, without disturbing the correction of the spherical abberation. By this addition, the telescope can either be used for observing or for photographic purposes, the result in either case being perfect. It is probable—certainly it is desirable—that in all large telescopes constructed henceforth, due arrangement will be made for securing on the one hand the best possible visual image of the object observed, and on the other of the most intimate union of the principal luminous and most active chemical rays of the spectrum; for it is only by such an addition as will permit of this being done that the utmost powers of the telescope will be developed.

When Professor Tyndal delivered his first lecture on "Dust and Smoke," at the Royal Institution, it is problematical whether he even then realised the importance of the subject. Probably few at the present time yet do so. The dust that floats in the atmosphere, and which is visible only when penetrated by a strong beam of sunlight, or even artificial light, consists of organic matter, both living and dead. This dust of our atmosphere, breathed at every inhalation, is composed of spores of fungi, pollen of flowers, smoke, and germs of —we know not what. When these obtain access to the blood of wounds, they would, according to Professor Listor, cause the blood to putrefy and become fetid; and, on examination, the putrefying substance would be found swarming with organic life, the germs of which have been derived from the air. Without speaking of the physiological effect of dust in this connection, it is well worthy of being recorded that, as suggested by Professor Tyndal, such matter may be removed from the atmospheric air by a simple process of filtration through cotton wool. Arising out of this, a new form of respirator has been constructed, by which a person may remain for an indefinite period of time, without inconvenience, in a room filled with the most dense and irritating smoke that can be devised, viz., that from resinous pine wood. The superintendent of the London Fire Brigade, Captain Shaw, together with several of the firemen, have tried the new respirator, and express their high approval of it. It is composed of cotton wool moistened with glycerine, by which the mechanical particles of the smoke are arrested and retained, the irritating gases being similarly arrested by a layer of charcoal. The importance of this invention can scarcely be over-estimated.

Travellers are proverbially shy of making themselves intimately acquainted with our Patagonian brethren. The whole length of that country, with the exception of Terra del Fuego, has, however, been traversed by Lieutenant Masters, R.N., who has communicated to the Anthropological Institute an interesting account of the manners and customs of the Patagonians, who consist of three distinct races of Indians, differing in physique and language. They are tall, hardy, active, have no fixed residence, and travel on horseback. They are inveterate gamblers, but play fairly, and for high stakes. They believe in a Great Spirit, who made them, but who takes no special interest in them. Their devils are the departed spirits of members of the medical profession, and the main object of their religious ceremonies is to keep these devils at a distance from them.

A contribution has been made by Dr. Debus, F.R.S., towards the settlement of the question whether, in addition to ozone, there is not another modification of oxygen called antozone. From his researches, communicated to the last meeting of the Chemical Society, Dr. Debus concludes that this substance is only peroxide of hydrogen.

It is expected that an appeal, which will be made to Government for a grant of £5,000, to enable photographic observations to be made of the approaching transit of Venus, will be successful. The immense service rendered by photography in obtaining valuable records of the recent solar eclipse is still fresh in the memory of every man of science.

A method of fixing, photographing, and exhibiting the magnetic spectra has been described by Dr. Mayer. A plate of glass is coated with an alcoholic solution of shellac. When dry, it is placed over the magnet, with its ends resting on slips of wood, so that the under-surface of the plate just touches the magnet. Fine iron filings are now sifted over the surface, and the spectrum is produced by vibrating the plate by a light piece of copper wire. The plate is now carefully removed, and is placed over a large Bunsen flame, by which the shellac film is softened, and the filings fixed. A plate prepared in this way can serve for the most accurate measures upon the magnetic field, for a photographic *cliché*, which will reproduce upon sensitised paper the lines in white upon a dark ground, or for a transparency which, when placed in a magic-lantern, can be exhibited on any desired scale of amplification.

MEETINGS FOR THE ENSUING WEEK.

MON.....Royal Geographical Society, 8½. C. R. Markham, Esq., "On the Races of the Peruvian Andes, and on the Communication between the Andes and the Atlantic."

WED.....Royal Literary Fund, 3.

THURS...Society for the Encouragement of Fine Arts. Henry G. Neville, Esq., "On the Stage, with its relation to the Fine Arts—its origin, influence, and present position."

SAT.......Working Men's Club and Institute Union (at the Royal School of Mines), 4. Mrs. Henry Fawcett, "On Women and the Franchise."

Journal of the Society of Arts.

No. 973. VOL. XIX.

FRIDAY, JULY 14, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The Fourth of the Series of Six Concerts in aid of a National Training School for Music was given by the Society, at the Royal Albert Hall, on Wednesday evening, July 12th.

Their Imperial and Royal Highnesses the Crown Prince and Princess of Germany and Prussia honoured the concert with their presence. They were accompanied by General His Serene Highness Prince Edward of Saxe Weimar and the Princess of Saxe Weimar, the Count and Countess Bernstorff, the Duke and Duchess of Manchester, and were received by Lord Henry Lennox, M.P. (Chairman), and the Council of the Society of Arts. At the entrance to the conservatory their Imperial Highnesses were met by the Council of the Royal Horticultural Society. Her Royal Highness Princess Louise and the Marquis of Lorne were received by Lord Henry Lennox, M.P., and the Council, and were conducted to the Royal box.

The following Music was performed :—

OVERTURE.................. "Euryanthe" ....*Weber.*

ARIA.............. "Sorgete" (Maometto) ....*Rossini.*
Signor AGNESI.

ROMANZA......... "Le parlate d'amor" (Faust)...........*Gounod.*
Mademoiselle FERNANDEZ.

PIANOFORTE { .... "Andante in F." ....*Beethoven.*
{ ...."La Cascade" ....*Pauer.*
Herr PAUER.

DUET......... "Parigi o cara" (La Traviata) ....*Verdi.* ...
Mademoiselle NATALIE CAROLA & Mr. W. H. CUMMINGS.

OVERTURE........... "Occasional Overture" ....*Handel.*

PART II.

OVERTURE.............. "La Gazza Ladra" ....*Rossini.*

AIR........... "I will extol thee" (Eli).......................*Costa.*
Mademoiselle CAROLA.

SOLO VIOLIN (by desire)... "Carnaval de Venise" ...*Paganini.*

QUARTET........... "Mezza Notte" (Martha) ....*Flotow.*
Mademoiselle CAROLA, Mademoiselle FERNANDEZ, Mr. W. H. CUMMINGS, and Signor AGNESI.

DUET, pianoforte and clarionet { "Adagio and Finale in E flat." } *Weber.*
Herr PAUER and Mr. LAZARUS.

SONG........................ "Pilgrim of Love"..................
Mr. W. H. CUMMINGS.

FINALE.................. "Wedding March" ....*Mendelssohn.*

At the commencement of the Concert a notification was received from Mdlle. Ilma Di Murska, that she would be unable to attend.

The next Concert will take place on Wednesday, the 19th July.

The prices of admission will be from one shilling upwards.

Tickets may be had of Mr. S. T. Davenport, Financial Officer of the Society, at the Society of Arts, 19, John-street, Adelphi, and of the usual agents.

DRILL REVIEW.

In accordance with the report of Council (see page 623, *Journal* 971), subscriptions of five shillings and upwards are invited towards the expense of the last and future reviews. The following amounts have been already received :—

	£	*s.*	*d.*
James Austin....	1	0	0
B. W. Bartram ..	1	1	0
L. Biden........	1	0	0
Sir W. H. Bodkin	1	0	0
W. W. F. Bolton	1	1	0
Wm. Botly	0	5	0
H. A. Bowler....	0	10	0
A. Cassels	0	10	0
A. S. Cole	0	10	0
Henry Cole.....	2	0	0
Sir Daniel Cooper, Bart. (will increase if needed)	1	0	0
W. Cooper	0	10	0
Rev. B. M. Cowie	1	1	0
Major-Gen. Croggan, R.A......	0	5	0
J. A. Crookenden.	0	10	6
John Cubitt	1	1	0
Thomas Dixon ..	0	10	6
John E. Evans ..	0	10	0
W. H. Fell......	1	1	0
F. Filliter.......	1	1	0
J. A. Franklin ..	0	10	0
Samuel Harton (to be doubled if required)......	0	5	0
Sir Rowland Hill	1	1	0
G. N. Hooper....	1	1	0
Chas. Horne (will give 10s. more if required)	0	10	0
Dr. Albert Horwitz..........	0	5	0
Edwin Lawrence	1	0	0
Maj. E. W. Mathew	0	10	0
R. Nicol	1	1	0
James Noble	1	1	0
John Noble	1	0	0
John Pritchit....	0	5	0
Edward Rosher ..	0	10	0
W. S. Rumsey ..	0	5	0
Philip Sancton ..	1	0	0
S. Metropolitan District School	10	10	0
George Stanton..	0	10	0
W. H. Tanqueray	0	10	6
Charles Telford..	1	0	0
Seymour Teulon	1	1	0
W. H. Thomas ..	1	0	0
E. C. Tufnell....	5	0	0
Z. Watkins......	0	5	0
C. Williams	1	1	0
W. B. Wrightson	1	0	0
	£48	8	6

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

OUR FOOD-PRODUCING RUMINANTS, AND THE PARASITES WHICH RESIDE IN THEM.

By T. Spencer Cobbold, M.D., F.R.S., F.L.S.

LECTURE II.—DELIVERED MONDAY, APRIL 24TH.

The Bovine Ruminants, more particularly in relation to the question of Parasitism.

Having, at my last discourse, offered you an outline of the general structure and affinities of our food-producing ruminants, I shall have the pleasure this evening of speaking more particularly of the parasites which reside in those animals. As the subject is rather complicated, it will be desirable to take up each family of ruminants separately, and then to select some individual member of the group as a type. I can next enumerate the parasitic creatures which exist in the type, and afterwards select from the series of parasites those particular forms which have an especial interest for us in connection with the subject of food. The bovine group of animals, or *Bovidæ*, includes not merely our ordinary forms of cattle, but likewise a large number of animals which are commonly termed oxen, though some of the forms differ from ordinary oxen; such, for instance, as the bisons and buffaloes, also particular creatures, such as the zebu, the gyalls of India, the musk oxen, the gour, the yak, and several other forms; but it is understood that all our ordinary varieties of cattle, that is to say, the nine well-marked types, called respectively Long-horns, Short-horns, Devons, Herefords, Ayrshire breed, Argylls, Galloways, and Welsh cattle, are all derived from one species. But naturalists have not been able to satisfy themselves as to the particular specific origin of all these forms. We call the common ox *Bos taurus*, but it was probably derived from a pre-existing wild form which has become domesticated. We do not know, however, whether it came from the original British wild ox, termed *Bos urus*, or whether it has descended from another species whose bones are only known to us in a fossil condition. It is just possible that all these varieties of our common ox have been derived from the *Aurochs*, *i.e.*, *Bison priscus*, or, as some also call it, the *Bison Europæus;* for many believe, and Professor Owen amongst the number, that these two forms are neither more nor less than one and the same species. Selecting, therefore, the common ox as the particular type before us, we desire to know what parasitic animals take up their residence in its interior. As I explained to you at our last meeting, we must, for the full appreciation of our subject, at once divest ourselves of all preconceived opinions, and look upon each higher animal form as a territory in which particular creatures are wont to reside. It is their prerogative, so to speak, to take up their abode in such quarters. Philosophically viewed, they have a right to do so. We may also speak of the ox as the host, entertaining certain creatures which reside in it as so many guests. In like manner, the sheep, or any other animal, may have to play a similar part in the economy of nature; the same undignified relation being shared by ourselves, however unwillingly.

Here is a list placed before you of all these species of parasites or creatures which are apt, under certain favourable conditions, to take up their residence in the ox and sheep. This list, you perceive, is a double one, those proper to the ox being indicated by a dot opposite the name in the first column; and when there are two dots, it means that the creatures reside in both beasts. Thus, for example, the *Fasciola hepatica*, or common fluke, resides in the ox as well as in the sheep. I have already pointed out to you that we have certain groups or families of parasites; but, as a reminder, I may refer to this table, expressive of the relations, and showing four well-marked groups, termed respectively *Cestoda*, *Trematoda*, *Acanthocephala*, and *Nematoda*. Originally, it was supposed we had five groups, but there are in truth only four, because the cystic parasites are merely young or larval forms of the cestodes. Next, come the trematodes, one of which is represented here. The term means perforated, the ventral sucker or disc having been regarded by the older naturalists as a sort of perforation. The next title, *Acanthocephala*, is equivalent to the expression thorn-headed creatures. Here is a representation of one, the *Echinorhynchus porrigens*, which lives in the whale. Its head, you observe, is covered all over with spines. Lastly, we have the *Nematoida*, or round worms, of which the little trichina forms a well-known example. The advantage of thus tabulating these creatures is that you see all the forms that reside in particular hosts, and you are likewise able to compare the distribution of the parasites throughout their respective bovine, ovine, canine, and human territories. Thus we have four different kinds of hosts, namely, the ox, the sheep, the dog, and ourselves; and at a single glance you may see the kind of relationship and parallelism subsisting between the occupants of one territory and those of another. We have here, for instance, eight different kinds of fluke, that is to say, three in the sheep and five in the ox. In man, so many as nine have been indicated, whilst in the dog only one kind of fluke is at present known. There is, therefore, a marked difference in this question of specific distribution. Then, again, if you direct your attention to the round-worm series, coloured green, you will notice that this particular group is very cogently expressed in the ox and sheep, large numbers living in them and also in man, the same being the case with the dog. Then comes the blue series, of two shades, the lighter representing the full-grown cestoids, whilst the dark blue refers to the same kind of parasites in their larval condition. In the dog, the tape-worms are exceedingly numerous, numbering no less than eight specifically distinct forms. In man, there are almost as many, but only two occur in the ox and one in the sheep. You thus get a bird's-eye view, as it were, of the general relations subsisting between the parasites and their hosts. I may also mention that, besides these entozoa, there are a great many other kinds of parasites not included in this series, some of which are liable to take up their residence within, whilst others dwell on the exterior of these hosts, but I purposely only allude to them in passing.

Doubtless, a practical question will by this time have occurred to such of you as are interested in the sewage question. You probably desire to know to what extent it is possible, by the distribution of sewage, to add to the supposed evils derived from this source. Well, as I am not an alarmist, I wish expressly to state that comparatively few of these parasites can be dispersed abroad by sewage irrigation. Some forms, certainly, are directly distributed in this way, others being only indirectly concerned. It is my intention, before the close of this short course, to make as clear to you as language will enable me to do what is the extent of this relation; but, in the meantime, it is far better that we should get a satisfactory notion of the structure, habits, and the mode of entrance of particular parasitic forms. When once you have obtained a firm hold of these primary data, the subsidiary facts and the conclusions legitimately deducible therefrom will, I am sure, be more readily appreciated.

At the last meeting, I expressed the intention of entering at once upon the consideration of certain forms occupying the "bovine" host, that is to say, the ox. But since I last had the honour of addressing you, a most interesting series of facts have come to my knowledge. I have, indeed, already communicated part of them to the *British Medical Journal* (for April 22nd, No. 538, p. 435). As in England we have never, hitherto, experienced an outbreak of this parasitic disease which is called trichiniasis, or flesh-worm epidemic, you will readily understand the importance of the announcement which I now make respecting the occurrence of this disorder amongst us. The *Trichina spiralis* has been obtained from the flesh of cattle, but it is not ordinarily a resident in the bovine territory. If you cast your eye down this list, you will see that the parasite belongs to the green, or nematode series. You see it again in the list of human entozoa, and also in that of the dog, the parasite being thus liable to reside in any of these hosts. The outbreak of trichiniasis to which I have referred has just taken place; for it was only on Wednesday morning last that I received from Dr. William Lindow Dickinson, of Workington, in Cumberland, specimens of pork, requesting me to examine them, with the view of verifying facts tending to confirm his suspicions as to the origin of the malady then and now affecting two or three persons under his professional care. More of this anon; but let us meanwhile, consider the general natural history of this remarkable parasite. The *Trichina spiralis* is a very minute nematode worm. I have here figured two individuals. The male, when full grown, is only the one-eighteenth part of an inch long, but the female is about one-eighth of an inch in length. It naturally resides in the alimentary canal of mammalia, but it is not known for certain whether the parasite is indigenous, so to speak, in any one particular species of quadruped. By myself and others it is believed to belong properly to the pig; nevertheless, in opposition to this view (which has derived great strength from the recent researches of Professor F. A.

Zenker, of Erlangen), Dr. Liesering maintains that the trichina is indigenous to the rat. In its full-grown state this parasite is, for the most part, only known to such as have reared it by experiment. In the juvenile condition it was originally discovered by Mr. Paget, when a student at St. Bartholomew's Hospital. Specimens were afterwards forwarded to Professor Owen, who gave a masterly account of the facts observed in the "Transactions" of the Zoological Society for 1835. The history of its development may be described as follows:—Here is a magnified representation of a portion of meat displaying capsules containing trichinæ rolled up in their interior. If you were to eat a portion of this sort of trichinised flesh, the enclosed larval parasites, after they have arrived in your alimentary canal, would, in the course of 48 hours, have completed the remaining stages of their larval growth. Some would thus have become adult females, and others adult males. More than half would be females. After a few days have elapsed, say six, the females will have yielded a progeny; this progeny being the embryos, or young, which have escaped from their eggs whilst the latter were within the body of the parent trichina. The eggs are very small, their longest diameter being the $\frac{1}{1300}$th of an inch only. These embryonic creatures are necessarily minute, and are sharply-pointed at the extremity, somewhat after the fashion of their parent. They have thus no difficulty in boring their way through the walls of the alimentary tube of the host, and they are independent enough to go wandering about or migrating on their own account. This they do by at once rushing off in enormous numbers in any direction that they can get; and, although they are not furnished with any very formidable weapons to bore with, still their pointed heads, aided by a minute hardened stylet, enables them to make rapid progress through the softer tissues of the unfortunate host's body. Now, whilst they are thus penetrating the voluntary muscles of the body, you will understand clearly that, in our own case, we must needs be subjected to a number of wounds or injuries. The trichinæ, in short, constitute a sort of Lilliputian army, whose special prerogative it is to inflict upon us millions of inconceivably minute wounds. These multitudinous injuries are capable of putting us to actual torture, the amount of suffering being precisely in accordance with the number of wounds. Thus, we should, perhaps, only wince under the operation of some 10 millions of wounds, but be seriously inconvenienced by double that number, whilst as many as 100 millions would probably terminate our existence. I say, probably, only because I think it possible for a man in very strong health to survive the shock caused by the infliction of this enormous number of Lilliputian thrusts, if I may so term them. During their migratory wanderings, the little trichinæ stop at nothing except hard, bony structures, penetrating every tissue that comes in the way. They will pass into the heart, but they will not stop there. At the expiration of seven, eight, or nine days from the time of their being introduced, they will have duly arrived at the voluntary muscles, their next business being to coil themselves up snugly between the ultimate fibres of the muscular tissue. In fourteen days altogether, they may be said to have attained a condition of perfect embryonal or larval development. Soon after the process has been thus far accomplished, changes occur in the tissues, the muscular fibres themselves disintegrating. Little lemon-shaped capsules are by-and-bye formed around each parasite, and the cycle of development is fully completed within a period of less than three weeks. These are proved facts, and they must strike you as very remarkable. When this capsule is recently formed it is transparent, but after a time the capsule thickens, and the parasite inside is obscured by the greater thickness of the wall. In eight or ten months, or a year afterwards, the capsule loses its transparency altogether, and partakes of the character of a calcareous formation. The creature in the interior, however, may remain inside for some years without dying, but how long it is possible for it to keep alive in this encapsuled state I am unable to say.

I trust you are now in a position to appreciate the facts which I have next to bring under your notice. I have here a box containing a small portion of ham, which I received from Cumberland the other day, with a request from Dr. W. L. Dickinson that I would examine it. This smaller piece of ham I have weighed, and find it amount to exactly 2 scruples 2 grains. I shall be able to tell you how many trichinæ it contains, and then we can also calculate the numbers of the progeny which would result from their ingestion by the human host. I have here, moreover, a still smaller portion of ham, which consists of several minute particles previously detached, and then subsequently rolled together into a pill-like mass, about half the size of a pin's-head; it only weighs half a grain. I next sought to ascertain the number of parasites existing within that half-grain, and found that there were exactly 108 of these trichina capsules. That gives us 216 in one grain, because these portions, forming this half-grain pill-mass, were carefully selected from different parts of the ham, in order that I might get a fair average estimate of the number. If you calculated from one portion only, you might, supposing you had stumbled upon a part which was more infested with parasites than any other, be led to over-estimate the degree of trichinisation. With these precautions, I have calculated that one scruple of this trichinous flesh would give us 4,320, and 2 scruples would yield 8,640. Without speaking so precisely to the numbers, I do not hesitate to aver my belief that there are at least 5,000 of these parasites inside this small piece of ham. The number is probably close upon 8,640. In one drachm that would give us 12,000, and in an ounce 103,000, according to the old apothecaries' weight. If, however, we take it according to the ordinary weight used by butchers, we should say that one ounce contains 437½ grains of meat, and therefore the number in one ounce would be 85,000. Thus, in one ounce of meat from this particular pig you have 85,000 trichinæ, calculated at the rate of 200 in the grain, for I have purposely cut off the odd numbers. You may say, if a person can survive 18, 20, 30, or 40 millions, he would not take so very much harm from eating a piece of flesh which only contains 8,640. Let me assure you, however, that this portion would be quite sufficient to make any one of us extremely uncomfortable were we to eat it, for, in truth, this piece of ham, supposing its contained parasites are alive, would prove dangerous to any one of us. Why? The explanation is of this kind. Half of those 85,000 parasites, at the very least, will, in 48 hours after ingestion, have become fully-developed females; and from each of those 42,000 there will proceed 1,000 as a brood, so that the entire progeny (and it is they that do the mischief in their wanderings and independent migrations through our tissues) will eventually yield exactly 42,000,000 of entozoa. If we should be so voracious as to eat a pound of such trichinised flesh, then there would be 400,000,000 as the result of a single meal. Having detailed these facts to you, I now wish to bring to your notice some particulars of the outbreak which has occurred in Cumberland. This is quite a novelty, since we have never hitherto had an outbreak of the so-called flesh-worm epidemic in this country.

Dr. Dickinson, of Workington, tells me that he was suspicious first of all that his patients were suffering from fever, but was not quite able to make out what the disorder was. At length certain symptoms occurred, which made him think it might possibly be the German flesh-worm epidemic making its appearance in this country for the first time, and in view of verifying the facts of the case, he sent me portions of the flesh of the pig. He describes the symptoms, which, however, I shall not detail to you, for fear you should imagine that any little rheumatic affection you may be suffering from is due to this cause. I may say, nevertheless, that those who have suffered from this malady assert that the pain of rheumatism is nothing as compared to the trichina pains. Dr. Dickinson remarks, towards the close of his communication, that the persons who are suffering from this disorder constitute a small family who have carefully reared their own swine. The British farmer is thus here introduced to us at his own table playing the part of "host"—at her own table—for, to be more precise, it is a widow, her daughter, and a man-servant who are suffering. Dr. Dickinson tells me that for two or three weeks before he was called to see them they had been eating sausages and boiled pork from one of their own home-fed pigs; which pig, by the way, as he remarks, rather humorously, turns out to have been an old sow. He brought away some sections of the leaner portions of the flesh, for microscopic examination. You will observe that there can be no mistake about the source of the food on this occasion. Hitherto, trichina has not been observed in our British-fed swine in more than one or two, or possibly three instances. Therefore it would be very interesting to ascertain how it happened that this poor pig became trichinised. In the communication addressed to the *British Medical Journal*, my remarks were couched in the following terms:—"Dr. Dickinson has," I said, "at the present time under his care a family suffering from the so-called flesh-worm disease, resulting from the consumption of ham prepared from pigs reared by the family themselves. A portion of ham sent to me swarmed with recently encapsuled trichinæ. Dr. Dickinson being thus the first person who has diagnosed trichiniasis in the living subject in England, I hope he may be induced to give us further particulars." The editor, in commenting upon this letter, added a practical point, which I wish especially to bring to your notice. He says:—"The subject of parasitic diseases of domestic animals is one of widespread and increasing interest. It is being treated in the Cantor lectures, now in course of delivery at the Society of Arts. It is immediately related to the irrigation of fields with sewage." The editor, of course, made that statement on independent grounds, and on his own responsibility. If he had said the subject bears an indirect relation to such questions, he would have said no more than is absolutely true, for, as I shall take occasion before the close of the lectures to explain, there is every reason to suppose that certain forms of parasitic disease may be propagated by means of sewage. In this connection some of you may be disposed to ask the question:—"Are there any sources of comfort to be gathered from the facts?" Or you may say, supposing that in future our British swine are not as free from trichinæ as they have hitherto been, can we possibly avoid the contingency of playing the part of host to those creatures? Certainly, I reply, it is simply a question of cooking your food. If these farmers have not cooked their food at all, or scarcely at all, that will at once account for their being laid up. I should tell you that the lady and the daughter are recovering, that they are convalescent, but that the man-servant is very ill indeed. If, during cooking, the flesh consumed by these persons had been raised to a persistent temperature of 160° to 170° Fahr., then, doubtless, the ingestion of trichinised pork would have done no harm. You observe that Dr. Dickinson says in his letter, that they partook of it roasted and boiled. Now, none of us are in the habit of eating underdone pork, although there are other meats that we devour very readily in this imperfectly-cooked state. It must be remembered, also, that although the exterior may have been subjected to a temperature of 212 degrees, it by no means follows that the whole of the joint throughout must have been submitted to that temperature. Under the circumstances of rapid cooking, the centre may remain much below even 140 degrees. If the man-servant ate only one ounce of this flesh with living trichinæ in it, he will have, I reckon, at this present moment at least 42,000,000 of these guests in his muscles. You will say at once, Will he recover? Yes; if he ate no more than that; but I am afraid that he has eaten much more than that. If he has eaten 2oz. thoroughly underdone, depend upon it he has 80,000,000, and if he has eaten 3oz. he will have over 100,000,000 of trichinæ in his muscles. Could he survive if he had eaten over 3oz., and thus have 100,000,000 and upwards of these inhabitants? I think he could. I have evidence on this point from a case the nature of which I hardly like to open to your view, because, perhaps, it would make you more uncomfortable than you wish to be. For myself, there is little or no discomfort on the subject, since, in the course of the last twenty years, I have escaped almost entirely from any annoyance, although millions of these creatures and their eggs have passed through my hands. However, it is something to know what you are handling, and what you are looking at, because there are many parasites which are dangerous. There are some residing in meat which you and I eat every day without any bad consequence. Though of a totally different zoological character, they are as harmless as cheese-mites.

There is no need to be in the slightest degree nervous about flesh-food, provided it is properly cooked. I believe there will be no fatal issue in the case of any of the three individuals alluded to; but the chief practical point before us arises out of the fact that we have here, for the first time in England, the commencement of an epidemic of trichiniasis. By thus calling attention to the subject, it will be easy to take those precautions by which future epidemics of the kind may be readily avoided.

If you will cast your eye again down this list of the entozoa of the ox and sheep, you will observe the words *Cysticercus bovis* near the lower part; these being the combined generic and specific titles of the measle of the ox. I have here two drawings, severally representing the exterior and the interior of the heart of a calf, shewing these cysticerci scattered over the surface and in the interior of the muscular tissue. Here is also the hip-muscle, called by Bourgelat *vastus longus*, its surface being covered with 120 little specks of a similar kind. These formations are the result of original experiments on their "bearers;" and I may mention that, in carrying out these researches I have been, to a great extent, assisted by funds voted by the council of the British Association.

The particular parasite before us belongs to a class whose propagation is almost certain to be favoured by sewage irrigation. The *Cysticercus bovis* is the larva of the cestoid worm called *Tænia mediocanallata*, a common form of tape-worm. Here is a representation of it, shewing the narrow neck, body, and tail. All these descriptive terms are in truth misnomers, since the tape-worm is to be looked upon as a colony of individuals, arranged in single file. The segments are the real individuals, and as many as 1,200 of them occur in the perfect tapeworm. Each ripe segment contains about 40,000 eggs. Multiply the 1,200 by 40,000, and that would give you a total number of eggs which is derivable from one creature (as the colony is commonly represented to be). You will see on the list *Tænia solium*, referring to the tape-worm derived from the pig; and there is another one which I believe to belong properly to the sheep.

I must next describe to you the general structure and the phases of life through which these creatures pass, in order that I may bring out their importance in relation to the sewage question. The beef tape-worm is not furnished with cephalic hooks or holdfasts, but it has four suckers, which are its principal means of anchorage; and there is also a small supernumerary sucker in the centre of the head, in the position ordinarily occupied by a proboscis or rostellum. As to its internal structure, and what is called the water system, I need not dwell upon those points, merely remarking by the way that no form of tape-worm has either a mouth or a stomach. It is nourished, therefore, by whatever is absorbed through the surface of the skin.

Now, perhaps, you would like to know how I succeeded in getting the result I have spoken of, and that will explain a great deal. In the course of my experiments, I have necessarily had to feed cattle with the eggs of certain parasites; and, having been assisted in this matter by a gentleman, who is not only remarkably humane himself, but who is eminently skilled in the practical departments of his profession—I mean Professor Simmonds, of the Veterinary College—you may be quite sure, therefore, that we should not do anything which was not justified by the important aims or ends which we had in view. I was, of course, chiefly responsible for the experiments, scientifically speaking, because it devolved upon me to select and procure the parasitic materials employed in these feedings. In the case of a calf, I procured from the human territory specimens of *Tænia mediocanellata.* I then removed a certain number of joints or proglottides, for each individual segment is technically termed the proglottis. We mixed them with a little food; the animal swallowing the bolus very readily. The calf went on eating and enjoying its food the same as before; but after a certain time it began to lose its appetite; by and by it refused its food, its coat began to stare, the animal began to shiver, and, to cut the matter short, we thought we were going to lose our bovine patient. However, by proper treatment (making up you will, say perhaps, for our own misdeeds, but in truth only doing what was perfectly right) we brought the animal round. He regained his appetite, and soon became quite well. But while the morbid symptoms were occurring, what had happened was this:—All these ripe eggs in the joints which we had given to the calf to eat had passed to the stomach; they had descended into the paunch or macerating tub, as I described it; they were transferred to the second stomach, and then re-masticated in the mouth; afterwards they were carried down into the third stomach, and then, finally, into the fourth stomach, where the eggshells would be dissolved by the gastric juice. Out of each shell there proceeded a little creature which we call the six-hooked embryo. The egg has a remarkably thick shell, which, I venture to think, would not only enable the enclosed embryo to resist the action of decomposition ordinarily going on in sewage, but also any amount of cold during the winter or heat in the summer. When the egg-shells were dissolved, tens of thousands of these six-hooked embryos made their escape, and, after the fashion of larval trichinæ, largely aided by a special hook-apparatus, set about migrating on their own account.

Now, if the calf were at all injured by our experiments, you will please to observe that we communicated an immense deal of happiness to all these thousands of little embryos, so that if we were cruel to one large individual we were benevolent to many thousands of smaller entities; and if you put the balance in that way, you will find that—pre-supposing these small creatures are capable of enjoying the peculiar mode of existence allotted to them—we performed a gracious act. But if you are not satisfied on that point, I think I can make it more comfortable to your minds, by saying that the whole object of these experiments is to put us into such a position that we may tell our fellow-creatures what to eat, what to drink, and what to avoid. In this way, also, we may have it in our power to prevent their being afflicted by a malady which is not only seriously inconveniencing thousands of our fellow-creatures at the present time, but which may even prove fatal. Besides all this, if without the slightest compunction tens of thousands of animals are daily slaughtered for our immediate wants, what harm can there be in destroying by experiment a few more animals, in the hope of conferring substantial benefits upon our fellow-creatures?

I am quite sure that all questions of this nature produce bad results when viewed from a narrow standpoint. Childish prejudices and antiquated conceptions of truth are the bane of society. The more you look into this subject, and the larger your grasp of the phenomena and nature of truth, the more will you be satisfied that men of science should be unfettered in those experimental investigations which conduce to the welfare and happiness of our race. At our next meeting I shall conclude this part of my subject.

ANNUAL INTERNATIONAL EXHIBITIONS.

INDIAN DEPARTMENT AT THE INTERNATIONAL EXHIBITION.

Another and a very interesting feature has been added to the Exhibition by the opening of the Indian annexe, which adjoins that of France, and lies close to the entrance of the Horticultural Gardens.

The collection contained in this large annexe is large and brilliant, and has been arranged with great care, under the direction of Dr. Forbes Watson, the curator of the Museum of the Indian Department, and increased value is given to the whole by an admirable catalogue,* full of interesting and instructive notes. It should be mentioned, moreover, that this catalogue includes, in their proper places, those objects of Indian production which are placed in the general galleries of the Exhibition, with indication of the position, so that it forms a complete record of the entire contributions of India.

The catalogue is arranged in the order of the classification of the Exhibition, and being supplied with a table of contents, reference is made perfectly easy.

Indian paintings on ivory, talc, wood, papier maché, and other materials, which form the first class, are well known, as are the jewellery, carvings, and models of the second class, the shawls and embroidery of the fifth, and the pottery, woollens, carpets, &c., of the later classes; but the notes which Dr. Forbes Watson has added to the catalogue give interest to many of even the best-known groups of articles. One of the most valuable features of the exhibition is the collection of inlaid and otherwise decorated metal work, for which the Indians are famous, and Dr. Watson gives us some curious information respecting the manner in which the various classes of ornament are produced; thus we are told that "Kooftgari work, or steel inlaid with gold, is produced chiefly in Goojerat and Sealkote, in the Punjab, that of the latter place is distinguished by higher finish. In former days, it was principally employed in the ornamentation of arms, but it is now extended to a variety of fancy articles of personal decoration, such as bracelets, brooches, ear-rings, &c. The work is produced by drawing the pattern, with a fine steel probe, on the surface of the metal to be ornamented. When the pattern is complete, the article is heated over a charcoal fire, and fine gold wire is hammered into the lines traced by the probe. The surface is then polished with an agate-rubber, cleaned with lime-juice, and burnished." Few persons would have imagined such a mode of manufacture, in the absence of the above note.

In connection with the ornaments from Nagpore, worn by the Gonds, the catalogue informs us that, not long since, an elderly woman of one of the labouring classes had her ornaments taken off and weighed, and that they exceeded thirty pounds!

The method of producing the Bidree work—pewter work—is somewhat similar.

"After the pewter has been shaped on a form made of cowdung and clay, a design is cut upon it, and the silver is then applied in leaves and hammered on over the incised parts, where it is cut by the process; when borders are required, a silver wire is introduced and punched into the design. Hooka bowls and Chillums (the pipe part of the hooka) are principally decorated in this way. The workmen complain that they meet with but very indifferent encouragement in our days. There is no doubt that the real Bidree work is very superior to that produced in Surat; the difference of the cost of living in each place has a great deal to do with this, and the Surat men are obliged to demand for inferior work, prices which will secure very superior examples in Bidree, food being much cheaper and wages lower in the latter place."

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* Printed and published in the Exhibition building, by Messrs. J. M. Johnson and Sons.

Similar notes illustrate most of the section, but the above will suffice to show the practical and educational value of the catalogue in question, as compared with a mere dry list of names, numbers, and little else.

In the third class, engravings, photographs, &c., there is much interesting information respecting the ancient buildings, temples, tombs, and caves of India. The photographs, moreover, are remarkable, as illustrating the modes of manufacture, and the domestic and other habits of the natives. As to the shawls, embroidered tissues, and garments, and carpets, each succeeding exhibition only the more clearly proves that all our European art, science, and ability still leave us far behind the poor Indian, with respect to material, design, and execution; but there is this consolation, that the distance between us is far less now than it was in 1851.

Dr. Watson has been careful to explain many native terms, so that the catalogue really deserves a place in the library, as an Indian technical vocabulary. Here is an instance by way of example:—" 'Kinkob,' 'Hemroo,' 'Luppa,' 'Tas,' are all of the same order of manufacture, gold, or gold and silver and silk. The 'kinkob' is principally gold, or gold and silver and silk, the metal predominating, whereas in the 'hemroo' the silk predominates. Another of the latter's characteristics is that the design is generally a diaper or 'boota.' Affixes of 'single' and 'double' are also made use of to designate one colour or several, such as 'ekowdu hemroo' and 'bewdu hemroo.' In Surat, it is known as 'kumjurno aleeacha,' which means that there is only a small quantity of gold thread used in it. 'Luppa' is all gold or silver, that is, the metal only is visible. 'Tas' is much thinner, but manufactured in the same manner."

On one side of the large building which contains this fine collection of objects, sent for exhibition by the government of India, are several small rooms, in which shawls and other articles of unquestionable Indian origin may be purchased.

EXHIBITIONS.

The International Exhibition in Peru.—But little attention has been hitherto paid in England to this important forthcoming exhibition, although no people are more deeply interested in the trade and prosperity of Peru and the South Pacific coast of America generally than we are. The *New York Times*, of the 10th ult., writing on the subject, says:—" The Exposition National of the capital of Peru is expected by the Spanish Americans to be the great event in the history of the progress of the Republics of the South, and there already exists a spirit of generous rivalry and enterprise among the inhabitants of Chili, Peru, Bolivia, Ecuador, Columbia, and the states of Central America, which argues well for the success of the laudable project." It was originally intended to have been opened during the month of July, but the demand for space required by intended exhibitors was so far in excess of what was contemplated, that it was found necessary to provide a much larger building than that which could have been got ready in time to open the exhibition in that month. The government have therefore postponed the opening until December next, which, by the way, is the most favourable season of the year in that country. The great prize of honour to be competed for, by both Peruvians and foreigners, consists of a gold medal and £200. It will be given to the exhibitor of any invention or discovery belonging to any of the classifications which, in the judgment of the commissioners, has required the greatest effort of genius and of application, most time and heaviest expense, and at the same time be of recognised and real utility. The next is a prize of honour for foreigners, consisting of a gold medal and £100, to anyone, not native born, introducing into the country any article which shall produce practical innovations advantageous to the industry of the nation. In addition to the grand prizes of honour, there are to be 24 money prizes, with silver medals, 50 gold medals, 151 silver medals, and 163 medallions of bronze. Senor Don Josias Harris, of 22A, Austin-friars, London, and Lima, one of the commissioners, will take charge of all suitable articles for the exhibition, which he will personally attend. The *Zingra*, which left the Thames last week for Callao, had on board a large quantity of machinery and other articles sent out for the exhibition under the care of this gentleman. The Pacific Steam Navigation Company, which has now a direct line from Liverpool to Callao, through the Straits of Magellan, had made a reduction of 25 per cent. in the freight of all goods intended for the exhibition. The government pay all the costs of transport from Callao, the port of arrival, to the exhibition in Lima. Articles intended to be sent by sailing vessel will require to be shipped in London not later than the end of July, but articles can be sent by the Pacific Steam Navigation Company, from Liverpool, as late as the end of August. The republics of Peru and Chili have made remarkably satisfactory progress during the last few years, and their trade with the United Kingdom has so much increased as to necessitate the Pacific Steam-ship Company establishing a new line of steamers direct from Liverpool, and doubling their existing service on the South Pacific coast; and, when it is borne in mind that upwards of thirty millions sterling is being spent in those countries in the construction of railways, and that almost everything in the form of manufactures and machinery is imported from England, our trade with that coast may be looked upon as merely in its infancy, and, therefore, well deserving of attention and encouragement. *The Panama Star and Herald*, of June 5th, says that a number of animals destined for the Great Exhibition at Lima had arrived at Bogota (United States of Columbia); and that they would be shipped on the above day for Lima. These animals consist of the following, viz., Leicester, Lincoln, and South Downs sheep; Durham and Hereford bulls and cows; Berkshire pigs, besides African buffaloes, baboons, hyenas, &c. The selection has been made in accordance with the views and directions of Doctor Fuentes, the Director of the National Exhibition, with the enlightened and patriotic intention of showing the agriculturists and farmers the great advantage of introducing an improved and thoroughbred stock of domestic animals into Peru. The collection will also serve the purposes of the National Exhibition in the meantime.

THE CULTIVATION AND PREPARATION OF TOBACCO IN INDIA.

The attention of the Indian Government having been directed to the improvement of tobacco, already grown very extensively, though of an inferior quality, the report by Dr. Forbes Watson, of the Product Department, contains a summary of the points most calculated to further the object intended. A manual of the practical operations connected with tobacco growing in Hungary is likewise appended, presumably for the purpose of furnishing examples of the best methods to be adopted; these are still further illustrated with drawings, descriptive of the buildings required, and the shape of the leaves most favourable for the manufacture of cigars. The districts devoted to the growth of tobacco in the provinces of Hungary and Gallicia present very similar features in regard to soil and climate. Although the mode of culture and preparation is still in a backward state, the quality and quantity of the produce satisfy internal wants; there, as in India, the improved and extended cultivation is principally insisted on with a view to an export into foreign countries. Under both circumstances the reform must devolve on the action of the government, and the principal obstacle is the ignorance and want of agricultural skill and of capital among the tobacco planters. Without doubt, any mere mechanical imitation of the directions given will not suffice. What will be wanted is an adaptation of these methods to the modified conditions of Indian climate.

At the same time very careful experiments have been made by different government officials in the acclimatisation of the Havannah seed, under the direction of Mr. E. P. Robertson. According to the unanimous statements, the chief desire of the native cultivators is to obtain strength, which implies a high per-centage of nicotine in their tobacco. But the Havannah tobacco is exactly that which contains the smallest known amount of nicotine, whilst on the other hand it is distinguished by richness of aroma; therefore, in all experiments with new seeds, it is not sufficient to choose what are considered by the ryot good tobacco soils, proper cultivation, &c., it is essential to use other soils and a different culture, to develop qualities different from those at present esteemed in the native commodity. What are considered favourable conditions for the culture of tobacco by the native farmer in India, are in no way an indication of the conditions necessary for ensuring the successful culture of varieties for the European market, and therefore the new trials ought to be made without too much deference to Indian experience.

Considering the importance of the subject, exact scientific observations and experiments have not led to the conclusive results that might be expected. They have, however, established beyond doubt, that complete acclimatisation—that is, a complete reproduction of the plant with all its distinguishing characteristics—is not obtained by merely using the seed of the desired variety. The acclimatisation depends on a concurrence of several conditions, and in the exact measure in which these conditions are fulfilled the acclimatised variety will approach to or recede from its original character. From observation of the principal constituents of the prepared tobacco leaf, it appears that its outward shape and size, the strength and disposition of the ribs, &c., together with the character of the aroma, depend to a large extent on the kind of seed used, and will probably remain substantially unchanged in the acclimatised plant; whereas the amount and relative proportion of the mineral constituents depend exclusively on the soil and its cultivation; and the amount of nicotine and the quantity of the aromatic substances partly on the soil, and partly on the joint influences of temperature, sunlight, and moisture. Next in importance to the cultivation is a proper system of cutting and gathering in the ripe plant. Throughout Europe, in the United States, in Cuba, and in the districts where the best Turkish is grown, the gathering does not take place at once, but extends over a long period, the leaves being taken one by one as each gets ripe. If the gathering of all the leaves is done at the same time, then one cannot fail to gather one portion of them while yet unripe, and another portion when over-ripe, the consequences being alike, almost equally fatal.

The next stage, the curing, consists of a series of operations. The cut leaves are first allowed to wilt, in the next stage they acquire the proper colour, then they are dried, made into "hands," and finally undergo a fermentation. This chemical transformation is a gradual process, and requires time, weeks and months even, to develop itself fully, and during this time there are other influences at work, which may become injurious to the product if the utmost care be not taken. The proper manner of sorting, packing, and arrangement for the market generally has to be finally considered. These operations, which are performed at various periods during the curing of the tobacco, and usually terminate definitively at the end of the drying, cannot, of course, influence the essential quality of the produce. They are, however, of very great consequence in ensuring commercial success. The points to be chiefly considered are the separation of the tobacco suitable for the production of cigars from that which is to be used for the manufacture of snuff, and the subdivision of the leaves, as regards quality, by which means a much better price is obtained for the whole of the produce. Great care and judgment are needed throughout these operations, and Dr. Watson observes that only by ocular demonstration, that is, by having collections of trade samples and other produce accessible to the producers in India, will they be able to satisfy the exigencies of the European market. Otherwise, any mere trifling defect might prevent the value of the article from being rightly appreciated.

To accomplish all these important objects involves nothing less than the reform of a considerable branch of agriculture—a reform not only profitable from an agricultural point of view, by raising the value of one of the Indian staples, but also salutary from hygienic considerations, by substituting the more aromatic and enjoyable varieties of tobacco for those of which the strength lies in their nicotine, a substance which cannot fail to exercise a deleterious action on the system. This can only be brought about gradually, and by the force of example. The possibility of growing superior varieties of tobacco must first be demonstrated practically, and this not only in a few garden experiments, but on the same scale and in the same manner as it is to be conducted by the producers. The reasons for anticipating success are derived from experience gained in the cultivation of the tea-plant in Assam. The similarity between the proposed culture of tobacco and that which has been successfully carried out in the case of tea is very great. In both instances the object aimed at is the production of a leaf containing certain active principles, and combining certain conditions as regards strength and aroma, and even the processes in the final preparation of the leaves are, in some measure, analogous, and certainly require as much nicety of manipulation in the one case as in the other. The conditions under which the experiments in the tobacco will have to be conducted are far more favourable to their success and to their economical importance than in the parallel instance of tea, an entirely new culture; whereas thousands of acres are devoted to the cultivation of tobacco, and a vast mass of the people are already interested in everything which affects the commerce in one of their own chief articles of production. It remains only to open to them the prospect of an advantageous export trade, by showing the preliminary conditions which must be satisfied in view of this prospect.

CATTLE IN NEW SOUTH WALES.

Having regard to the question of the supply of Australian meat into this country, the following account of the cattle in New South Wales is interesting; it is taken from the *Sydney Herald*:—

By the Statistical Register of 1869, the cattle in the colony stand at 1,795,904, while the numbers given there during the last nine years are as follows:—

1861	2,271,923
1862	2,620,383
1863	2,032,522
1864	1,294,119
1865	1,961,905
1866	1,771,809
1867	1,728,427
1868	1,761,411
1869	1,795,904

The decrease in our cattle since 1863 is attributable partly to losses by pleuro-pneumonia during 1862, 1863, and 1864, and partly to cattle-owners selling off their cattle and replacing them with sheep, for two reasons—1st, because the losses of cattle from the disease alarmed them; and, 2nd, because wool was bringing a long price, and sheep-stations were paying better than cattle-runs, independent of the disease, as will be found more fully explained in the portion of this report which accounts for the large increase of sheep during the period from 1863 to 1867.

In no particular district is there a distinct breed. Our cattle are more short-horn than anything else, with a sprinkling, say, perhaps, from one-tenth to one-twelfth of Hereford. There is little or no uniformity among them in quality or form; and, as a rule, there is still plenty of room for improvement. Their want of uniformity, and their mediocrity also, to a large extent, are, of course, attributable to the great variety of breeds from which they are descended. There is in them more or less of the blood of all our British and Irish breeds, and even of the cattle of Cape Colony; and, as if this was not enough of "differentness," the generality of our breeders, under the false notion that such a course was necessary to the proper management of their herds, have been keeping up a continual round of changes in their bulls, to the perpetuation of this incongruity, and the deterioration of their cattle. The unenclosed state of the country, and consequent impossibility of keeping the different breeds separate, have also tended to the deterioration of our cattle, and this, again, has been aggravated by the droughts with which the colony has been frequently afflicted. The scarcity of labour consequent on the outbreak of the diggings has also tended to the deterioration of our horned stock.

Under such circumstances, it is not to be expected that our cattle—looking at them from a thoroughbred point of view—would, as a whole, display much "quality." They do not; and although considerable improvement has taken place in this respect in a large number of herds during the last six or eight years, they are, as a whole, still comparatively short and rough in the coat, hard in the touch, and large in the bone.

As to "form," again, they lack size, squareness, and fulness in the handling points. The best of the general average of our cattle are compact, short-legged, and fleshy enough, but they are comparatively light at the flank, round in the hind quarters, and turned more like the "Black-poley," or "Devon," than the "short-horn," from which their horn, colour, and general appearance, show they are principally descended.

Their "meat" is generally excellent when killed on or at a short distance from the station on which they were fed. It is comparatively fine in the grain, well-flavoured, and fairly marbled. It is seldom, however, that townspeople get it in its prime state, as the effects of the droving not only destroys the flavour of the meat, but wastes the carcase, on an average journey of 250 miles, to the extent of from 75 lbs. to 150 lbs. in ordinary seasons, under careful droving, and a great deal more in droughts and floods, and with careless handling. It is to be hoped that, as the railways are extended, such arrangements will be made for the loading and unloading of the stock, as will induce their owners to send them by rail instead of by the road, and thus save the enormous waste which is now going on in the condition of our fat stock, besides bringing a very large increase of revenue to the railway department.

Ordinarily well-bred bullocks off a good run will leave it, at from 3½ to 4 years old, weighing from 700 lbs. to 800 lbs., and cows 150 lbs. less.

As has been already said, the short-horn blood is the most prevalent in our herds, by far the larger proportion of our imported cattle having for the last thirty or forty years been of that breed; and there is little doubt, considering the state of our horned stock, but that this was the best breed that could have been introduced. The short-horns are superior to all other cattle in size, squareness, compactness, early maturity, and imposing appearance; and the pure bulls of this breed possess the power in an eminent degree of marking their progeny, and conveying to them the size, substance, and quality for which they are themselves so justly distinguished; in fact, they supply the very qualities which our colonial cattle generally lack.

The effect of the importations has been most beneficial, and the best proof which can be adduced in support of this assertion is the contrast which our cattle-stock present, compared with those of Mexico and South America. Thus, while ours are highly valuable, and yielding a handsome return per head, the cattle of both Mexico and South America are comparatively worthless, except for their hides, horns, and bones. They have little or no fat, and their meat is tough and flavourless. There is no doubt but that the encouragement government gave in early days to the importers of well-bred stock tended greatly to the improvement of our herds and flocks, and was thoroughly sound policy.

The Herefords are a superior race of cattle with distinctive type, characteristics, and form, thoroughly established and capable of being transmitted to any other race with which they may be interbred. They are especially remarkable for their large weight, hardihood, and good meat.

The effect of the introduction of the Hereford strain into our herds has, so far, been very satisfactory; and if a constant supply of pure bulls of this breed is kept up in the herds in which it has been tried, still further good results may be expected, as the Herefords are hardier, more active, and carry thicker and heavier coats than the short-horns; they are better suited for inferior pasturage and outlying runs, while they stand the road and winter better. They come as early to maturity, but are not quite so heavy. A good many stock-owners are now beginning to breed from Herefords, and it is to be expected that they will eventually displace the short-horns on the lighter soils and more distant runs.

Devons have found but little favour with our stock-owners generally, as they do not possess the qualities which our own principally lack—*i.e.*, size, squareness, and fulness in the handling points; and they are too active in their movements for any but careful managers. There is no doubt, however, but from their hardiness and good travelling qualities, and from the excellence of their meat, they will, ere long, be found on many of the runs in the far back salt-bush country; and as fencing progresses, we may expect to find herds in the outlying districts with Devon cows breeding to Durham and Hereford bulls, the progeny being fattened off and not bred from.

Taking the cattle in the colony in round numbers, as per the Statistical Register, at 1,800,000, and fixing the annual draft or "cast" of fat stock at one-eighth of the whole—the number that would be sold annually from a fair breeding and fattening station in proper working order—we have 225,000. Then, taking the average price in Sydney and Melbourne markets at £5, the gross annual value of the "cast" of fat cattle would amount to £1,125,000.

To show again the amount received annually from the export of the produce of our cattle, we have as above—

225,000, at 100s.		£1,125,000
Less—		
Consumed in Sydney and suburbs, as partly estimated and partly obtained from slaughter-house returns, 52,000 at £5	£260,000	
Ditto in Maitland, 18,000 at £5 ..	90,000	
Ditto in the rest of the colony, 56,000 at £5	280,000	
		630,000

Leaving value of 99,000 cattle sent into Vic-

toria and South Australia, and boiled down and preserved in this colony, at £5 each ..			495,000
Value of hides of cattle slaughtered in the colony, exported as hides or leather, as above	£126,000		
Less—used for green hide (say)...............	26,000		
At 18s...	100,000	£90,000	
Value of tallow exported from cattle slaughtered (say)..............		75,000	
Value of bones, hoofs, horns, &c. (say)		5,000	
			170,000
Total annual export from cattle......			£665,000

—Report of the Chief Inspector of Stock for the year ending December, 1870.

EDUCATIONAL NOTES.

Education and Competitive Examination.—In arguing against the scheme of the Endowed Schools Commissioners for the re-organisation of Emanuel Hospital, Lord Cairns said that, though he should speak with great respect of competitive examination, he feared that in this country we were drifting much too rapidly into a perpetual and chronic system of competitive examination. At all events, it was most unsuitable as a means of introduction to an elementary school. Imagine a consumptive hospital established on the principle that those applicants should be most eligible for admission whose lungs were in the most healthy state. Well, a school was, after all, an establishment for curing ignorance, and yet, in the present instance, the pupils who were to be admitted were those who were the least ignorant. It might be urged that many schoolmasters were in favour of competitive examination; but, speaking with all due respect for schoolmasters, he maintained that they were the very worst judges on this point. If he were a schoolmaster, he would say, "By all means let every boy who enters my school come in by competitive examination. That will secure to me all the clever boys, while all the dunces will be kept out." Consequently, schoolmasters, instead of being the best persons to form an opinion on this subject, were the very worst. This argument, as applied to "elementary" schools, appears to be unanswerable, but the reply to it is, that the schools in question are not mere "establishments for curing ignorance," which is supposed to be done already in true elementary schools, but are rather intended to afford opportunities to those who have talents for acquiring higher knowledge to make use of them.

Legal Education.—The educational movement is extending upwards. The benchers of the Inner Temple announce that for the future no students at law will be called to the bar at that inn who have not passed the examination—at present merely optional—which is conducted by the Council of Legal Education. On Tuesday evening, Sir Roundell Palmer moved two resolutions in the House of Commons—the first, affirming the necessity of establishing in this metropolis a "general school or university of law;" and the second, proposing an address to the Crown requesting the incorporation, by royal charter, of such an university. In moving these resolutions, Sir Roundell Palmer desired to pledge the House to the principle that, after the establishment of a legal school as before-mentioned, "no person shall be admitted to practise in any branch of the legal profession, either at or below the bar, or as an attorney or solicitor in England, without a certificate of proficiency in the study of law, granted after proper examination." In support of his views, Sir Roundell Palmer expatiated on the desultory and empirical character of our present legal education, and on the importance and advantage of making it really scientific and professional. He described, next, the reception given to the scheme by the universities and the various legal societies, and controverted the pretensions of some of the inns of court to superintend the legal education of the country, and the objections raised to the joint training of barristers and solicitors. Mr. O. Morgan seconded the address, and the debate was adjourned.

Education in New South Wales.—The report of the Council of Education for this colony shows that the public schools increase, and the denominational schools decrease. In 1867, the denominational schools numbered 317; the public schools, 288. Now the positions are reversed, the former being 241, the latter 359. As to numbers, the public schools count 39,731 heads; the others, 36,460. The evils of a double system are much deprecated, and many of the clergy intimate that a compromise would be grateful to them. An hour's religious instruction by the clergyman would satisfy them; they would then give the whole weight of their influence to the public school system. But when the effectiveness of education is to be judged of, it is necessary to consider the figures under "attendance." These are not such as to lead one to suppose that the parents appreciate the value of the boon very highly, for only 65 per cent. of the children enrolled are in attendance. The introduction of a compulsory clause would probably improve this state of things. The total expenditure for 1870 was £154,738, of which £39,583 was realised from school fees. The total amount expended on buildings was £18,750, exclusive of £3,854 from local contributories.

Education in Natal.—It appears by a report of the Superintendent of Education in this colony that the public schools in operation are of two kinds—schools maintained and managed entirely by government, and schools receiving grants of aid from government upon certain conditions. With regard to those of the former kind, it appears that, in 1863, there were but three in existence, but the number has now been largely increased. The schools not wholly managed by government are divided into infant schools, receiving a grant of £50 per annum; district boarding schools, receiving a grant of £80 per annum; and five classes of so-called public schools, which receive grants varying from £16 to £70 a-year. To these must be added itinerant teachers, receiving grants of £16 per annum. The total number of schools of the different classes is about fifty in all. The number of scholars is estimated as follows:—Boys, 1,077; girls, 694—total, 1,771; the cost to government, after deducting receipts, being given as £3,878.

CORRESPONDENCE.

THE RESOURCES OF INDIA.—BRANCH RAILWAY TO THE NEILGHERRY HILLS, IN MADRAS.

SIR,—Your *Journal* having for many years past advocated the advantages that would ensue from placing the hill-stations in direct communication with the plains of India, your readers will no doubt be glad to learn that it is now settled that the above railway is to be commenced.

It will start from, I believe, the Poothanoor station of the Madras line, at about 4¼ miles from Coimbatore, and run a short course to Metapolliam of about 25 miles 28 chains; it will therefore not cross the river Bhowany, which flows at the foot of the hills, and will save the expense of bridging that stream for railway purposes; the present bridge will be available for the purposes of traffic to the hills from Metapolliam.

This branch line will run nearly parallel with the high road from Coimbatore to the hills; it will have a formation width of 18 feet, and be ballasted to the depth of 18 inches, and the rails will be laid on iron pot-sleepers. And I trust that the resources of the Presidency of Madras may be drawn upon to provide a cheap locomotive fuel for it, in the shape of condensed peat, which I have now been advocating for use on its railways for the last four years, with no apparent success, and so keep down its working expenses, which have been steadily rising of late years, while its traffic has greatly fallen off. A cheaper fuel would admit of a reduced rate of freight, and thus allow of the cotton, which is now locked up from the high cost of transport, being brought to port, and its transportation thereto would increase the traffic receipts of the railway, and relieve its cultivators from the heavy loss entailed by its detention—subjects deserving attention.—I am, &c.,

A. Romaine Wragg, Lieut.-Colonel.

Old Charlton, S.E., July 3rd, 1871.

SILK SUPPLY.

Sir,—The question of the silk supply has become a matter of material importance, and no moment could be more opportune than the present for the promotion of sericulture in our colonies.

For some years past we have seen the productiveness of some of the oldest silk manufacturing countries almost annihilated by the terrible scourge that has attacked the silkworm. It is highly necessary that some steps should be taken towards increasing the supply of raw silk to England, and I consider it to be the duty not only of the government, but also of private individuals, to encourage and extend the production of silk in the colonies.

I learn with pleasure, from a recent number of the *Journal*, that the Acclimatation Society of Sidney are endeavouring to promote the cultivation of the silkworm in that colony, by the distribution of some silkworms' eggs that they have received from Japan.

This is one step in the right direction, and I trust it may be followed by other societies in Australia and at the Cape, where the rearing of the silkworm and the cultivation of the mulberry-tree might become a source of wealth to the colonist.

With the intention of throwing out a few hints by which this important industry might become more developed, I shall refer to the attention that is bestowed on sericulture in Italy, and it would be well if her example were followed in our colonies in instructing sericulturists. In the first place, courses of lectures on the silkworm are given by competent professors in most of the principal towns. These lectures, which are free to the public, explain in a proper manner the anatomy, rearing of this useful insect, and the various diseases to which it is subject. The local agricultural societies do all that is possible to procure good seed for their members, and in many places have established model establishments for the purpose of experimenting on the best methods of breeding silkworms, and for introducing fresh varieties; these societies have also conferred great benefits on sericulture, in enquiring into the causes of the epidemic and in endeavouring to remedy it.

The microscope is becoming daily an indispensable instrument in the hand of the sericulturist, and by its aid it may be hoped that the progress of the *Pebrine* will eventually be arrested.

The result obtained this year in Lombardy from silkworms raised from eggs produced on the cellular system of Messrs. Pasteur and Cantoin have been highly satisfactory. The cellular system consists in a microscopic examination of eggs that are intended for breeding silkworms for reproduction, and a selection of the healthiest moths which have completed their metamorphosis in the most satisfactory manner. Each pair of moths (male and female) is placed in a separate cell, and, after the eggs are deposited, both moths and eggs are carefully examined with the microscope, and should no trace of disease be found, the eggs are preserved for the following season. Should more than 2 per cent. of the eggs be found infected, they are destroyed. This system, if not wholly certain, is certainly based upon sound principles, and several well known sericulturists undertake to supply eggs obtained in this manner to their numerous clients.

A great deal has also been done with regard to the re-acclimatation of the mulberry in Italy by Signor Cattaneo, of Milan, who believes the disease in the silkworm to be caused by a degeneration of this tree since it was introduced into Europe. Whether this is really the case or not it is not for me to say, but Signor Cattaneo's arguments seem to be well founded, and the specimens of mulberry trees obtained from original seed, brought by him from the north of China, are far more luxuriant in growth than the common white mulberry usually cultivated in Italy, their leaves containing a greater quantity of resinous substance and nutriment, which undoubtedly tend to preserve the worms in a healthier state, and therefore more able to resist the attack of the epidemic, and to produce a larger quantity of silk. The cultivation of the mulberry for its leaves might also become most profitable to the land proprietors and farmers, and for this reason it would be well to procure the best varieties, and to introduce it direct from China, instead of the impoverished tree of Europe.

The re-acclimatation of the mulberry tree, combined with the artificial selection of the grain by the microscope, seems to me to be the most rational means of preventing the spread of the disease, and I should strongly urge upon intending cultivators in the colonies to turn their attention to generating the silkworm by these means, instead of drawing their supply of grains from Japan and other countries from year to year, at greater cost, and with less certainty of success. It may be worth consideration whether it would not answer to rear silk-worms expressly for the purpose of supplying other countries with grains, and in this manner to compete with Japan, which is at present the principal source of supply.

Colonial societies would do well to put themselves in communication with other societies both in Italy and France, and in this manner profit from the experience of the latter. Prizes should also be offered, not only for the best silk produced, but also for grains and mulberry trees. I should also venture to suggest to the Society of Arts to offer a prize for the best bale of silk sent from the colonies to England, or for the first batch of grains exported to Europe, and which have given satisfactory results.

Numerous treatises and handbooks on sericulture are published in Italy, and I have before me the list of a Milan bookseller, containing no less than eighty works on this subject. These are chiefly cheap pamphlets, varying in price from 0·50 centimes to from 4 to 5 francs each. A collection of these books would be a useful addition to the library of a Colonial Acclimatation Society, and some of the best might be translated and sold at a cheap rate by the Society.

How valuable, also, it would be if competent persons were sent to Italy and other silk-producing countries to report on this industry, and if the colonies were to be represented at the International Congress of Sericulture that is to be held in the autumn at Erdine, the government in this manner would confer inestimable benefit to colonial silk producers, as also to your obedient servant,

Lomellina, 20th June, 1871. Bombyx Mori.

OBITUARY.

Colonel George T. Haly died suddenly on the night of Sunday, the 18th of June, at St. Leonards-on-Sea, while on a visit to his brother-in-law, General Haly. Colonel Haly was the son of the late Sir George Haly, governor of Newfoundland, and had seen considerable service in India, and was twice wounded in engagements with the natives. He has written several pamphlets on the condition and resources of India. He became a member of the Society of Arts in 1869, and took an active interest in the working of the India Committee and the conferences held in connection with it.

GENERAL NOTES.

Hill Stations.—It is to be regretted that the Indian government is not complying with its pledges. In this hot season, only 4,587 English troops and 1,851 convalescents are to be placed in the hills. Were only the promised fifth permanently kept in the hills, we should have a great extension of tea-gardens, cotton culture, and industrial enterprises, tending to promote permanent settlement.

Sulphur in the Province of Caltanissetta, Sicily.—The following extract is taken from a report sent by M. Thibaudier, of the French consulate at Palermo, to the Minister of Foreign Affairs, 20th January, 1870. In the province there are altogether about 134 mines at work, which employ 11,000 workmen, and produce 105,350 tons of sulphur. This is almost entirely transported to the coast by means of mules, and is shipped from the ports of Girgenti, Catane, Terranova, and Licata. The price varies from twenty-two to fifty francs per ton. The principal mines of the province, either from the development which they have already obtained, or from the importance that they are likely to acquire in a short time, are in the mining district of Caltinissetta, viz., Trabonello, Gebbria rossa, and Giordano (stretto); the Capo d'Arso and Floristella, in the Castro Giovani district; Gallitano, in the district of Mazzarino; Grottacalda, in that of Piazza; Sociale, in the Montedoro district; Solfare Grande, in the Sommatino district; and in the Riesi district, the mines of Solfara del fiume, Apaforte, and Stincone. Some of these mines already have a production of from five to eight thousand tons annually, as Trabonello, Capo d'Arso, Solfare Grande, Grottacalda, and Solfara del fiume. All the mines are capable of great development.

Coloured Cement.—Professor Böttger prepares cement of diverse colours and great hardness by mixing various bases with soluble glass. Soluble soda glass of 33 deg. B. is to be thoroughly stirred and mixed with fine chalk, and the colouring matter well incorporated. In the course of six or eight hours a hard cement will set, which is capable of a great variety of uses. Böttger recommends the following colouring matters:—(1) Well sifted sulphide of antimony gives a black mass, which, after solidifying, can be polished with agate, and then possesses a fine metallic lustre; (2) fine iron dust, which gives a grey black cement; (3) zinc dust—this makes a grey mass, exceedingly hard, which, on polishing, exhibits a brilliant metallic lustre of zinc, so that broken or defective zinc castings can be mended and restored by a cement that might be called a cold zinc casting: it adheres firmly to metal, stone, and wood; (4) carbonate of copper gives a bright green cement; (5) sesqui-oxide of chromium gives a dark green cement; (6) Thenard's blue, a blue cement; (7) litharge, a yellow; (8) cinnabar, a bright red; (9) carmine, a violet red. The soluble glass with fine chalk alone gives a white cement of great beauty and hardness. Sulphide of antimony and iron dust, in equal proportions, stirred in with soluble glass, afford an exceedingly firm, black cement; zinc dust and iron in equal proportions yield a hard, dark grey cement. As soluble glass can be kept on hand in liquid form, and the chalk and colouring matters are permanent and cheap, the coloured cements can be readily prepared when wanted, and the material can be kept in stock, ready for use, at little expense. Soluble glass is fast becoming a most important article of chemical production.

The Library of the Luxemburg Palace is now re-opened to the public. It had been closed in consequence of the explosion of the powder magazine, which had caused damages requiring repair. This explosion had shattered all the glass in the large gallery to which the public is usually admitted, and also that of the two principal annexes. It threw down several large doors, and particularly those facing the Observatory. The books, however, had all remained intact, and they are once more at the disposal of the public.

The Vendome Column.—A search made at the house of M. Camélinat, director of the Mint under the Commune, has brought to light a very curious calculation on the profit the Commune expected to make out of the Vendôme Column. The expenses of pulling it down were 25,000 francs; those of its transport, 15,000 francs. It was calculated that they have to add 75,000 francs' worth of copper to the bronze to convert it into sous. This alloy was to have produced a million of francs, in five or ten centime pieces. The memorandum of M. Camélinat concludes by saying that thus a net profit of 885,000 francs would be obtained.

The Halfpenny Postage.—Nearly nine months' experience of the halfpenny postage does not appear, the *Globe* states, to have belied the anticipations respecting it. There are no such signs of a serious diminution of postal revenue as had been predicted—although a loss of £50,000 was caused by the abolition of the newspaper stamp—while the development of the postal service has only been in proportion to public requirements. It is clear that the Post-office administrators were prepared for a large addition of work. In the first six months of the new rates, upwards of 58,000,000 post-cards, and about 114,000,000 halfpenny labels and stamped-wrappers were issued. In one direction, however, the anticipations of the authorities appear not to have been verified by results. The quantity of paper sent in by the public to receive the impressed stamp appears to have fallen far short of the estimate, the number of stamps impressed being only in the proportion of 10 per cent. to the wrappers supplied at Somerset-house. The six months' issue of the halfpenny postage was as follows:—½d. postage labels, 77,215,680—duty, £160,866; ½d. post-cards, 58,485,960, £121,845; ½d. wrappers, 33,048,420, £68,850.

The Turin and Savona Railway.—The works of the railway from Turin to Savona, which were suspended in the spring of 1866, have been lately resumed, arrangements having been made by the Italian government with the contractor, Signor Guastalla, for completing the line, as well as the branch from Savona to Acqui (15 kils. in length). The first section of the line from Savona to the Sella tunnel (2,260 metres in length) which, at the stoppage of the works, was about half completed, will be finished in the course of a few months. The next section (17 kils. in length), from the Sella to the great tunnel through the Appenines, viz., the Belbo (4,240 metres in length) is being pushed forward with the greatest activity, as also the next section (six kils. in length) to Ceva, where the railway joins the valley of the Tanaro. From Ceva to Bra, the most difficult parts of the line are already sub-let for a distance of 24 kils., leaving still 27 kils. of lighter work yet to be commenced. The number of tunnels on this line, not including that of the Belbo, is 27, of the united length of about six kils. In the valley of the Tanaro there are also many important works, as this river is crossed no less than eleven times by the railway. Near Bra the line crosses the river Stura, on a bridge of seven arches, of 20 metres span each, of brickwork. On the line from Savona to Acqui there are also many important works, as the river Bormida is crossed several times by the railway. Besides this, there are eight tunnels, of a united length of 1,725 metres. The total length of the main line is 94½ kilometers, and that of the branch to Acqui, 48 kils. These important lines are to be finished by the end of 1872.

Indian Hills.—"Monitor," in the *Asiatic*, suggests that if English recruits under 21 arrive in India, they should be at once sent to the hills, so as to preserve their stamina, and, it might be added, to give them the chance of participating in industrial labour.

Vegetable Ivory Nuts.—From the port of Savanilla, in Columbia, 540,000 lbs. of these nuts were shipped in 1869, valued at £1,498. From Santa Martha, the shipments were 387,904 lbs., valued at £960. From Guayaquil, 8,580 cwt., worth, at 6s. per cwt., £2,574.

India-rubber from Guayaquil.—There has been a large increase in the shipments of rubber from Ecuador at the port of Guayaquil. In 1868, 16,273 cwt. was shipped, and in 1869, 17,652 cwt., but the average price was somewhat lower, at £2 15s. per cwt.

Outilla Wood.—The collection of outilla wood has been carried on energetically, during the last few years, from Guayaquil, 10,444 cwts. having been shipped in 1868, and 12,770 cwt. in 1869. In Santa Elena, the supply has almost failed, so that there only remains that from the Galapagos Isles. It is valued at 30s. a cwt.

French Journals under the Commune.—We learn from *La Liberté* that the person who possesses the most complete collection of journals which appeared under the Commune is the ex-Emperor Napoleon III. There is not a sheet, not a broadside, however ephemeral, of which a collection has not been bought for Chislehurst. The last packet, composed of late numbers of *L'Officiel* and of *Père Duchêne* was sent off from Paris on 17th of June, and was addressed to one of the ex-Emperor's valets.

The Meat Supply of the United Kingdon.—The live stock census in 1870 gave us, says the *Chamber of Agriculture Journal*, 9,235,052 cattle of all ages, 32,786,784 sheep of all ages, and 3,650,730 pigs of all ages, representing, according to the estimate adopted, a production of 659,646 tons of beef and veal, 409,834 tons of mutton and lamb, and 151,145 tons of pork and bacon, or a total of 1,220,625 tons of meat. The imports of 1870 were 202,175 cattle and calves, 669,905 sheep and lambs, and 95,624 pigs; or, in other words, 45,127 tons of beef and veal, 14,953 tons of mutton and lamb, and 3,842 tons of pork and bacon, making a total live importation of 63,922 tons. The dead, salted, and preserved meat received from abroad in the same year was 57,743 tons. Thus the meat supply of the United Kingdom last year amounted to 1,342,290 tons (including 5,825 tons of British and Irish beef, pork, bacon, and hams, and 1,147 tons of foreign and colonial bacon and hams exported), of which 63,922 tons, or 4¾ per cent., were imported as live animals.

Beef Extract in Combination.—The *American Journal of Pharmacology* says that Dr. Edmund Parrish, observing how some patients acquire a disgust for essence of beef and beef-tea, given constantly under medical advice, suggests the use of Liebig's extract in extemporaneous mixtures with iron, quinine, the phosphates, and other tonics, dissolved in either very dilute alcoholic or in saccharine menstrua. Some judgment is required in the selection. As a rule, sweet syrups are best adapted to children; great care is required not to cloy the stomach of an adult with sweets. Fluid extract of liquorice is one of the best excipients for disguising the meat flavour; that made from the root by the use of diluted alcohol gives a strong liquorice flavour and taste without much body. Diluted phosphoric acid, or the compound syrup of phosphates, is a good addition. Strong alcoholic liquids would be incompatible with it, but wines mix well, increasing fluidity and producing but slight precipitation. Wine of iron or bitter wine of iron may be advantageously added in the proportion of one part of the wine to three of the *extractum carnis fluidum*.

The New Postal Rates.—The new postal arrangements will come into operation on the 1st of August. The scale will be:—For parcels and letters of all sorts, closed or open, making no distinction between them, as follows:—Not exceeding 1oz., 1d; above 1oz., but not exceeding 2oz., 1½d.; above 2oz., but not exceeding 4oz., 2d.; above 4oz., but not exceeding 6oz., 2½.; above 6oz., but not exceeding 8oz., 3d.; above 8oz., but not exceeding 10oz., 3½.; above 10oz., but not exceeding 12oz., 4d. Twelve ounces to be the limit of weight for letters.

The Post-office in Italy.—The direction of the post in Italy publishes the following statistics respecting the postal service in 1870, as compared with that of the previous year. The total number of letters posted in 1870 was 89,430,261, against 87,613,348 in 1869, showing an increase in favour of 1870 of 1,816,913. This amount was divided as follows:—

	1870.	1869.
No. prepaid	81,719,916	79,348,315
,, unpaid	5,301,978	6,157,510
,, registered	2,270,811	1,980,690
,, insured	137,556	126,803
Value of letters insured	101,886,601 fr.	106,442,315 fr.
Newspapers and periodicals	59,899,212	59,102,556
Otherprinted matter	15,242,544	14,869,904

The number and value of money orders was as follows:—

Italian Orders.

	1870.	1869.
No. issued	2,745,876	2,500,930
Value	232,318,011·58 fr.	193,269,499·69 fr.
No. paid	2,698,033	2,483,281
Value	232,200,950·67 fr.	193,228,717·91 fr.
Foreign Money Orders.		
No. issued	69,060	65,034
Value	27,489,350·63 fr.	12,041,004·75 fr.
No. paid	95,560	90,396
Value	27,849,633·63 fr.	12,533,993·51 fr.
Postage Stamps.		
No. sold	104,752,011	98,302,653
Value	13,768,630·52 fr.	13,488,776·40 fr.

Land in South Australia.—The government now propose to sell land in agricultural areas on the following terms, which are considered very advantageous to the selectors. The land will be offered only on credit. The government fix an upset price, which is the supposed value of the best land in the area, and at intervals of not less than seven days, nor more than two months, the upset price is to be reduced 5s. per acre at each reduction until it reaches £1. A person taking up land in the agricultural areas must at the time of purchase pay down 10 per cent. on the amount of purchase-money, and at the end of the three years another ten per cent., and these sums will constitute the interest on the purchase-money for five years. Should he wish for further credit he can obtain it for three years longer, on payment in advance of further interest at the rate of 5 per cent. per annum on the purchase price of the block. During the time of occupation, he will be required to make substantial and permanent improvements on the land to the following extent:—During the first two years, 5s. per acre; before the end of the third year further improvements, so as to make up a total of 7s. 6d. per acre; and before the end of the fourth year, a total of 10s. per acre. These improvements may consist of a dwelling-house, farm-buildings, wells or reservoirs of water, and fences.

MEETINGS FOR THE ENSUING WEEK.

Thurs...Society for the Encouragement of Fine Arts, 8. J. T. Wood, Esq., on "The Discovery of the Temple of Diana at Ephesus." (Illustrated.)

Fri.......Royal Botanic Society, 3¾.

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FRIDAY, JULY 21, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The Fifth of the Series of Six Concerts in aid of a National Training School for Music was given by the Society, at the Royal Albert Hall, on Wednesday evening, July 19th.

The following Music was performed :—

Overture.......................... Gustave ....*Auber.*
Quartet...“Un di se ben rammentomi” (Rigoletto)...*Verdi.*
Madame LEMMENS-SHERRINGTON, Mademoiselle FERNANDEZ, Signor VIZZANI, and Signor FOLI.
Song......... “O, mio Fernando” (La Favorita) ....*Donizetti.*
Mademoiselle FERNANDEZ.
Duet, Pianoforte and Violoncello { “Variations in D” (Op. 17) } *Mendelssohn.*
Herr ERNST PAUER and Mr. E. HOWELL.
Song.........“Oh, ma Maîtresse” (Lalla Rookh).........*David.*
Mr. W. H. CUMMINGS.
Song.....“Ocean, thou mighty monster” (Oberon).....*Weber.*
Mademoiselle TITIENS.
Overture................. “In Memoriam” ....*Sullivan.*
(Conducted by the Composer.)

Part II.

Overture...................... Leonora ....*Beethoven.*
Romanza........“Alma Soave” (Maria de Rohan)........*Donizetti.*
Signor VIZZANI.
Song............ “O vago suol” (Gli Ugonotti) ....*Meyerbeer.*
Madame LEMMENS-SHERRINGTON.
Trio...... “Guai se ti sfugge” (Lucrezia Borgia) ......*Donizetti.*
Mademoiselle TITIENS, Signor VIZZANI, and Signor FOLI.
Solo, Pianoforte............ { “La Campanella”...........*Taubert.* and “Tarantella” ....*Pauer.* }
Herr ERNST PAUER.
Aria................ “Nasce al bosco” (Ezio) ....*Handel.*
Signor FOLI.
Duet................. “Philémon et Baucis” ....*Gounod.*
Madame LEMMENS-SHERRINGTON and Mr. W. H. CUMMINGS.
Overture.............. Le Nozze di Figaro ....*Mozart.*
Conductor.................. Sir MICHAEL COSTA.

The Sixth and last Concert of the Series will take place on Wednesday next, the 26th July, at 8 o'clock. The following artistes will appear—Mademoiselle Titiens, Mademoiselle Natalie Carola, Signor Prudenza, Signor Mendioroz, Signor Agnesi, Signor Sivori (violin).

The Council have the satisfaction of announcing that His Royal Highness the Prince Oscar of Sweden and Norway, who is a great promoter of musical education in his own country, will be present, and that the Members of the London School Board and the Masters of the twelve City Companies, are invited to meet him at 7.30 p.m., previous to the Concert, which will begin at 8 punctually.

The prices of admission will be from one shilling.

Tickets may be had of Mr. S. T. Davenport, Financial Officer of the Society, at the Society of Arts, 19, John-street, Adelphi, and of the usual agents.

DRILL REVIEW.

In accordance with the report of Council (see page 623, *Journal* 971), subscriptions of five shillings and upwards are invited towards the expense of the last and future reviews. The following amounts have been already received :—

	£	*s.*	*d.*
James Austin....	1	0	0
B. W. Bartram ..	1	1	0
L. Biden........	1	0	0
Sir W. H. Bodkin	1	0	0
W. W. F. Bolton	1	1	0
Wm. Botly	0	5	0
H. A. Bowler....	0	10	0
A. Cassels	0	10	0
A. S. Cole	0	10	0
Henry Cole	2	0	0
Sir Daniel Cooper, Bart. (will increase if needed)	1	0	0
W. Cooper	0	10	0
Rev. B. M. Cowie	1	1	0
Major-Gen. Croggan, R.A......	0	5	0
J. A. Crookenden.	0	10	6
John Cubitt	1	1	0
Thomas Dixon ..	0	10	6
John E. Evans ..	0	10	0
W. H. Fell......	1	1	0
F. Filliter.......	1	1	0
J. A. Franklin ..	0	10	0
Samuel Harton (to be doubled if required)......	0	5	0
Sir Rowland Hill	1	1	0
G. N. Hooper....	1	1	0
Chas. Horne (will give 10s. more if required)	0	10	0
Dr. Albert Horwitz..........	0	5	0
Edwin Lawrence	1	0	0
Maj. E. W. Mathew	0	10	0
R. Nicol	1	1	0
James Noble	1	1	0
John Noble	1	0	0
John Pritchit....	0	5	0
Edward Rosher ..	0	10	0
W. S. Rumsey ..	0	5	0
Philip Sancton ..	1	0	0
S. Metropolitan District School	10	10	0
George Stanton..	0	10	0
W. H. Tanqueray	0	10	6
Charles Telford..	1	0	0
Seymour Teulon	1	1	0
W. H. Thomas ..	1	0	0
E. C. Tufnell....	5	0	0
Z. Watkins......	0	5	0
C. Williams	1	1	0
W. B. Wrightson	1	0	0
	£48	8	6

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

OUR FOOD-PRODUCING RUMINANTS, AND THE PARASITES WHICH RESIDE IN THEM.

By T. Spencer Cobbold, M.D., F.R.S., F.L.S.

Lecture III.—Delivered Monday, May 1st.

The Bovine Ruminants, especially in relation to Diseased Meat caused by Cestode Entozoa.

Mr. Chairman, Ladies, and Gentlemen,—It will be within your recollection that the greater part of my discourse, last Monday evening, was devoted to the consideration of a little parasite named trichina. That creature is extremely rare in the flesh of cattle, but the same cannot be said in respect of the parasite whose larvæ I referred to at the close of the lecture. As regards trichina, many points of interest were necessarily omitted, because I only introduced the subject incidentally; and since I cannot, of course, answer all the questions which have naturally found expression in the interval, I will only notice one or two of them before proceeding with the more immediate subject of this evening's lecture. It has been said, can these muscle trichinæ, after they have arrived at their destination within the flesh of a man, produce any more unfavourable consequences to the host or bearer? The answer is, certainly not. In the case of man, it would be necessary that his muscles should be eaten in order for the trichinæ to become developed; and in those countries where cannibalism exists, the man-eater would himself become trichinised, and I dare say you will agree with me that he would deserve his fate. I was very desirous, as I mentioned, of following up the account of this outbreak by inquiries respecting the particular animal which had been the cause of the outbreak. I may therefore mention that my informant, Dr. Dickinson, states that the family, including the man-servant, all fed together, and that they had for upwards of a fortnight eaten daily, and sometimes twice a-day, sausages made from the flesh of the trichinised animal. And he adds, the meat cut from the hams and flitches, and what is called the spare-rib, was roasted before the fire or in the frying-pan; occasionally it was cooked in the oven. Dr. Dickinson ascertained from the mother that she liked meat underdone, and therefore there is very little doubt that the meat was generally under-cooked. The man is a strong labourer, had a good appetite, and would therefore get a good share. He is improving slowly. Dr. Dickinson adds in a postscript, what is still more to the point, that the sausages would be most likely undercooked; they would be cooked in the frying-pan, and if only brown on the outside would be eaten. It is probable that the outbreak was due therefore to eating of underdone meat from this pig, cooked in various ways, and not from the ham itself only.

To return to the consideration of the *Cysticercus bovis*. You will remember that I told you of an experiment which, in conjunction with Professor Simmonds of the Veterinary College, I had performed on a calf; and I told you the kind of effects produced by this experiment up to a certain point. We ascertained that the migration of the larvæ, or the six-hooked embryos, which escaped from the eggs, produced symptoms in the animal on the 15th, 16th, and 17th days after the adminstration of the eggs. You will remember also that we fed the animal with the joints of a particular parasite, or tape worm, known as *Tænia mediocanellata*. The calf having recovered, we caused it to be slaughtered at the expiration of 14 weeks, and the result of our examination of the flesh after death was such as to give us very characteristic specimens of measled meat. In this jar on the table I have portions of muscles of the calf, and also portions of measled beef from a subsequent experiment. In either case the larvæ are well displayed. You will observe in these specimens what I venture to say, even now, no butcher in the United Kingdom has ever yet seen—at least those to whom I have spoken on the subject never saw or heard of such things until I communicated these facts to them. You will say, perhaps, they had no desire to see them, and therefore, since none are so blind as they that will not see, that may account for their ignorance of the matter. That, however, is not the sole reason. When we brought into view one of the muscles, we found on the surface, by careful dissection, an arrangement of these little larvæ in their cysts, precisely as they are represented in the large diagram. At the surface of this heart of a calf you observe little projections or cysts, each of which contains in its interior one of the aforesaid larvæ. Professors Leuckart and Mosler are the only experimenters on the Continent who have reared this parasite in the ox, whilst Professor Simmonds and myself have done the same in this country. Whatever information therefore has been obtained from experimental research in this matter is due to our united labours. I may also mention, as a further novelty in this connection, that Professor Zenker and his colleague Dr. Heller have likewise succeeded in rearing these little unarmed cysticerci in the goat. I have not quite clearly explained to you how the transformation takes place, and I must, therefore, be a little more explicit. Here is a small egg of a tape-worm, say $\frac{1}{800}$th of an inch in diameter, containing the six-hooked larval parasite. When the egg has been introduced into the alimentary system of the ox, the gastric juice dissolves the coat or shell, and the hitherto contained embryo makes its escape. The embryo then bores its way through the walls of the canal, and passes into the blood-vessels; and thence, by the medium of the circulation, towards the muscles. Having by further boring gained access to the muscular tissue, it comes to a state of rest. During the resting stage it parts with the six hooks (which are no longer wanted for the purposes of tearing and boring), and undergoes a series of changes of too complicated a character for me to detail to you, but which are, nevertheless, represented in the diagram. By these changes it is converted into a cysticercus, that is to say, into a higher larval condition, characterised by the presence of a head, with or without hooks, according to the species; in this case without any hooks, but with four suckers, as in the adult animal, a neck, and a large, bladder-like tail. Now, when it has arrived in the muscles—precisely as obtains in the case of the trichina—it waits to be eaten. If it is not eaten it will die. It is a point, therefore, of some importance to determine how long it will live in this situation before finally perishing. In the case of the trichina, the larval life is longer than that of the parasites I am now describing. In the second experiment, which I performed in conjunction with Professor Simmonds, the heifer was not slaughtered until the expiration of more than a year, thus affording the very kind of information I was anxious to obtain. We had thus given the cysticerci time to live as long as they could, and I found that all the little cysts, without exception, had undergone a process of degeneration. Thus, therefore, a natural process of cure by means of calcareous degeneration was demonstrated to have taken place. This is practically very interesting, because, even if you had an animal whose flesh happened to be crowded with these minute organisms, there would be, you perceive, after a short time, a perfect destruction of the parasitic inhabitants of the bearer. The meat could be eaten with impunity, nor would there be any injury to the flesh, rendering it in any other sense unfit for human food. Another practical point has thus been gained by experimental research. I have yet further to remark in this connection that, having carefully examined the cysticerci of the heart of the calf, I was surprised to find that the larvæ had not developed themselves so perfectly in this organ as they had done elsewhere. The most normal specimen encountered had only three cephalic suckers in place of four, and most of them had but one; a few, however, had two, while a majority had not been able to develop any appearance of a head. The most complete larva shewed one sucker well developed, two others imperfectly so, with a calcareous patch in the centre of each, whilst the fourth was wholly wanting. It is curious to notice that those parasites which pass into the heart very rarely succeed in growing to perfection. In the case of the trichina, they pass through the heart, and will not stay there, because the abode is obviously unsuitable. You may ask, why not stay? Well, the heart is a highly contractile organ, and its muscular fibres are so densely set that the pressure is such as would not afford these creatures adequate room for their full development. There are some other parasites, however, which get into the heart, and, notwithstanding this inconvenience, do manage to develop somewhat more perfectly. I shall probably have occasion to allude to them again.

I may mention, in passing, that there is a specimen of mammalian heart in the museum of Guy's Hospital, which, some years ago, when studying the entozoa of our metropolitan museums, excited my attention. It is stated in the catalogue to be from a bear, and is particularly interesting as being extensively occupied by larval cestode parasites resembling those reared in experimental animals. It would be very interesting to know the history of that preparation, and of the bear, or the bearer, but I fear it is not forthcoming. I should have mentioned that, in the heifer which was killed at the end of a year, we obtained about 12,000 larvæ.

The practical question before us is this:—How do the measles obtain admission to the human territory under ordinary as well as under unusual circumstances. When the flesh of any animal is eaten by us, if the flesh be not properly cooked, cysticerci will become transferred to our alimentary system, and they will undergo changes quite as remarkable as those which obtain in the case of the trichinous larvæ as already explained. Thus, if we swallow a portion of this calf, each one of the little cysts would be liable to undergo changes which would result in the formation of a creature from ten to fifteen feet in length. As soon as the larva is transferred to the vital organs of man, the cyst in which it is enclosed is readily digested, and the little cysticercus makes its escape, after the fashion of the six-hooked embryo when the egg was previously swallowed by the intermediary bearer. Curiously enough, the gastric juice dissolves away all the bladder-like tail portion of the animal, but the head and neck retain sufficient vitality to enable the animal to fasten itself on the wall of the alimentary canal; and, immediately thereafter, by a process of budding, little joints begin to form below; so the process goes on, week after week, until eleven, twelve, or thirteen weeks have elapsed, and at the end of that time you have a completely developed tænia from each larvæ.

Now, how do we know that is the case? The evidence on this point is perfectly distinct and conclusive. First of all, we have our experiments on animals with a great variety of cysticerci, showing that one form of cysticercus will yield but one kind of tænia. Thus, a considerable variety of species have been reared by our experiments. But not only so, for Dr. Küchenmeister was, very properly, allowed to experiment on condemned criminals. Although it sounds rather strange, there was really no harm in that, as benefit was conferred on others, without the slightest injury or inconvenience to the criminals. Dr. Küchenmeister experimented twice in this way, and obtained positive and satisfactory results in both cases. In one case, in which only a few hours (two days, I believe, was the exact time) were allowed to elapse, very young tapeworms, just developing from the head, were discovered; and in the other case, where a greater length of time was allowed, the parasites had obtained a considerable degree of development. But to show that there was nothing so very shocking in these experiments, I may tell you that people animated by a desire for the welfare of their fellow-species, subsequently came forward and subjected themselves to experiment. Thus, one gentleman allowed Professor Leuckart to experiment, by giving him four cysts, or measles from a pig, to eat. The pork measle is a much more dangerous larva, seeing that it developes into the *Tænia solium*, having four hooks on the head, whilst the beef measle developes into the *Tænia mediocanellata*, which is hookless. It was really courageous on the volunteer's part, because the pork tapeworm is an extremely difficult guest to get rid of, once you have undertaken to entertain him. However, the volunteer having taken four cysticerci, eventually succeeded in playing the part of host to four tapeworms in consequence. Again, a medical student, named Humbert, actually swallowed numerous cysticerci, when, as a satisfactory result, a considerable number of these cestode creatures were developed in his interior. By disciplines of this unselfish order it is that the cause of science is advanced.

All these experiments, made on animals and man, have led to the inevitable conclusion that certain larval parasites, when swallowed, will bring about the development of well-known adult forms of tænia. There is no escape from this. But some say, we are not satisfied that such things do really take place in the ordinary course of nature? Has anyone ever seen such a thing as a beef measle in any animal killed for food? Have you any proof that these developments take place naturally? To all of these, and many other kindred questions, I am in a position to give entirely satisfactory and affirmative answers. You must understand that, for the detection of parasites of this kind, people must be educated properly. A meat inspector may be a very honest and able man in many respects, but if he never saw these things, of what use is it to ask him to look for that which he does not recognise even when he sees it? For instance, I read in the *Indian Medical Gazette*, published at Calcutta, which I received this afternoon, that in a certain locality, nearer home, four policemen are employed as animal-food inspectors, under the direction of the deputy-clerk of the markets. Now, I have a great respect for the constabulary force, but I respectfully submit that four policemen, or 400 for that matter, would not be able to determine a scientific question of this kind. The sort of people that are to be paid for inspection of meat should be men who have devoted years to the study of this subject, not people who are merely simple, honest, good men in other avocations. The writer of this article in the *Indian Medical Gazette* makes a very sensible remark when he says:—"Without advocating for Calcutta an elaborate or expensive organisation, we would at least demand the appointment of one skilled inspector of meat, armed with full powers to examine all meat, and to confiscate all bad meat." The further importance of this observation will appear when you find it elsewhere stated:—"The number of cattle slaughtered during the fifteen months commencing November 1st, 1868 (the number for each separate month being given), amounts in the whole to 654 bulls and 1,455 cows, and out of this number no less than 899 cattle were found affected with larval parasites." Statements of this kind will give the audience some idea of the practical importance of the subject.

But you will say, touching this animal you have been describing, this beef measle, has any one ever seen it? Well, to be candid, I reply that no one in this country has seen it in slaughter-houses or butchers' shops, for the chief reason that no one knows anything about it. I had an application made to me very recently by an inspector of slaughter-houses in one of the largest cities in Her Majesty's dominions, requesting me to put him in possession of the kind of information which would enable him to recognise these things if they happened to be there. As you will perceive, one cannot be educating people all over the United Kingdom in this sort of way. They ought to look out for themselves. If information is published, they ought to take opportunities of studying the publications in which that information is given; for when one has written a hundred distinct papers on the subject, besides a large treatise, one cannot be expected to give individual replies to every applicant for information. The thing is impossible. The number of questions which are put to me week after week by well-disposed people in different parts of the country is collectively enormous. It had, indeed, become necessary that these facts of parasitism should be made more widely known, and therefore our best thanks are due to the Society of Arts for the present opportunity of publicly opening up the subject.

But, touching the question as to whether the *Cysticercus bovis* has ever been seen in a state of nature, I happen to have in my hand the most satisfactory evidence. This *brochure* is the Bombay medical officer's report for the last quarter of 1870. It forms a most satisfactory contribution to our knowledge of the facts as they occur in nature. Dr. Hewlett, the writer, has not only made himself acquainted with this parasite, but has given a most admirable representation of the creature, quite as good, if not better, than any which Leuckart, myself, and others have published as the result of our experimental researches. Dr. Hewlett says:—"During the quarter, the carcases of 13 full-grown cows and one bullock had been destroyed by my orders, on account of the flesh of these animals having been found to be infected with what is popularly called tape-worm or measle." Let me tell you that these records from India give us the first indication of a true knowledge of this subject abroad; and this knowledge of what may be found in the flesh of cattle has been derived entirely from the researches of Professor Leuckart and myself in this connection. We had experimented in this way, and had published the result of our experiments, and told people to open their eyes and they would find these things in nature; and, though they have not been found in our own country, in India, as you see, they have observed the indications we pointed out, and our predictions have been verified to the very letter. This shows that science does really originate sometimes the most interesting practical discoveries. Dr. Hewlett also gives another figure of a small portion of the meat (which is exactly a representation of what might have been taken from our experimental calf), showing the parasite of its natural size. I will not detain you by reading any lengthened extracts from his valuable report; but in his advice as to burning, Dr. Hewlett has gone farther than I should now be prepared to go; and he has quoted a statement of mine, made some ten years ago, which I could now repeat only in a qualified sense. After considering the number of these and other parasites existing in cattle, he says, he "thoroughly endorses Dr. Cobbold's *dictum*, that all entozoa which are not preserved for scientific investigation and experiments should be thoroughly destroyed by fire, and under no circumstances should they be thrown away as harmless refuse." Herein lies an important practical matter. Under ordinary circumstances, tens and hundreds of thousands, nay, millions of eggs of tapeworms are daily discharged into our sewers. I suspect that at least 4,000 of the inhabitants of this metropolis have the honour, if you may so call it, of playing the part of host to these singular creatures, and every day one or two of the individual segments of each living tapeworm will pass to the outer world, causing 40,000 eggs to escape along with each of them. These go down the sewers, and if that sewage be collected and utilised over our fields, it follows that these hundreds of thousands of eggs will be also distributed. The thing is clear to demonstration. And what happens? The eggs, furnished with a covering which it has been stated will resist any amount of atmospheric changes, are swallowed by the cattle feeding on the grass.

When an ox swallows an egg, or a hundred eggs, each egg is liable to become transformed into a cysticercus. At the present time it is certain that only a comparatively small number of cattle obtain the eggs in this way. It must inevitably follow, however, that if you distribute artificially these ova, without stint or limit, the cattle will have much greater opportunities, so to speak, of getting the eggs, and therefore of having the larvæ developed in their interior. In like manner we shall, in our turn, have greater opportunities of eating these cysticerci in the meat; and therefore, if we do not take the very simple precaution of having our meat sufficiently cooked, more of us will play the part of host to these creatures than is now the case.

But some person will come and say "I like meat underdone; it loses all its goodness if it is over cooked." There is abundant truth in that remark, for the meat is injured by excessive cooking. Another says, "I have eaten underdone meat ever since I was a child, and never suffered any ill consequences; therefore your statements cannot be true." The reply is this—You fortunately live in a country where the distribution of sewage, in a fresh state, has not been carried on to any great extent, and where, moreover, the general habits of the people are more cleanly than obtains amongst the uncivilised occupants of other lands. Hereafter you may not be in such a proud position as regards freedom from parasites; and that will depend upon the steps taken to ensure the destruction of the parasites, in some one or other of the stages of development through which all of them must inevitably pass. Chemical changes in the sewage itself may cause the destruction of many parasites; but, not being a chemist, I have no original researches on this head to lay before you. As to the evidence of the prevalence of these things in a state of nature, nothing can be stronger. I have here a heavy official volume, entitled "Annual Report of the Sanitary Commissioner (Dr. James Cunningham) of the Government of India for 1869." It is, in many respects, an extremely interesting blue-book. Let us read a short paragraph on the subject before us. "During 1869, out of 13,818 head of cattle killed for rations at the stations of the Upper Punjaub, 768 were found to be infected with cysts (those very things which, according to some people, do not exist), or a ratio of 5½ per cent. In 1868, the proportion was rather larger, viz., 6·12. The condemnations were made chiefly in the earlier months of the year, and since the modifications in the regulation alluded to in the last report, the number of carcases rejected has very much diminished. Recent statements received from the Commissary-General showed only five or six cases in each month, and these had occurred chiefly in a certain district." Here, then, we have certain evidence that in those parts of India where irrigation of some kind or other is extensively practised, the presence of these parasites in cattle bears a certain amount of co-ordinate relationship, and the inference which one may legitimately deduce from such facts is, that in this country the parasites might, under similar circumstances, become as prevalent as they are found to be in India.

If we go a little way further north, into Central Asia, for example, and ask what is the condition of the people on the borders of Lake Baikal, we find parasitism existing to a frightful extent. In those parts of the country where the Cossacks under the Russian government dwell intermixed with the natives, the whole population are so little accustomed to cook their food that very few of them take any precaution whatever in the matter. They eat continually beef and veal, as well as meats of other descriptions, almost raw. And what is the result? Some years ago, when writing on this subject, I quoted a statement which will at once show you the importance of this subject, in connexion with underdone meat. This is an extract from a communication received, through Professor Leuckart, from St. Petersburg. According to Dr. Kachin, who is a medical officer in the Russian army, the native Cossacks, or Burätes, of the Baikal region are nearly all of them occupied by tape-worms. These people, be it observed, feed almost exclusively on the flesh of calves, sheep, camels and horses. They neither clean the meat properly nor cook it completely; fat, liver, and kidneys, are eaten quite raw, and so voracious, moreover, are these persons, that any two of them can demolish a one-year-old lamb at a single meal. The entozoological result of all this is strikingly exhibited by the fact, that Dr. Kachin ascertained, by *post-mortem* examination, that almost every person in that region is a "host;" in fact, no grown person escapes.

Fortunately, the adult parasite seldom does serious injury to the bearer; but the larvæ of some of these tapeworms are dangerous, and it is against them, therefore, that we should be especially on our guard. Thus, if you or I were to drink a glass of water containing two or three eggs of the *Tænia solium*, whose larvæ reside in the pig, (and we might very well do that, for if there were 1,000 eggs in this tumbler of water you would not see the slightest trace of them with the naked eye) they would become transformed in our interior into cysticerci; and, as they have an awkward habit of betaking themselves to the vital organs, especially the brain, it necessarily follows that they would give rise to serious symptoms.

Therefore, after all, you see, it is not so much on this question of parasitism in meat that I want to insist, as upon the possibility of a larger distribution of ova being concerned in the bringing about of much more serious issues. The larvæ of some of these entozoa are perfectly capable of producing death—even sudden death—in the human bearer. This fact, in my judgment, affords a sufficient reason for looking into the matter of parasitism more closely than has hitherto been done.

At our next lecture, it will be my purpose to bring before you details respecting a totally different class of parasites, the flukes. They are more attractive in appearance than the forms just considered, and are equally productive of mischief to their bearers; yet, as regards ourselves, they are chiefly injurious as affecting the price of animal food.

SCIENCE AID TO THE STATE.

By R. J. Mann, Esq., M.D.

Upon a recent occasion, Lieut.-Colonel Strange, in a paper read at the United Service Institution, and which has been printed in full detail, addressed himself to a new development of his now thoroughly appreciated and recognised theme, the relation of science and the State. Having secured the substantial consideration of the question, how the State can best aid science by the appointment of a Royal Commission, he proceeds logically to argue that it is absolutely essential for the best interests of the community that this commission shall be made permanent, under the form of an organised science-council to the government, possessing consultative and not executive powers, and consisting of not less than fifty members, carefully selected from the established notables of science, under a plan that shall effectually secure it from all suspicion of subserviency to the government, which shall furnish adequate remuneration for the very important services rendered.

In his previous arguments, the author of this paper has again and again drawn attention to the more important distinction between scientific education properly so-called, and what may more properly be termed "scientific investigation," that more advanced and more dignified operation by which the progress of science itself is strengthened and quickened, and by which the beneficial application of science is matured and enlarged. In this last phase of his advocacy, the colonel incidentally and almost unconsciously touches a chord that vibrates in the opposite direction, in so far as it tends to show how absolutely it is the very lamentable state of scientific education in England at the present day which makes the advance he is contending for difficult of attainment. The one condition that can render the step which is here proposed, in the organisation of this State science-council, not only possible but indispensable is the creation of a "public opinion" which shall require from the constituted government this enlightened recognition of the proper position of science in the scheme of a civilised community. Certainly, no government in England will ever take steps to establish such a science-council, unless the general voice of the people of England insists upon its right to the advantages inherent in such an institution. But, unfortunately, in the existing state of the education of the public, all that deals with the meaning, and bearing, and power of pure science is exactly what the public mind has the least power of apprehending. At the present day, exact, sound, and severe scientific exposition and reasoning are simply unintelligible to the masses. They are all-powerful with the privileged and enlightened few, who form an aristocracy of intelligence and enlightenment; but their language is an unknown tongue to the larger section of the community through which public opinion acts and speaks. It is a notorious and familiar fact, that it is the shallow quack and pretender who advocates some sensational plausibility, and not the patient and profound sage who enumerates some deep and well-digested truth, who forms and leads the opinions of the community. Does not every thoughtful man who has actual experience in the ways of the world as it moves, know that in nearly all the important relations of life, the ready, self-confident quack always takes precedence of the modest, self-questioning student and true philosopher. Does not every one know that if at the present time an advocate of the earth's flatness calls together, in any of the larger towns, a promiscuously gathered assembly, to hear him refute the conclusions of the Copernical and Newtonian astronomy, he may, with the utmost confidence, calculate on carrying with him the voices and convictions of nine-tenths of his audience? The great fact should never be lost sight of, that the ability of men to distinguish true science from impudence and pretence, and to appreciate severe and exact reason, presupposes their having been educated to a very considerable degree, certainly far in advance of that which has been yet attained, even in the most civilised and developed community.

Now, it is, in grave and sober truth, this lamentably defective state of the science-education of the community which makes the necessity for government to interfere in the matter at all. This will be at once apprehended if the argument is narrowed and cleared by a reference to one particular branch of the science action of the government, which for a special reason comes at once home to the understanding and personal experience of every one. The general community knows nothing at all of the organisation of its own physical frame, or of the operation of the subtle material agents by which that physical frame is influenced for good and ill. The general community has been taught nothing, or next to nothing, of this most momentous branch of practical knowledge. Sanitary science has no place in the curriculum of general education; but in this particular the penalty of the general ignorance is so heavy and so obvious, that the government has been constrained to do just so much for the good of the masses as serves to save them from being too gravely visited for their sin of ignorance. The State insists that certain arrangements shall be made where men congregate in dense communities, which shall prevent them at surely recurring intervals from accomplishing their own destruction by wholesale, and from shortening the appointed and allowed span of human life by a third. If this grave defect in general education were efficiently remedied, and all men were taught these matters, as they ought to be taught, soon after their leaving their cradles, then the necessity for the interference of the State with the liberty of the subject in this essential and vital particular would no longer exist, and men might safely be left to do for themselves, under the mere suggestion of self-preservation and saving economy, that which the State is now compelled to do in their behoof. In all matters of science it is identically the same. It is the more or less absolute ignorance of the masses which necessitates State action, and which calls for organised interference from central and capable intelligence placed in authority, to do for the ignorant people what their best interests require, but what, in their ignorant and helpless state, they cannot do for themselves. Colonel Strange very fairly and truly argues, it is as much the bounden duty of an enlightened central government to forbid five hundred gallant men from being sent to unequal conflicts with the storms of the Atlantic in an unseaworthy ship of war, as it is its duty to protect the poor and helpless community of east Smithfield and Stepney from the pestilential breath of small-pox or cholera. Indeed, the holocaust of a *Captain*, with its entire crew, in the waves of the Atlantic is far less excusable or defensible than the decimation of a poor and helpless community by pestilential disease, because, in fact, it relates essentially and immediately to a branch of knowledge in which the human mind has a far clearer insight and a far stronger grasp. The foundering of a well-manned ship of war in the open sea, in a moderate gale of wind, is a far heavier reproach and disgrace to a nation than a hundredfold larger loss of life from the swoop of the pestilence.

We are thus, then, now in a position to realise somewhat definitely what the real obstacle to a satisfactory reform in our national practice in this matter is. The community needs the supervision and control of the State in matters of science, because it is too ignorant to understand and take care of its own interests in that particular; but that very ignorance of the community implies that the State cannot be efficiently acted upon by the voice and mind of the community to provide what those interests require. The science-ignorance of the public is at once the need for State action and the obstacle to State action. The remedy which nature herself has provided for this complication is the severe one of the enactments of penalties and pains. The pestilence stalks abroad, and takes tithe of human lives, until the human intellect has been quickened by the lash of this dreadful experience. Disasters like the foundering of the *Captain* recur perennially to press the same teaching home. But, unfortunately, the action of this great natural code of criminal procedure is ponderous and slow; and it is thence the part of human intelligence to anticipate its admonitory operations, and intercept its penalties, so far as may be. Here, then, is the point to which the plea for science-aid to the State is now brought. It is not possible for that small and highly-enlightened section of the community, "the scientific men," which Colonel Strange not unadvisedly affirms to be a section possessing "enormous power," to find some way, pending the perfection of formal education and the maturation of public opinion, which are the proper and radical cures of the evil, whereby a provisional and *ad interim* protection of the community can be secured. As the small end of the wedge has happily been introduced into the sanitary crack by the lame and impotent influence of "public opinion," is it not possible to drive the implement on—if not home—by the force of "scientific opinion?" Is it not practicable to extend the salutary and beneficent interference of the State, which has been adopted and amply justified in matters of sanitary need and discipline to collateral channels of public necessity? That, in compact significance, is the problem which is now urged upon the consideration of thoughtful men, who certainly have in this matter a responsibility at least as large as their power. It is not easy to conceive how, in this High Court of Appeal, the cause could be more forcibly or more ably argued than in the words which the advocate of State aid to science has here employed on both counts of his plea, and which, on this account, are here reproduced:—"Science is indispensable to national greatness, the arts cannot flourish, trade cannot prosper, knowledge cannot advance, war cannot succeed with a nation that neglects science. Other things also are necessary; a strong, just, and wise government, constitutional and religious freedom, love of order and respect for the laws. Without these, also, there cannot be national greatness. But even with these, the nation that is not foremost in science cannot be foremost in civilisation;" and 2ndly, "Science, looked upon in the driest commercial spirit, must pay."

THE COINING OF GOLD.

The following interesting account of the chlorine process of coining gold, now in use at the Mint, is taken from the *Standard*:—

The statements which have been of late made in Parliament and the press, respecting various matters connected with the operations at the Mint have given a public interest to the only notable improvement in the metallurgy of coining which has been made in the present century. Indeed the whole process of coining is so old, and was so far perfected at a very remote age, that after the application of machinery not very much has since remained to be done. There was, however, one trouble, causing great annoyance, which had existed from time immemorial, and which was the more vexatious that no inspection of the metal when received could effectually guard against it—brittleness. The ingot might be, to all appearance and test, as tough as it should be for the coinage, and yet when the processes of minting were far advanced, a portion of the mass might turn out of such brittleness as to necessitate its return to the importer—of late years almost solely the Bank of England—and thence again to the refinery. This difficulty has been entirely overcome, and by a process so inexpensive as to be practically costless; and now, instead of returning the gold as heretofore, it is treated at once in the Mint itself, and the full coinage of the quantity brought in is completed, without even the importers being made aware at all of any imperfection in the condition of any of the ingots. The chlorine process by which this admirable result is effected is equally simple as inexpensive. The intractable gold is merely put into a crucible and remelted, having, while in that state, a jet of chlorine gas passed through it by the insertion of a clay pipe into the mass of liquid metal. Thus is effected a combustion of impurities, very much, as one might say for comparison, like the Bessemer steel process, only substituting chlorine gas for common air. In the Mint works a large glass jar about 15 inches or 18 inches high, containing the hydrochloric acid, is placed against the back of the wall of the furnace-house, at about twelve feet from the ground, and a piece of glass tubing, eight feet long, connects it with a chlorine generator below, capable of containing about eight gallons, and from which a ¼-inch pipe is passed through the wall, the clay nozzle of which is inserted into the crucible for about five minutes at each operation.

In thus treating brittle gold, two grave points of consideration had to be met boldly at the outset. The brittleness in the standard gold arises from the presence, in very minute quantity, of lead, antimony, arsenic, or bismuth. This minute quantity—as little as 1·1900th part—sufficing to render the gold too brittle for coining—made it necessary, on the one hand, not to employ any process which should volatilise and waste the gold. On the other hand, the chlorides are either volatile, as in the case of those metals which occasion brittleness, and in such combinations are driven off by the heat; or, as in the case of silver, melt into a fluid mass which floats on the surface of the gold. If, however, we compare the loss of the valuable metal in the chlorine process, as conducted at the Mint, with the loss regularly experienced in the ordinary process of gold-melting, which is one grain per troy pound of gold, we shall find that the results are highly satisfactory; in fact, the initial loss by the chlorine process may be briefly stated as 19 parts in 100,000, whilst the experience of the melters of the Mint is, that the ordinary loss by ordinary melting amounts to 17 parts in the 100,000, of which in both cases the greater portion is recoverable. The bearing of this success in manipulation goes to show that, at the extremely high temperature at which the operation is conducted, chloride of gold does not exist, being in fact decomposed, whilst the chlorine combines rapidly with the baser metals. Any very light loss of gold, therefore, that may take place must arise either from its being mechanically carried away, or from the production of a volatile compound of gold and the volatile metal with the chlorine introduced. Of the inexpensive nature of the apparatus, and the materials employed in the chlorine toughening process—for the gold so treated comes out of the crucible perfectly workable—we may say that the amount of chlorine required for £10,000 worth of gold would not cost two shillings, and that the whole apparatus for generating it could be put up for a couple of sovereigns.

Another topic deserves public notice, namely, the perfectly innocuous character of the process. The Mint operations are at all times, on account of the rarity and value of the materials dealt with, very small in scale compared with the metallurgical processes of the great manufactories of the ordinary metal industries; and even of these the toughening process is only applied to the smallest quantity of the most valuable metal. There is, and has been, no need for its employment for more than a total of three days a-year, taking in the most active seasons, and then only for a few hours at a time. Between the generator and the furnace every joint of the apparatus is made tight, and there is no escape for any of the gas, excepting up the flue—and what, indeed, if the whole went up, would that quantity, ejected from the top of a lofty stack, during three or four hours' work, into the full current of the winds, effect in the way of nuisance to any neighbourhood? Even in a perfectly calm day, the amount of chlorine so disseminated in the atmosphere would not be enough to be smelt; and, if it were, it is by no means unwholesome, but, on the contrary, a very effectual destroyer of disease-malaria. It is a pity, therefore, that critics who are not chemists "enough to understand" the point in question should attempt to prejudice the government and the public against, not only this useful operation, but also against the removal of the Mint to Whitefriars, where it would have a frontage towards the Thames Embankment, by raising phantoms of nuisances and annoyances which never did, and never can, have any reality. To discuss the question of a transference of the Mint from Tower-hill to the vicinity of the Strand is not part of our present purpose; but we may add, in passing, that a small manufactory, such as the Mint is, and ever will be, can be much better and more economically managed if compacted in one moderate-sized building than it can be in a multiplicity of buildings, spread over five acres, as it is at present.

Returning to our immediate subject, we may note that the gold coins of the country are not fine gold, but an alloy of copper with 916·6 parts of gold in 1000 of the mixture. This is "standard gold." Brittleness can very seldom be detected in the ingots of pure gold as received, and the friability is often exhibited after the formation of the alloy, the quality of the copper needing careful selection. The alloy, when free from impurities is tough and malleable, but when, as we have said, there is a small amount of some of the baser metals present it may be as brittle as loaf sugar. Refining silver and gold, that is, removing either metal from the other, as well as from foreign or impure metals, is ordinarily a long and tedious operation. The process of refining was, however, much simplified by Mr. F. Bowyer Miller, of the Sydney Mint, who found that when chlorine gas is forced through a molten mixture of gold and silver, the latter metal is converted into chloride of silver, which rises through the gold and floats on the surface of the metal, and the separation of the gold and silver is thus easily effected, the quality of the metal proving excellent. This process has been further developed in its direct application to the toughening of standard gold by Mr. W. Chandler Roberts, the present chemist of the Mint, a pupil of the late most eminent Mr. Graham, and associated with that great chemist in his memorable researches on palladium. Mr. Roberts's able reports upon this subject, combined with the success realised in the practical operations, ought to ensure for him a higher recognition than even that of a very useful public servant; and viewing the chlorine system in its other aspect of a refining process, it will be to his pioneering that the credit will be mainly due, should it in this country replace in a few years the existing tedious operation of refinery. Short as is the period since its adoption at the Mint, some 40,000 ounces, or nearly £150,000 of brittle gold, have been already so treated, and this so effectually that the severest tests have been applied to the coins with impunity. It will require, however, a study of the voluminous corespondence, printed in the appendix to the first annual report of the Deputy Master of the Mint, issued a short time ago, to understand fully the vexatious nature of the difficulties arising from this source, which are now completely remedied.

It is to be hoped that Mr. Roberts will continue those useful efforts to which, as is shown in the report referred to, he has been most properly encouraged by the present Deputy-Master of the Mint, Mr. Fremantle.

CENSUS OF ENGLAND AND WALES, 1871.

The preliminary report, published by the Registrar-General, contains a rough digest of the census of England and Wales, taken at the commencement of the present year. The same machinery had been employed in the three previous enumerations of the people, and many of the officers had therefore gained experience which they turned to account upon the last occasion. It remains yet to ascertain the strength of the navy, the merchant seamen, of British subjects in Foreign States, in India, and the Colonies. The publication therefore refers especially to the population at home on the census day; and certain reasons are alleged for the choice of the particular date fixed upon. Many statists have agreed that the best time is the first day in the year, but in England and Wales the climate has to be consulted, when all localities are most easily accessible. The midnight of Palm Sunday was selected as the census hour; and on the 3rd of April, the month when the English folk of old longed to go on pilgrimages, the 32,606 enumerators began their work, and wended to "every shires-end of England." The day—and this was not unimportant—was cool and fine all over the kingdom. The enumerators collected 5,030,985 schedules from that number of families or lodgers, living in 4,259,032 houses.

The enumerated population of England and Wales living at midnight on April 2nd, 1871, was 22,704,108 souls. This is an increase of 2,637,884 over the numbers living at the last census, and exceeds general expectations, for the increase from 1851 to 1861 was 2,138,615, and the rate of increase was 12 per cent. in the ten years that ended in 1861; whereas the rate of increase in the last ten years has been 13 per cent. From a review of the period from 1801 to 1811, it appears the population increased rapidly while the French war was going on, and most rapidly after the peace. The increase from 1811 to 1821 was 18 per cent.; and from 1821 to 1861, while emigration grew every year more extensive, the population went on increasing, but at a decreasing rate, so that in the decennial ending in 1861, the increase became 12 per cent. The actual addition to the numbers was every ten years, except in 1841-51, greater than in the ten years preceding, but it was never so great before as in the ten years which we have just passed through. When we add to the population of England and Wales that of Scotland, Ireland, and the Channel Islands, with a provisional return of British subjects abroad, the whole numerical strength of the United Kingdom may be taken at 31,817,108 persons, of whom 15,549,271 were males, and 16,267,837 females.

For the convenient exposition of the facts relating to population, and the determination of the relation of these facts to others in equally large masses, England was divided at the census of 1851 into ten great divisions, Wales constituting one division by itself. This system, which has been found convenient for many statistical and some physical purposes, is maintained now. An English division contains, on an average, 2,148,769 inhabitants, living in 351,343 houses, on 3,259,040 acres of land. It contains about 300,000 men, of the ages from 20 to 40, one-tenth of whom would form a corps of 30,000 efficient men. The area is 5,092 square miles, equal to a square of 71 miles to the side. It is of rather less size than Yorkshire, and somewhat less populous. Besides size and population, in forming the divisions out of districts or counties, contiguity and industrial connexion were considered. The north-western division contains the greatest number (3,382,590), the eastern division the least number (1,218,257) of people; thus, no division contains less than a million, nor more than four millions of people—not more, therefore, than double, nor less than half the population of the average division. The numerical ratios deducted from these larger numbers are not liable to the extreme fluctuations deranging accidentally the results where small numbers are used. The largest (south-western) division has an area of 7,804 square miles. The north-western, the most populous, is the smallest except London, and has an area of 3,125 square miles. The area is less, but the population of these divisions is on a par with the population of such states as Denmark and the Netherlands, of Saxony and Wurtemberg, in Germany, Piedmont and Tuscany, in Italy. The eleven provinces of Prussia have the same average population, but they are more than twice as extensive as the English divisions, which correspond in size with the average area of the ancient provinces of France at the Revolution, cut up into 83 departments by the Constituent Assembly. In England, the kingdoms of the Heptarchy had given place to counties, corresponding to the French departments, long before the Conquest, and are not recognised in the Doomsday survey, but the idea of territorial units greater than counties existed. The Roman provinces of Great Britain were larger than the kingdoms of the Heptarchy. Ireland is now conveniently divided into four provinces, which, with ten divisions of England, one of Wales, and two of Scotland, will constitute seventeen divisions of corresponding magnitude.

With all the advantages derived from the assistance of local authorities and the intelligence of the officers engaged, the Registrar-General remarks that it is impossible to enumerate every individual in dense towns, so that the population is always understated; but there is reason to believe that the numbers that escape are few, and in consequence of the many improved arrangements, mechanical or administrative, suggested by experience, and now brought into action, the census of the kingdom has never been more accurately taken.

EDUCATIONAL NOTES.

The London School Board.—At the meeting on the 5th inst., it was decided by a majority of 21 against 15 that Latin be not included among the discretionary subjects. On the 12th inst., the question of evening schools was discussed at length, and it was agreed that the course of instruction in elementary evening schools be of the same general character as that already recommended for the junior and senior elementary day schools; and that the formation of science and art classes in connection with them be encouraged and facilitated. On this latter question, Professor Huxley had no hesitation in saying that nothing had been done by the government of this country for many years which had so much contributed to a knowledge of science among the poorer classes of the community as the establishment of these science and art classes. A number of classes in definite subjects were taught by any one who chose to take up that business, and, at the end of the year, an examination was held, under the sanction of the Department, and money was paid according to the number of students who passed the examination. The number of students under that system was now very great, and, as an examiner himself under that system, he could undertake to say that, in all those branches in which he was himself concerned, there was an enormous amount of definite knowledge, very good as far as it went; and thus a considerable amount of valuable knowledge was spread throughout a large number of people, with the majority of whom the Board had to deal. He looked upon this system as having an enormous value with regard to a question which the country would have to look at by-and-bye, viz., the establishment of technical schools, for which there was a great cry at the present moment. Many persons thought they had only to have a school for science, and that everything would be done that was needful, that manufactures would flourish henceforth, and that this was the one thing needful; but he believed that to be a profound and mischievous mistake, and that the country could not possibly commit a greater error than in establishing schools in which the direct application of science and art was taught, before those who entered the classes were grounded in the principles of physical science.

Payment of School Fees.—The School Boards of Liverpool and Manchester have adopted the following recommendation:—That school fees shall be allowed in the following cases only, excepting under special order:—(*a*) Where the family consists of two persons, and the weekly income (after allowing for rent) does not exceed 4s. per head per week. (*b*) Where the family consists of three or four persons, and the income (after allowing for rent) does not exceed 3s. 6d. per head per week. (*c*) Where the family consists five or more persons, and the income (after allowing for rent) does not exceed 3s. per head per week.

A School Board Difficulty.—The Stoke-on-Trent School Board, requiring money, issued a precept against the overseers. That body declined to include the School Board's requirements in the poor rate, and the School Board then wrote for advice to the Education Department, who replied as follows:—"In reply to your letter, dated June 26th, I am directed to state that the question as to the proper mode of raising the money to answer the precepts of the School Board, is one which depends upon the proper construction of the Elementary Education Act, 1870. Upon such questions my lords are not empowered to express any authoritative opinion, and as their interpretation of the Act might differ from that of the ratepayers or of a court of law, they must follow the ordinary rule in such case, and decline to express any opinion on the subject. According to the Act the overseers are the rating authority in this case, and they must act as they may be advised by counsel or the law officer of the Crown. I may add, however, that the School Board, as such, does not appear to have any jurisdiction in the matter."

Scientific Instruction.—A very clear and able paper, by Mr. George Gore, F.R.S., on "The Aims and Methods of Scientific Instruction," appears in the *Educational Review* for July. The writer says:—"The chief objects of teaching science should be to educate the senses, to train the mind to habits of careful, trustworthy, and exact observation of material phenomena, to exercise the judgment in reasoning on those phenomena, their causes, operations and effects, and to impart a systematic knowledge of the facts and principles of science, of their varied manifestations in the material universe, and of their applications in arts, manufactures, and occupations. While scientific method (says Arnold) 'is getting more and more power upon the Continent, and while its application there is leading to very considerable results, we in England, having done marvels by the rule of thumb, are still inclined to disbelieve in the paramount importance of any methods but our own. The English notion is, that you come to do a thing right by doing it, and not by first learning how to do it right and then doing it.' Faraday remarks, that if science is to be taught with success, it must be begun at an early age, because the faculties of youth are plastic, naturally disposed to observation, and to practical manipulation. It is not possible for adult persons to acquire these qualities fully unless they have shown during boyhood a decided predilection for that branch of study. In order that boys may learn science with success, they ought to be previously instructed in elementary subjects, and should possess some acquaintance with mathematics, algebra, and geometry. Instruction in physics should precede instruction in chemistry. Boys are best prepared for instruction in chemical physics and chemistry, not by means of introductory popular lectures in these subjects, but by special tuition in mechanics, hydrostatics, hydraulics, pneumatics, the simple properties of matter, &c., which are more elementary in their nature, and therefore precede, in point of time, the subjects of chemical physics and chemistry." The writer goes on to point out the uselessness of merely showing young people amusing experiments, and again quotes Faraday, who says:—"Lectures which really teach will never be popular, and lectures which are popular will never really teach." After pointing out the importance of systematic teaching, the writer touches upon what is commonly called "technical education." He says:—"In this country commercial energy is great; the desire for gain largely swallows up the desire for learning; men wish to see how a knowledge of science will enable them to get money quickly. In consequence of this desire, and of the recent transference of some of our trade to foreign nations, there has arisen a demand for some indefinitely understood 'technical education,' by means of which it is hoped to obtain an easier road to wealth. The extent to which this idea of 'technical education' can be carried has been found, in the Polytechnic schools in Germany, to be very limited; science cannot be readily taught in small detached fragments, applicable to single particular trades; it requires to be taught systematically; students must first learn the basis of science without much regard to its practical applications, and afterwards learn the uses of science in the arts." The writer appears to think the great difficulty is to obtain good teachers. "At the present time," he says, "the teachers of science in our large schools are frequently amateurs, and consist, in some instances, of University men and others who have had only a few lessons in the subject before they commenced to teach; some are men possessed of a fair knowledge of science, but without experience; the result is defective teaching. Some of the scientific professorships in our colleges are held by men who pursue science only as a means of living, and make no original investigations. Were such appointments conferred only on men who pursue science primarily from a love of the subject, the cause of scientific education would be greatly promoted. The teacher should have a higher dominant motive for labour than the pursuit of money." On the other hand, the writer complains of the want of encouragement given to science in this country. "The difficulty of obtaining a sufficient number of properly qualified scientific teachers, under the present circumstances, is very manifest. But if science was properly encouraged in this country, the case would be different: many young men possessed of natural scientific ability, who are now obliged to abandon the pursuit of science for want of proper remuneration, would be glad to devote themselves to teaching and to original research, and thus a sufficient supply of properly qualified teachers would be obtained."

CORRESPONDENCE.

ORNAMENT.

Sir,—"When will a Turner arise in the science who will point the way to intellect, instead of the square and rule?" is the question of your recent correspondent on the subject of ornament. Now, sir, Turners, if you will permit me to call them so, as wheeling and turning about, are very frequently the authors of our art-literature, and are mostly as innocent of any tendency to "square" and "rule" as nebulous intellect can well be, and this Turner-science which your correspondent desires has, I think, been tolerably illustrated in the letters, &c., on the subject of ornament which have appeared in these columns, and your former correspondents are probably, for the most part, at one with the author of the latest communication, in the issue of July 7th, in thinking that order is the weakest part in creative design, and consequently in poetry, painting, and sculpture.

Is it possible that philosophy has all these ages been wrong in supposing that progress is from the hazy and nebulous towards system, order, and the well-defined, rather than from symmetry and order to confusion and the nebulous? If the latter were the true sequence, then, when there is least of squareness and method in our intellectual madness, or when science and art are but as tales told by idiots, "full of sound and fury, signifying nothing," they would be at their best.

Does not your latest correspondent on the science of ornament recollect that wonderful prophecy in Isaiah—that forecast of the teaching of modern science—"Judgment also will I lay to the line, and righteousness to the plummet?" It will be backwards, ever backwards, till the spirit of that prophecy is generally understood, and men strive after perspicuity, order, and proportion in all things, art not excepted.—I am, &c.,

W. Cave Thomas.

July 15th, 1871.

MEETINGS.

By permission of the Council, meetings were held in the Great Room of the Society as follows:—

The Aeronautical Society.—A Conference was held on Monday evening, the 17th, when papers were read and a discussion ensued. The Chairman, Mr. Glaisher, said the society had received great encouragement from the use made of balloons during the siege of Paris, and in consequence people who never supported them before had been led to inquire into the merits of aerial locomotion. A letter from Mr. Proctor, F.R.A.S., was read, stating that he was looking with great interest to the results of the experiments which Mr. Browning was about to make, in conjunction with Mr. Wenham, into the laws of velocity and pressure. His own belief was that very little was known as to the effects of air currents moving with different degrees of velocity, and he believed if the forthcoming experiments extended to plane bodies traversing the atmosphere and moving horizontally on its own plane, it would appear that the supporting power of the air depended largely on the dynamical stability of the moving plane. At the same time, he thought the principle of gyroscope would largely enter into the construction of aerial machines of the future. The great difficulty experienced in learning to fly was balancing, so as to secure the chance of practising; therefore he asked whether horizontal rotating discs might not be attached on either side of the body, so as to afford material assistance to the learner, his opinion being that if the discs were large and thin, and a rapid motion given to the body it was possible to secure steadiness of motion and aerial support. Inclined planes worked in rowing style might also answer. The papers read were by Mr. Alexander, "On Aerial Flight as dependent on man's muscular exertion;" by Mr. Wenham, "On the Resistance of Air through passages of different lengths;" and by Mr. Baudler. Captain Burnaby gave an account of a balloon ascent he made, incidentally stating that the muscular power of a bird was in proportion 200 times that of a man; and urging that the essential requirement for successful ballooning was some power 500 times greater than that of a man, yet not heavier, and something that would answer the performances of a bird's wing—a point to which æronauts had never yet been able to arrive. The papers and speeches were illustrated by models and diagrams.

Monument to Shakespeare.—On Monday afternoon, a general meeting of the subscribers to the Shakespeare Memorial Fund was held, under the presidency of Sir W. Tite, M.P. The chairman explained that the object of the meeting was to decide what was to be done with the balance of £285, which stood over from the Tercentenary Shakesperian Festival. Professor Donaldson said if there were any probability of subscriptions coming in, he should be for going on with the work of the committee, so that they might have in London a Shakespeare monument; that a good statue of Shakespeare should be provided. If they could raise £10,000, it might give them some hope of carrying out the object they had in view. Mr. Gruneisen said, under all the circumstances, he thought the best thing to do would be to hand over the balance to the Dramatic College at

Woking, an institution which supported and kept those who had represented Shakesperian characters. He should be glad to move a resolution to that effect. The Chevalier Chatelain said he should be pleased to second the resolution. Mr. W. Hepworth Dixon did not think the committee had any power to divert the money from the purpose for which it had been raised. The amount subscribed was £2,400, and there was from £800 to £900 outstanding which had never been applied for. If that amount were called in, he believed a very considerable amount of it would be paid; and they could then have for a sum of £1,200 a very beautiful statue of Shakespeare erected on the Thames Embankment. Mr. Richardson-Gardiner said if there was a determination on the part of the committee to carry out the object for which they were appointed, and erect a statue to Shakespeare, he would undertake to get subscriptions to the amount of 200 guineas. Mr. Cousens said he would also undertake to raise 200 guineas. Mr. W. Hepworth Dixon said that, rather than abandon the object he had in view, he should undertake to raise 100 guineas. After some further discussion, on the motion of Mr. W. Hepworth Dixon, seconded by Mr. Godwin, the following resolution was carried:—"That it be referred to the executive committee to endeavour to get in the outstanding subscriptions, and to receive further subscription, for the purpose of carrying out the original object for which the fund was subscribed; that the executive committee do have power to add to their number, and to appoint any officials whose places may have become, or may become vacant."

GENERAL NOTES.

Our Coal Supply.—It is stated that the labours of the Royal Commission on Coal, appointed a few years ago by Sir George Grey, are on the point of completion, and and the result is the demonstration of the fact that, assuming a certain annual increase in the rate of consumption, sufficient economically getable coal exists in Great Britain and Ireland to last for 800 to 1,000 years.

Statistics of New South Wales.—According to the returns recently published, the population of New South Wales was numbered at 485,356, and the area at 206,9 9 680 acres. The area under wheat was 189,452 acres; under barley and bere, 9,152 acres; under oats, 17,302; under rye, 2,378; under maize, 128,041; and under other kinds of grain 134 acres, making a total of 346.459 acres of land under corn crops. Potatoes occupied 17,133; sugar cane, 3,918; tobacco, 366; vineyards, 3,907; and grass for hay, 75,034 acres. These statistics refer to the years 1869-70.

The Cotton Crop in Scinde.—A statement of cotton cultivation in the province of Scinde in the year 1870-71, contrasted with the extent of the year, shows a net increase of 2,618 acres 25 guntas in native, and a decrease of 29 acres 12 guntas in foreign. There was a considerable increase in the Hyderabad collectorate, being 37,780 acres, against 32 228. In the Thurr and Parker districts the acreage was 58,584, against 56,445. In the other parts of the province there was a decrease in cultivation, the total figures being, Kurrachee collectorate, 1,489, against 4,573; Shikapore collectorate, 16,080 against 16,133; frontier, Upper Scinde, 1,580, against 1,978. The prospects of the season's crop appear from the following figures:—

	Raw cotton. maunds.		Cleaned. maunds.
Kurrachee collectorate ..	2,994	..	937
Hyderabad ,, ..	273,466	..	85,473
Shikapore ,, ..	8,879	..	2,314
Upper Scinde ,, ..	4,700	..	1,644
Thurr and Parker districts	292,090	..	96,629

Abolition of Fairs.—An Act of Parliament has just been passed to amend the laws relating to fairs in England and Wales. It recites that certain of the fairs held in England and Wales are unnecessary, and are the causes of grevious immorality, and are very injurious to the inhabitants of the towns in which such fairs are held, and it is, therefore, expedient to make provisions to facilitate the abolition of such fairs. The Secretary of State may, on representation of magistrates, with the consent of the owner, order fairs to be abolished, notice of the representation and of the order of the Secretary of State to be published in the newspapers.

The Cultivation of Cotton in the United States.—The cultivation of cotton in the United States commenced with this century, and it rose from 400,000 bales in 1820, to 5,000,000 bales in 1859 and 1861, the two most productive years. The price fell during the same period from fifty to ten cents a pound. Since the end of the civil war, cotton cultivation has rapidly increased, and it is estimated that the quantity gathered during the past season will reach 4,000,000 bales, an amount which has only been surpassed in 1859 and 1861. But the war between France and Germany has influenced the price in a most disastrous manner, and cotton which a a year ago sold for twenty-five cents a pound, now obtains only fifteen cents.

Albumen from Blood.—Albumen is now produced on a large scale, at Pesth, Hungary, and in North Germany, from the blood of animals. The serum separating when blood coagulates, consists chiefly of albumen. The best quality of albumen thus obtained is transparent and soluble in water, and is used for mordanting yarns and cloth. At Pesth, blood is dried in flat iron pans, by exposure to air at a temperature of from 100 to 112° F. From 3,000 pounds of blood about 110 pounds of albumen are obtained, at a cost of 29 dols.; 16,200 eggs would yield the same amount of albumen, at a cost of 96 dols. Although the cost of egg albumen is three times as great as that of blood albumen, the former is preferred for dyeing purposes, on account of its purity. Blood albumen of a second quality, darker in colour, but nearly all soluble in water, is used largely in the process of refining sugar.

Cotton-seed and its Products.—The weight of the seed produced (says the *New York Times*) in the Southern States is estimated at 2,000,000 tons, being about double that of the cotton from which it is gained; but it is supposed that, after deducting the quantity necessary for planting, waste, &c., there will remain about 1,000,000 tons, valued at 12,000,000 dollars. The value of the hulls for fertilising purposes is estimated at 20 dollars per ton, and it is also estimated that the seed crop all might be made to yield a total value of over 40,000,000 dollars, over and above the quantity reserved for seeding. If the whole seed product could be saved and sold at its marketable value, it would be sufficient to meet the provision cost of cultivating a crop of cotton. A man and a mule will produce ten bales of cotton, weighing 4,500. This will afford 9,000 lbs. worth of seed, which will bring 64 dollars in the market. The cereal food of the man and mule will cost 63 dollars; the seed of cotton may, therefore, be made to pay more than three-fourths of the corn consumed. Within the last two or three years the trade in these products has assumed large proportions. At first, no one knew to what purposes the oil was put, but it has come gradually to be understood that it mixes well with other and more costly oils. Not long since, it was discovered that some of the well-known brands of olive oil imported from France had been counterfeited, and cotton-seed was supposed to be at the bottom of it. Most of the seed is crushed in the forest, so that it is not known what proportion of the oil produced is consumed there. Some of the stearine made in the process of pressing is as sweet and yellow as butter. The cake made in pressing is shipped to England and fetches about £2 per ton.

Journal of the Society of Arts.

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FRIDAY, JULY 28, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

NATIONAL TRAINING SCHOOL FOR MUSIC.

The Sixth and last of the Series of Concerts in aid of a National Training School for Music was given on Wednesday evening. His Royal Highness Prince Oscar of Sweden honoured the Concert with his presence. His Royal Highness was received at the entrance to the Hall by Mr. Seymour Teulon (deputy chairman), and the Council of the Society of Arts, and conducted to the Prince of Wales' Room, when the Masters of the City Companies and the Members of the London School Board were presented to him. The Band of the Swedish 1st Regiment of Guards was in attendance, and played the Swedish National Anthem on the arrival of the Prince.

The following Music was performed, conducted by Sir Michael Costa :—

OVERTURE .... Fra Diavolo .... *Auber.*

TRIO .... "Qual Voluttà" (I Lombardi) .... *Verdi.*
Mademoiselle TITIENS, Signor PRUDENZA, and Signor AGNESI.

ARIA .... "Di Provenza" (Traviata) .... *Verdi.*
Signor MENDIOROZ.

VIOLIN SOLO { "Adagio Religioso et Rondò de la Clochette" } *Paganini.*
Signor SIVORI.

DUO .... "Ah! Morir" (Ernani) .... *Verdi.*
Mademoiselle NATALIE CAROLA and Signor PRUDENZA.

SONG .... "Sorge infausta" (Orlando) .... *Handel.*
Signor AGNESI.

ARIA .... "Dove Sono" (Le Nozze di Figaro) ... *Mozart.*
Mademoiselle TITIENS.

CONCERTO, Organ .... (No. 1) .... *Handel.*
Mr. W. T. BEST.

OVERTURE .... The Caves of Fingal .... *Mendelssohn.*

SONG .... "Confounded be all they" (Naaman) .... *Costa.*
Mademoiselle NATALIE CAROLA.

DUET .... "Se le vita" (Semiramide) .... *Rossini.*
Mademoiselle TITIENS and Signor AGNESI.

SOLO VIOLIN .... "Folies Espagnoles" .... *Sivori.*
a. Promenade des Masques.
b. Danse Villageoise au son de la Cornemuse.
c. Orage et Prière.
d. Retour du beau temps et reprise de la danse, suivie du chant des vieilles femmes.
Signor SIVORI.
(Accompanied by Herr Stoeger.)

ARIA .... "Deserto in terra" (Don Sebastiano) .... *Donizetti.*
Signor PRUDENZA.

DUET .... "La ci darem" (Don Giovanni) .... *Mozart.*
Mademoiselle NATALIE CAROLA & Signor MENDIOROZ.

OVERTURE .... Jubilee .... *Weber.*

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

DRILL REVIEW.

In accordance with the report of Council (see page 623, *Journal* 971), subscriptions of five shillings and upwards are invited towards the expense of the last and future reviews. The following amounts have been already received :—

	£	*s.*	*d.*		£	*s.*	*d.*
James Austin....	1	0	0	G. N. Hooper....	1	1	0
B. W. Bartram..	1	1	0	Chas. Horne (will give 10s. more if required)	0	10	0
L. Biden........	1	0	0	Dr. Albert Horwitz..........	0	5	0
Sir W. H. Bodkin	1	0	0	Edwin Lawrence	1	0	0
W. W. F. Bolton	1	1	0	Maj. E. W. Mathew	0	10	0
Wm. Botly	0	5	0	R. Nicol	1	1	0
H. A. Bowler....	0	10	0	James Noble	1	1	0
A. Cassels	0	10	0	John Noble	1	0	0
A. S. Cole	0	10	0	John Pritchit....	0	5	0
Henry Cole	2	0	0	Edward Rosher..	0	10	0
Sir Daniel Cooper, Bart. (will increase if needed)	1	0	0	W. S. Rumsey ..	0	5	0
W. Cooper	0	10	0	Philip Sancton ..	1	0	0
Rev. B. M. Cowie	1	1	0	S. Metropolitan District School	10	10	0
Major-Gen. Croggan, R.A......	0	5	0	George Stanton..	0	10	0
J. A. Crookenden.	0	10	6	W. H. Tanqueray	0	10	6
John Cubitt	1	1	0	Charles Telford..	1	0	0
Thomas Dixon ..	0	10	6	Seymour Teulon	1	1	0
John E. Evans ..	0	10	0	W. H. Thomas ..	1	0	0
W. H. Fell......	1	1	0	E. C. Tufnell....	5	0	0
F. Filliter.......	1	1	0	Z. Watkins......	0	5	0
J. A. Franklin ..	0	10	0	C. Williams	1	1	0
Samuel Harton (to be doubled if required)......	0	5	0	W. B. Wrightson	1	0	0
Sir Rowland Hill	1	1	0		£48	8	6

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

OUR FOOD-PRODUCING RUMINANTS, AND THE PARASITES WHICH RESIDE IN THEM.

By T. Spencer Cobbold, M.D., F.R.S., F.L.S.

LECTURE IV.—DELIVERED MONDAY, MAY 8TH.

On the Fluke Parasites of our Food-producing Ruminants.

MR. CHAIRMAN, LADIES, AND GENTLEMEN,—On account of the great interest attaching to the trichina and the beef measle we devoted two lectures to their consideration; and perhaps it is as well that we should thus exhaustively discuss particular forms in relation to the food question, rather than hurry through the entire series of parasites severally occupying the bovine and ovine territories. In the further pursuance of our plan, I propose this evening to give you an account of the common liver fluke, which takes up its residence in the sheep. At the same time, we shall have an opportunity of incidentally referring to other allied forms.

I have already stated that the flukes constitute a distinct and natural group of entozoa, termed "trematodes," or flat-worms. For the most part they reside in the ruminants, but some of them attack other quadrupeds, and also man himself. The liver-ducts of the ox and sheep constitute their head-quarters, so to speak.

If you glance at this list, representing the entire parasitic fauna in each case, you will see that a considerable variety of flukes occupy these two hosts. The first entozoon, or *Fasciola hepatica*, is the form which we have to deal with especially, this species being common to the ovine and bovine quadrupeds. Fortunately, it is an extremely rare parasite in man, only eighteen instances being on record of its having been found in the human host; but far otherwise is it the case with the ox and sheep.

Now, what sort of a creature is this entozoon? There are, perhaps, 100 specimens in this phial, and each specimen, you perceive, is flattened and leaf-like, measuring about half or three-quarters of an inch in length. Why is it called a fluke? Fluke is a term which applies to many things, but its original meaning signified "anything flat." Thus, the common flounder fish is often termed a fluke; and our sailors engaged in the whale fishery speak of the flukes of the whale; in fact, when a whale is harpooned, and takes a sudden plunge downwards in an almost vertical direction, it throws up its great laterally-disposed tail appendages, which are termed flukes. The sailors, as soon as they see the tail turned up, shout out, in bad grammar, "There goes flukes."

The structure of the fluke is very complicated, and altogether so remarkable that it is necessary I should say a few words on this point. When viewed from the under surface, the animal appears quite flat. There is an oral sucker, at the base of which lies the mouth; and there is also a ventral sucker, placed immediately below. These suckers enable the animal to adhere to the lining membrane of the liver ducts, in which it naturally dwells. The anterior or oral sucker leads into the alimentary canal, which is at first a single tube, passing a short way down towards the region of the ventral sucker. Then it divides into two branches, each of which is continued on towards the lower extremity of the body. In its passage each division sends forth a number of branches, directed obliquely outwards and downwards. In point of fact, this wonderfully-branched arrangement of alimentary tubes is neither more nor less than a complicated dendriform stomach. Here is another fluke, showing a number of vessels which, instead of branching downward, branch upward, all of the divisions proceeding from a central trunk vessel. This forms the so-called water-vascular or aquiferous system.

Here is a specimen which I injected about twenty years ago, and it is still in a tolerably good condition, displaying the two systems perfectly. M. Blanchard, of Paris, has also succeeded in injecting the aquiferous vessels; but I have not seen his specimens. Still more complete structural arrangements exist in the interior of this entozoon. These have reference chiefly to the parts concerned in the formation of the eggs. Without going very minutely into this part of the subject, I may mention that the germ-forming and albumen-secreting glands are quite distinct, each system of ducts eventually terminating in a beautiful rosette-like body, which you observe to be placed directly below the ventral sucker. This rosette-like organ has a brownish-green colour, which is due to the presence of an enormous number of eggs crowded together in its interior. These eggs make their escape whilst the parasitic animal is still resident in the host.

Without going further into the anatomical details of the fluke itself, we must now glance at one of the most intricate points connected with the study of entozoology. The eggs of the fluke are large—very large indeed—when compared with those of other forms of parasites. The eggs of the common tape worm measure no more than the 1-700th of an inch in diameter, and will, it has been said, pass through an ordinary charcoal filter. The eggs of the fluke, however, are so large that they measure as much as 1-180th of an inch lengthways. These eggs are scattered over the field by millions, passing from the hosts or bearers in a way which it is quite easy for you to understand without its being particularly described. When thus scattered, they require for their further development a certain amount of moisture. A good shower of rain is, of all agencies, the one thing needful in their favour; for the rain carries them down into ditches, and streams, and lakes, and into other artificial or natural collections of water, where the further development of their contents will be rapidly accomplished.

Consider, I pray you, what takes place when an egg is conditioned in a manner suitable to its further development. The egg is furnished with a lid, so that when moisture is supplied, this part forming the anterior pole of the shell, rises up and a locomotive animalcule immediately emerges from its interior. This little creature is furnished with a dense covering of vibratile cilia, and it swims about with extraordinary rapidity.

Let me tell you that I have frequently experimented with the eggs of certain flukes, and it is really a beautiful and instructive sight to watch the behaviour of these minute organisms as they disport themselves, darting across the field of the microscope with astonishing activity. But they do not long retain the simple ovoid form assumed within the shell. They change into a conical figure, the larvæ of the common fluke bearing a mark, in the shape of a cross, on its back. This pigment spot has been called an eye, but whether it sees or not with this organ is quite another matter. The spot consists of a number of minute granules collected together. I have not seen this spot in any of the other forms of trematode larvæ which I have examined.

What is the subsequent history of our fluke? For years past entozoologists—abroad and at home—have been trying to work out the genetic relations of the common species; but I fear we have not yet succeeded in fixing all the phases through which it passes. It is a difficult subject to make clear; nevertheless, by putting together the changes which obtain in other forms of fluke larvæ, we are enabled pretty accurately to determine the phases of life-changes which these creatures undergo.

At the risk of being a little tedious, I will now endeavour to open out the principal data by which our definitive conclusions have thus far been arrived at.

Speaking of flukes generally, the ciliated larva loses its cilia, and at the time of the decay or falling off of the cilia another small body is observed inside the original ciliated larva. This secondary body, or juvenile organism, grows rapidly at the expense of the primary larva. The little organism inside—you may call it the germ if you please—increases in size until it assumes a form similar to that of the original. The odd thing is, that it has no sooner arrived at this stage of development than another organism appears in its interior; so that we have the ciliated animalcule producing a germ in its interior, the germ itself increasing in size, until it becomes what we call a germ-sac. First a germ, and then a germ-sac. Now, the germ-sac developes within itself numerous other larvæ. These again, on emerging from the sac, become what is termed a redia, and the still stranger thing is, that these rediæ develop other larvæ inside themselves. This process is essentially a kind of budding, only, instead of being carried on outside, as in a plant, it is produced internally. We have, therefore, you perceive, two kinds of sacs, simple and organised, or, in other words, sporocysts and rediæ.

In many of the flukes those germ-sacs contain in their interior an enormous number of buds, and the buds again, in their turn, during certain favourable seasons, go on multiplying, practically speaking, *ad infinitum.* One cyst will thus form a series of new germ-sacs, and these also will multiply indefinitely. Notice, however, if you please, that in the case of the redia, which is only a more highly organised form of germ-sac, the larvæ developed in its interior have a different form from any of those proceeding from the simple, original, unorganised germ-sacs. They are furnished with tails, and are termed cercariæ. I must also tell you that all kinds of sacs, whether simple or compound in character, are collectively termed nurses. When, therefore, I used the term nurse, I mean some kind of sac which contains larval flukes in its interior. The redia has a structure something like the adult fluke, for there is a sucker and a mouth at its base, leading into the stomach, which is a simple unbranched tube or cavity.

In the history of the larval development of flukes, the cercariæ play a most conspicuous part, and it is they that are chiefly concerned in bringing about the epidemics of rot. You, doubtless, understand that the rot is an endemic disorder, produced entirely by the *Fasciola hepatica.* When this highly-developed form of nurse, termed the redia, bursts, the cercariæ are liberated, and, escaping into the water, they swim about with great rapidity. But my hearers will say, "You have not told us where the larvæ dwelt whilst all these changes took place?" My reply is, "they were for the most part ensconced in the bodies of water snails belonging to the well-known genera, *Lymneus*, *Paludina*, *Planorbis*, and their allies.

Some of these cercarian forms are very peculiar. The true cercariæ have no eyes, but the larvæ of certain kinds of flukes have visual organs. Thus, the larvæ of certain polystomata, of monostomata, and also of tristomata have eyes. "But," you will say, "what is the meaning of all this?" I shall endeavour to explain the point immediately, but I have scarcely done with other matters, which I must make clear before proceeding further.

I have said that during certain seasons the larvæ are much more prevalent than at others. Atmospheric changes involve the reproduction of a greater number at one season than at another. In point of fact, not only does a favourable season increase the number of these larval forms, but it increases the degree of their organisation. It is a strange thing, but it is nevertheless perfectly true, that if the heat be excessive, and there be abundance of moisture, the number and character of the larvæ will be altered accordingly. Speaking generally, it may be said, in short, that under these atmospheric and other favourable and peculiar conditions, one germ-sac may become a thousand, and this thousand may produce other thousands; and all these collectively will finally involve, if the season is prolonged, the production of innumerable forms of cercariæ.

So extraordinary are some of these larvæ, that in the case of the form termed *Bucephalus polymorphus* the creature is furnished with two tails. There is something yet more remarkable about this bucephalus. The head and body will develop into a fluke like an ordinary cercaria, whilst the tail, which presents a beaded or jointed appearance, develops in its interior a large number of larvæ. Every joint, in fact, becomes, as it were, a nurse, developing in the interior new germ sacs; these latter, again, in their turn, being capable of producing bucephali. Thus the tail of the animal is a concatenation of germ-producing sacs, whose developmental phenomena are practically without a limit.

I dare say you may think I have made the subject appear sufficiently complicated, but what I have said is, in truth, not half the story, for not only do the larvæ of flukes undergo these various changes, but the nurses themselves will split up into several other nurses, and all these divisions will go through the same transformations, after the manner I have described.

Then you will say, "What of the snails?" Well, it is very difficult to generalise on so complicated a subject; but I think, with the aid of Dr. Pagenstecher, who has written a valuable monograph on this subject, one can advance a certain number of statements which are true, even though they may not embrace all the data we should like to collect before making definitive propositions. As a rule, one larval fluke will only select one molluscan host. You know the ultimate destiny of nearly all these larvæ of the common fluke is to arrive in the sheep or the ox, as the case may be. They have to pass a part of their time sojourning in the territory of snails. We call the snails the intermediary bearers, because they supply a habitat between the free condition, when the larvæ swam about, and the ultimate bearer which is the sheep or ox.

It is usually the prerogative of the snail to have its own particular set of larvæ, belonging to one species; but that is not invariable, for some of the snails will harbour a limited number, two, three, four, or five, and, I think, as many as six in one case. However, at least three or four juvenile trematodes may be found in one kind of snail.

Having traced their development as far as the cercarian stage, what is the final outcome? The cercaria developed inside the snail makes its way out into the water, and swims about in a perfectly independent fashion. And here a slight difficulty presents itself, for some have supposed that they went back again into the snails; others maintaining that they remained in the water until they were swallowed by the sheep or ox drinking. It is quite clear that in many cases the flukes are conveyed to their hosts as actively swimming carcariæ; but it is also extremely probable that many forms of fluke larvæ are passively transferred to their ultimate bearers whilst occupying the bodies of molluscs or other aquatic intermediary bearers.

Our great desire has been to find out what particular species of snail plays the part of intermediary host to the larval form which develops into the common fluke. Manifestly, if you or I were in a position to say "that is the culprit," pointing out a particular lymneus, paludina, planorbis, succinea, or other species of mollusc, we might put a stop to outbreaks of rot by getting a number of children to collect and destroy all the snails of the particular species thus known to act in the capacity of intermediary bearers. But this is the very thing we have not been able to find out. Statements, it is true, have been put forward by some persons to the effect that they have discovered the snail which harbours this larva; and they will tell you that it is the little mollusc called *Succinea putris.* I once debated on this subject with an eminent naturalist, at a meeting of the British Association, and I am free to allow that there is nothing improbable in the notion that such a relation might actually subsist. This little mollusc is peculiar in many respects. In the first place, it cannot hide itself altogether within its shell. It is seldom seen in the water. It goes to the very brink of ditches, ponds and rivers; being an inhabitant of marshy grounds, where there is plenty of moisture. Never being away from such localities, it is exactly the kind of snail in which you would naturally expect to find the particular cercarian form we have so long been looking for. As regards epidemics of rot amongst sheep, it is notorious that they occur principally in the spring; and you may get a notion of the extraordinary amount of disease which is induced by this parasite, when I state that every year hundreds of sheep are destroyed by it. During certain years, indeed, tens and hundreds of thousands of sheep are cut off. Thus, in our own country, the injurious effects of this parasite were most clearly exhibited during the epidemic of 1830 and 1831, when between 1,000,000 and 2,000,000 sheep perished from the rot disorder. One and a half million of sheep represents a considerable sum of money, not less, probably, than £4,000,000 sterling; consequently, the price of mutton during that year rose enormously. In all previous seasons, when the disorder has been prevalent, the price of meat has risen. In the year 1812, in the neighbourhood of Arles, in France, 300,000 sheep perished; and, in 1824, an epidemic occurred in the Isle of Thanet. So severe was this local outbreak, that Mr. Cramp, a sheep-farmer on a large scale, lost £3,000 worth of sheep in less than three months. In point of fact, he was completely ruined, and had to give up his farm. Many other agriculturists have suffered in a similar manner; but I merely mention these particular instances as showing the importance of a knowledge of the history of the development of this parasitic animal. It is likewise my duty to suggest the means of combating this serious malady, on the well-known principle that "prevention is better than cure."

It has been observed that cattle, sheep more particularly, are only affected when grazing in low pastures. And the reason of this is obvious; for since the larvæ can only get access to snails residing in such localities, the sheep in like manner can only be infected by devouring the snails and the parasitic larvæ frequenting these situations. Consequently, as is well known, when the slightest symptom of the disorder appears, if the sheep are removed from the marshes to high ground, the disorder is at once checked. The sheep soon recover, unless they happen to have swallowed a large number of the larvæ.

Everybody who has to do with cattle and sheep, is familar with the appearances presented by animals thus affected. Even butchers' boys can tell a rotten sheep, as they call it. They examine the eye, and find that it has lost its lustre; whilst there is a peculiar paleness about the membrana nictitans. The conjunctiva loses its ordinary bright colour, and the vessels contain a fluid which, instead of being a bright red hue is pale and watery. There are, also, many other characteristic indications. I have myself repeatedly tested sheep for flukes by simple manipulation. If you run your fingers or thumb down the spine of a rotten sheep, it winces when you come to the region of the loin.

Another matter of some interest is, as to how these animals should be treated. Not only should they be removed from moist localities and placed on high and dry ground; but they should also have cereals mixed with their ordinary food. Peas, beans, and other seeds of that nutrient class, should be given with grass, taken from uninfected districts; whilst speaking generally, the animals should be kept apart from all other influences calculated to promote the disorder.

Thus then I have, I think, pretty clearly indicated to you all the principal phases through which the *Fasciola hepatica* passes in its development upward from the egg to the fully developed fluke. I did not mention, however, that before its final change, the cercaria parts with its tail, and becomes what is called the pupa. It rolls itself up, undergoing in this state further changes, which eventually bring about the formation of the digestive system. First, the mouth and the suckers appear, and then, in succession, all the other structures which combine to constitute the perfect adult fluke.

So much for the history and development of the most common species. Let us now briefly glance at certain other forms which are closely allied to it. Of no inconsiderable interest is the much smaller trematode called the *Distoma lanceolatum*. This species also dwells in the ox and sheep. It is usually only the one-third of an inch in length, but I have here a specimen nearly half an inch long. It differs from the ordinary fluke, no only in respect of size, but also as regards its organisation. You notice that there are two alimentary canals, terminating in blind extremities. Similar arrangements of the alimentary apparatus are observable in most of the other trematode species, such as *Tristoma*, *Brachylæmus*, and the remarkable genus *Campula*, which I discovered some fifteen years ago in the liver of the common porpoise. In *Polystoma* and *Diplozoon*, the digestive tubes are somewhat more complicated. In the polystoma, the digestive system is not unlike that of the ordinary fluke, but with this difference, that the two main branches on either side join together at the middle line below. This parasite resides in the frog—an animal which is beset with persecutors, both human and entozootic. Some seven, eight, or nine species of entozoa take up their residence in its interior. Here is another species of fluke, termed the *Monostoma verrucosum*. There is but one sucker, placed at the mouth, and leading into two simple alimentary canals, very much as in the distoma. This species resides in the fox. The other two animals represented in the drawings are *Planarians*, of the genera *Polycelis*, and *Proceros*. They live in ponds and ditches, but do not gain access to the bodies of animals.

Here is a remarkable fluke, termed *Bilharzia hæmatobia*. This parasite causes the death of a large number of our race in certain parts of Africa, notably in Egypt, at the Cape, and at Natal; and it also exists, I believe, in the Mauritius. It is the most terrible species of fluke with which we have to deal; for, in place of taking up its residence in the open cavities of the human body, it gets into the circulation. By its presence in the blood-vessels it gives rise to a serious malady, which is exceedingly fatal to life. Having had an opportunity of studying this animal very carefully, I may mention that I first discovered it in the body of a monkey which died in the Zoological Gardens. Those who are on the look out for affinities between mankind and quadrumana, may perhaps see in this fact an additional link in the chain of evidence required to establish their intermutual relationship. Be that as it may, I merely allude to it as an interesting circumstance. At the present time I am acquainted with a young person, now residing in England, who is, unfortunately, suffering from the presence of the bilharzia. Not only has this young lady been exceedingly ill on account of the attacks of the parasite, but the eggs of the parasite escape from her at the rate of at least 10,000 per diem.

It was this destructive parasite that I had in view when I wrote a *brochure* some twelve years ago, the contents of which certainly did alarm some people. No wonder that they said the author was an alarmist. I reasoned in this way. If one human host gets rid of 10,000 larvæ of bilharzia every day, and if these larvæ are carried by rains into brooks, ponds, or sewers, so as to be largely distributed, then, in all probability, the larvæ will undergo changes and transformations such as occur in the ordinary fluke. That was surely a legitimate mode of reasoning.

I have carefully investigated the development of the larvæ of the bilharzia, and have had thousands of them alive, and swimming vigorously; watching them thus for weeks, and day by day. Not only so, but I have made a series of experiments, not yet published in detail, with a view of getting at the higher stages of this larval creature. Thus far, I have observed them in a more advanced condition than any one else has hitherto been permitted to do; nevertheless, my experiments on fishes and other animals have not enabled me to complete the history of their development. Still, I think there is room for caution, since in Africa the residents undoubtedly get this creature by swallowing the higher larvæ, or cercarian forms. The little girl I have referred to had drank from a notoriously impure African stream. A draught of water containing cercariæ or snails with sporocysts would probably be quite sufficient to produce a multitude of creatures in the human host; and, therefore, I think there is some danger lest this disorder should become endemic amongst us. On the other hand, I am quite aware there are sources of comfort arising out of the considerations I have previously enunciated, to the effect that, as a rule, each larval fluke will only select as its intermediary host some particular slug or other small aquatic animal. I rejoice to think, therefore, that it is by no means improbable that the larvæ of the bilharzia will only take up their residence in the body of some form of African snail or insect. If that be the case, we shall remain free from invasion. In the absence of the proper intermediary bearers, our experiments will likewise only yield negative results. Thus it happens also, that certain of our acclimatised animals, such as guinea pigs, remain free from parasites, suitable intermediary bearers only existing in the countries whence they came. Notwithstanding, therefore, the statements I originally put forth in this connection, I have good reason for thinking and hoping that my fears, as then expressed, are not destined to be realised.

Before I close I have to mention another matter in connection with fluke parasitism. The *Distoma lanceolatum* being small, does not put the ox-bearer to much inconvenience; but it is otherwise when it takes up its residence in the human territory. Three cases are on record where this has occurred. One of these cases is particularly instructive. A peasant girl, thirteen or fourteen years of age, and living in the neighbourhood of Kaplitz, in Bohemia, had been accustomed to look after her father's sheep ever since she was nine years old. She had freely, on several occasions, drank from a ditch which runs along the centre of a large grazing-ground, where the sheep fed. The stagnant water in this ditch contained many amphibious molluscs, which harboured a variety of larval flukes. Some of these larvæ, either free or in the sporocystic condition, were undoubtedly swallowed by the little girl; certain of the parasites finally taking up their residence in her liver. Here they produced symptoms akin to those of the rot, and the disorder thus superinduced, in association with other misfortunes, finally brought about the death of the host. Thus amongst other teachings, one hereby learns that, under certain circumstances, flukes will stray from their more legitimate bovine or ovine territory, and take up their abode in the human body. What may be the precise limitation of this area of distribution, so to speak, it is difficult to say, but that there is the greatest possible variety in the individual cases of different forms of parasite there is no manner of doubt. The common *Fasciola hepatica* will take up its residence in any ruminating animal; but the *Distoma lanceolatum* has a more restricted distribution. It is quite clear, moreover, that whilst some parasites will only live in one host, others are not so particular, for they will take up their abode in any bearer that they happen to come across. So far as in us lies, it is our duty to ascertain all the conditions, favourable and unfavourable, as the case may, to the development of these creatures, in order that we may put those who are immediately concerned in possession of that kind of knowledge which shall enable them to avoid playing the part of host. In this also we may restrict the parasitism of our flocks and herds, and by so doing prevent much suffering and inconvenience on the part of the animals. Moreover, we may thus help to keep down the price of animal food, which is more affected by the prevalence of these entozoa than is commonly supposed.

EXHIBITIONS.

THE NAPLES MARITIME EXHIBITION.

The Naples Maritime Exhibition is situated on the Spiaggia di Mergollina, one of the most delightful positions on the bay, at a short distance beyond the Villa Nazionale. The general plan of the building was designed by the Commendatore Francesco del Guidice, and the details of the construction by Signor Frederico di Maria, and Professor Panfilo Rosati.

The general arrangement consists of a garden, of pentagonal form in the centre, surrounded on four sides by the building, and of two wings, in which the principal objects are exhibited.

In the middle of this garden, which is laid out in a most tasteful manner, is a group of statuary, by the Cavalier de Crescenzio, in which Italy is represented as inviting the yet uncivilised America to future greatness; for it must be remembered that the Italians claim the discovery of the New World for their countryman, Columbus, who was a Genoese by birth.

The garden is 46m. in length, by 26½m. in breadth, and surrounded by a portico, which gives access to the various departments. The central part of the building is occupied by the offices of the Royal Commission and juries (13m. × 16m.), and on the left hand follows the secretary's office (12m. × 12m.), adjoining which is the coral and jewellery department, which perhaps is the most frequented part of the exhibition. This room, which is 16m. in length by 10m. in breadth, communicates with that in which the articles of Italian export are exhibited (Group 10); the dimensions of this room are 21m. × 10·60m., and from thence the visitor enters the left wing of the building (97½m. × 20m.), which is devoted to Groups 1, 2, and 3. To the right of the offices of the Royal Commission is a *café* (12m. × 12m.), communicating with the restaurant (21m. × 10m.), and next to which is the second part of Group 10. The right wing of the building, in which Groups 4, 5, 6, 7, 8, 9, are exhibited, is 123m. in length by 20m. in breadth. A small garden, (15m. × 20m.) separates this portion of the building from the annexe, in which the machinery in motion is shown. This annexe is 58m. in length by 20m. in breadth. Some centrifugal pumps and other hydraulic machines are shown at work in the small garden.

The general classification of the exhibition, which has already been published in a previous number of the *Journal*, differs materially from that of other exhibitions, when, as at Paris and London, each country was kept apart from the other. At Naples, on the contrary, the various objects belonging to each group are shown together, so that the comparison of the state of progress in any particular branch can easily be made between different countries.

The total number of exhibitors is about 1,300, of whom 750 are foreign. Italy, as may be expected, both as regards the number of exhibitors and importance of objects exhibited, certainly occupies the first place. The next country in importance is Austria, with 164 exhibitors, of which 20 belong to Group 1; 11 to Group 2; 16 to Group 3; 7 to Group 4; 8 to Group 5; 44 to Group 6; 22 to Group 7; and 36 to Group 9. Holland follows next, with 123 exhibits; then Great Britain, with 75, of which 12 are in Group 1; 11 in Group 2; 2 in Group 3; 11 in Group 4; 10 in Group 5; 10 in Group 6; 14 in Group 7; 3 in Group 8; and 2 in Group 9. A list of the British exhibitors has already been published in the *Journal*. The next country is Spain, with 70 exhibits.

The following shows the number of Italian exhibits, as compared with those of other nations:—

	Italian.		Foreign.
Group 1. Naval construction	259	..	63
,, 2. Steam engines	66	..	53
,, 3. Ports and naval establishments	42	..	30
,, 4. Timber, metals, and fuel	359	..	30
,, 5. Various articles and materials used for fitting and equipping ships	157	..	58
,, 6. Nautical instruments, apparatus for saving life at sea, and arms	97	..	63
,, 7. Ships' provisions, &c.	197	..	43
,, 8. Fisheries	94	..	61
,, 9. Scientific section	72	..	61
,, 10. Principal articles of Italian export	516	..	0
Totals	1,859		462

Commencing with naval construction, we find that Italy has made considerable progress in this industry since she became a nation, and an interesting collection of models of ships of war, as well as of merchant vessels, are shown in this group. Amongst these may be mentioned the models of the iron-clad frigates, the *Roma* and the *Venezia*, designed by the Chief Constructor of the Italian Navy, the Commendatore De Luca, and built under his direction at the government dockyard of La Foce, near Genoa. The principal dimensions of these ships are as follows:—Length, 80 metres; breadth of beam, 17½ metres; mean draught, 7·50 metres; and displacement, about 5,700 metrical tons. Their armament consists of 36 rifled guns, of 6⅝ in. calibre, and the thickness of the armour-plating 12 centimetres. The engines are of 900 nominal horse-power, and were made by Messrs. Maudsley, Sons, and Field, of London. The *Principe Amadeus* and the *Palestro*, the models of which are also exhibited, differ but slightly from the former vessels; their armament, however, is considerably heavier. The first is now building at Castellamare, and the other at

Spezzia. A model of another class of vessel, recently built for the Italian Navy, is also exhibited, viz., of a steam corvette of six guns, the *Carri-ciolo.* The principal dimensions of this vessel are 64m. in length, 11m. in breadth, and 6·53m. in depth. The engines are of 300 nominal horse-power, and were made by Messrs. Guppy, of Naples.

With regard to the mercantile marine, the shipbuilders of the Ligurian coast have made a creditable display of models and drawings of vessels of every class, from the common fishing-boat to the clipper of the Eastern trade.

An exhibition at Naples would not be complete without models of the craft used for the coral fishery, which form such an important branch of industry there.

To give a complete description of the models exhibited by the various other countries would occupy too much space, and we shall therefore pass on to Group 2, in which are comprised steam-engines of all kinds, and other machinery. In a maritime exhibition this department occupies a most important place; and, commencing with marine engines, Italy has certainly made within the last few years most important progress in mechanical arts. In this group the palm is certainly borne by Messrs. Maudsley, Son, and Field, and by the Società Nazionale d'Industrie Meccaniche of Naples. The first-mentioned firm exhibit four small working models of marine engines which, for beauty of workmanship and delicacy of finish, certainly leave nothing to be desired. One of these models is a marine engine with oscillating cylinders, and fitted with feathering paddle-wheels; another is a screw engine, with vertical cylinders, of the type for which this house is famous. The two last are also screw engines, with horizontal cylinders. These models are shown in motion, being driven by another model, which is supplied with steam from the boiler of the exhibition.

The Società Nazionale d'Industrie Meccaniche are proprietors of two establishments at Naples, the most important being that of Pietrasa, which they have hired from the government. This firm exhibits one of the cylinders of a marine engine of 900 nominal horse power, which they are making for the *Principe Amadeus.* The diameter is 86 inches, and stroke four feet, and it weighs about 20½ tons. The screw propeller for the same ship is also exhibited, and is of gun metal; its diameter is 19ft. 8in., and weight 12½ tons, and has four blades. The slide-valves and reversing gear are also shown, and together with the cylinder are excellent specimens of workmanship, and reflect great credit on Italian mechanical industry. This firm have contracted with the government to furnish these engines for the sum of 1,336,000 francs.

The engines for the sister vessel, the *Palestro*, are also being made by an Italian firm—Messrs. Ansaldo, of Sanpierdarena, who are well-known in Italy for this class of work, and who exhibit various parts of engines, such as connecting-rods and bearings.

We cannot leave the exhibits of the "Società Nazionale," who also have contributed various portable engines, thrashing-machines, &c., without praising the workmanship of a six-wheeled locomotive engine, of the type now adopted by the Southern Railway Company, the only novelty in design being in the reversing gear.

The arsenal of Naples has also contributed various machine tools of excellent construction, but presenting no especial novelty in design.

The machinery in motion is driven by a 16-horse horizontal engine, on Wolff's system, by Paterson, of Naples. Of the 32 machines shown in motion, 21 are exhibited by Italians, 10 by England, and only one from France.

Passing on to Group 4, where, we regret to remark that, in spite of what might have been expected, the mining industry of Italy is but poorly represented at Naples. Whether from the fault of the local committees, or from a want of enterprise on the part of the proprietors of mines, it does not give a fair idea of the mineral resources of the country. It has not even been thought worth while, for instance, to exhibit specimens of the argentiferous galena of the Sardinian mines, which yield annually to the value of half a million sterling. The Elban irons, which perhaps are the richest in Europe, are also remarkable by their absence. Sulphur the most important of the mineral productions of Italy, is also badly represented, and give one no idea of the importance of this industry. The manufacture of steel, however, has a worthy representative in Signor Gregorini, of Lovere, on the Lake of Iseo; and the samples of Bessemer steel and of iron show that Lombardy, with her fame for iron, and all the crafts belonging to it, could not remain unrepresented at this exhibition. The steel works of Signor Gregorini are, perhaps, the most important in Italy, and produce about 600 tons of steel annually. Some excellent samples of copper are exhibited from the government works of Agordo.

The zinc exhibited by the Vielle Montagne Company also deserves especial notice, as also that of Auronzo (province of Belluno); and, were these mines conducted in a proper manner and scale, their production might rival any other in Europe.

The scarcity of fuel in Italy is proverbial, but this is no excuse for the neglect on the part of Italian mine proprietors in allowing this occasion to slip by without contributing their produce to the exhibition. Amongst the few samples that may be mentioned are the lignites of Claudinico (Fruili), said to be the best in Italy, and those of Mont Rufoli, in Tuscany.

The peats of Lombardy are also absent, and it is remarkable that such an important industry should be so badly represented, the only specimens deserving notice being those exhibited by the Comizio Agrario of Amonzo. We cannot leave this group without referring to the geological maps and works of Professor Torquato Taramelli, of Udine.

In Group 6, by far the most remarkable instrument for navigation, and which has attracted the attention of naval men of all nations, is the "Nautismograph," exhibited by Signor Ferdinando Esposito, an engineer in the Italian navy. This ingenious instrument for keeping the ship's log is self-registering, and the various movements of the ship at sea are recorded by means of curves traced on paper by the apparatus, which is acted upon by clockwork. Two of these instruments are shown at the exhibition. The first is intended to be used on board steamers, and the second on sailing vessels. The nautismograph for steamships is far more complicated in its arrangement than the other, and it registers, first, the ship's course; second, her evolutions on a horizontal plane; third, the number of revolutions of the engines; fourth, the speed of the engines, whether at quarter, half, three-quarter, or full speed; fifth, speed in nautical miles; sixth, degree of rolling; seventh, degree of pitching. This instrument consists of two distinct parts, which are placed in the line of keel, and in such a position as to receive movement from the engines.

The nautismograph for sailing vessels is very similar in construction to the one just described, but it is far more simple in its construction, as its duty is only to register the ship's course and the degree of rolling and pitching. Both instruments are maintained in a horizontal position by a most ingenious arrangement, which, together with the extreme nicety of detail and construction, reflects great credit upon the inventor, Signor Esposito.

Besides the nautismograph, the same exhibitor shows an "Entinsiograph," or compass, to be used for marine surveying, by means of which four points are accurately determined upon a sheet of paper, indicating respectively the north, the relative positions of the ship's bow, and the direction of the object that has been observed. Uniting these points with the centre, which is the axis of the magnetic needle, the operator obtains the rhombus upon which the vessel is being sailed at the moment the observation was taken, together with the angle of the direction of the object.

An improved ship's compass is also exhibited by Signor Esposito, in which the ordinary binnacle is dispensed with, and the card can be seen at a greater distance than is usually the case with the ordinary ship's compass.

Proposed International Exhibition of Female Industry.—A committee has been formed in Florence for the purpose of organising an International Exhibition of Female Industry, which is to be held in that city in the course of two or three years. At the first meeting, which took place the other day at the residence of Prince Poniatowsky. the secretary explained the nature of the proposed exhibition, and dwelt upon the necessity of making arrangements in order that no other country should get the start of Italy in organising a similar undertaking. A provisional committee was afterwards appointed to draw up a report, which is shortly to be laid before a general meeting of the promoters.

THE POLLUTION OF RIVERS BY THE WOOLLEN MANUFACTURE.

The Commission appointed to make inquiries into the pollution of rivers caused by any particular manufacture, whether in England or Scotland, have published the result of their investigations. These extend not only to the clothing districts of the West Riding of Yorkshire, but also to Gloucestershire and Somersetshire, the flannel trade of Wales, the blanket manufactories of Witney and of Dewsbury, the worsted and rug factories of Kendal, and the carpet works of Kidderminster, Halifax, Rochdale, Durham, and Wilton. To make their observations more easily understood, a coloured map accompanies the report, showing the localities chiefly influenced by the processes in question. Attention was especially directed to the principal seats of the woollen and worsted trades in the West Riding. The Commissioners, in their endeavour to appreciate properly the information gathered by their predecessors, and collect such further evidence as seemed necessary, have particularly examined the whole course of the rivers Aire and Calder, for which purpose a steam vessel was placed at their disposal. They have held meetings and made inspections at the principal towns upon the Aire and its tributaries, and at those situated upon the Calder and its affluents. These inspectors' meetings have also extended to the West of England, to Westmoreland, and several of the Scottish towns, chiefly occupied with the manufacture of various woollen fabrics. Every assistance needed for the prosecution of the inquiry has been cordially rendered by the local authorities, and by a large number of individual manufacturers and traders. The recommendations of the Commission have been delayed publication until the present time, in deference to the express objection of some of the West Riding manufacturers to any legislation which should not also be enforced upon the textile trades of other districts; but advantage has now been taken of the evidence collected in 1866, with that forming the subject of this report, and the Commission feel in a position to enter fully into the question of the river pollution due to the woollen manufacture, including a description of processes, localities, and samples that define the nuisance thus created; a discussion of remedial or preventive measures that may help to abate the same; and the conclusions and recommendations which ought, in their opinion, to guide legislation on this subject.

Around the localities of Bradford and Leeds, of Halifax, Huddersfield and Wakefield, are collected many gigantic establishments, the principal example being taken from that of Sir Titus Salt, Bart, and Sons, who employ 3,500 hands. Here the materials used annually are quoted in detail, representing enormous quantities of logwood and similar dyewares, chloride of lime, ammonia and oil of vitriol, Gallipoli oil, soap, alkali, and coal. In consequence of this and other like establishments, the beds of the rivers have been silted up, and were formerly trout were very plentiful, now no living thing can exist except rats, which feed on the dead carcases of animals. Besides this mixture of dyewares and chemicals, very serious pollution arises from the addition of town sewage from these extremely populous neighbourhoods. At the West of England we learn that the character of the pollution due to the manufacture of short wool can be nowhere better studied than on the small streams uniting below Stroud, in Gloucestershire. Upwards of 25,000 pieces of cloth are made in this district annually, and the greater part of this large quantity is black and blue cloth. In addition to the drainage from this large manufacture, there is the waste from six or eight shoddy mills, as well as the ordinary industries of the considerable population here located. But in the worst instance, where the water was found to be tinted with dye, the pollution was not greater than the Thames at Hampton Court; and in no part of Gloucestershire was there a nearer approach than this to the condition of the frightfully polluted streams of Lancashire and Yorkshire. The drainage liquors from wool factories are ascertained to be not less polluting than those of calico print works; but, in the Gloucestershire streams, their volume bears a very small proportion to that of the rivers with which they mingle.

The experience gained during these inquiries has enabled the commissioners to arrive at certain definite conclusions that will enable the legislature to deal with this important question. They recommend that the casting of any solid matters, of whatever kind, into rivers and running waters be absolutely prohibited, and that immediately; that the discharge of any polluting liquids, which transgress certain limits assigned, shall be prohibited, but a reasonable time be allowed for the execution of the necessary works for purification. They recommend also that all rivers and streams in England be placed under the superintendence of central boards, whose duty it will be to exercise a surveillance over both the quality and quantity of the water-supply of towns, and to investigate all schemes connected with river conservancy, and to refer such matters for the consideration of one of her Majesty's principal secretaries of State.

PUBLIC HEALTH AND LOCAL GOVERNMENT.

In the House of Commons, on Tuesday night, Sir C. Adderley moved for leave to introduce a Bill to consolidate and amend the laws relating to local health and government. He said the present measure was simply the report of the Sanitary Commission appointed two years ago, in the form of a Bill. The first task of the Commission was to consolidate all the sanitary laws which had been passed during the last quarter of a century; and in this Bill no less than 40 Acts were reduced into one measure. Many of those Acts were conflicting, being merely a series of instrumental measures which different members had introduced for particular objects, while some of them were wholly incomplete and inadequate to the purpose. The first object of the Commission having been to reduce all the various statutes into one; the second was to consolidate the authorities throughout the country, which had been needlessly multiplied. There were, for example, nuisance authorities, sewer authorities, local boards, and improvement commissioners throughout the kingdom; and in the rural districts there were the boards of guardians, and in some cases vestries. A third object was to remove the extraordinary anomaly of leaving the enforcement of sanitary laws optional with every locality. It would not be necessary to constitute any new authorities for that purpose, but merely to unite existing ones. Neither was it proposed to interfere with any of the local Acts in such large towns as Liverpool and Birmingham; but it was intended to afford such places every facility for merging themselves in the general system by adopting the provisions of this Bill; and he had not the slightest doubt that many of them would avail themselves of those facilities. Another object was to reconcile the confusion of areas of local government. The areas at present constantly overlapped each other, and the result was conflicting jurisdiction and immense confusion. He was astonished at the opposition manifested to the establishment of a central authority. There were thousands of instances in which the local authorities required the assistance of a central one, and such authority as now existed was scattered over various departments. What he proposed involved no increase of expenditure. The number of authorities and officers would be lessened rather than augmented, and the waste of money arising from the want of concentration would be avoided. The effect of the inanition of the sanitary laws at this moment was greatly to increase the mortality of the country, particularly among the working classes. There was no reason why the great mass of the people should breathe foul air and drink impure water, and all that was needed to reduce sickness was to establish proper and uniform regulations, and to make their adoption imperative. Another provision of the Bill contemplated mapping out the country into sanitary districts, and there would be no locality without a sanitary authority. The Bill next proposed to simplify the areas of rural districts which at present overlapped each other. There were other clauses which dealt with the supply of water, burial grounds, markets, &c. He entertained a sanguine hope that the House would allow him to introduce the Bill that evening. He could not, of course, expect to carry it to a further stage this session, but the effect of introducing it would be, that it would be circulated throughout the country, and the people would have an opportunity of considering its provisions during the recess. Leave was then given to bring in the Bill.

SCHOOL TEACHERS REQUIRED FOR A NATIONAL SYSTEM OF EDUCATION.

At a meeting of the Council of the London Association of Church Teachers, on the 11th inst., Edwin Chadwick, Esq., C.B., vice-president, in the chair, the following report of the Sub-committee on the Supply of Teachers was received and adopted:—

The Sub-Committee appointed to inquire into this subject was instructed to direct its attention to two points in particular, viz., first, to estimate the number of certificated teachers likely to be required when the schools called into existence by the Education Act of last year are in full working order; and, secondly, to consider the means of supplying that number.

The Committee first endeavoured to arrive at a careful and accurate estimate of the number of children to be educated. From the census returns of April last, we find the population of England and Wales to be 22,704,108. But this number includes the upper and middle classes, whose children are educated in higher schools, and consequently are not to be included in these calculations. The Committee had considerable difficulty in ascertaining the proportion of the population that may fairly be said to belong to these classes. Dr. Farr, after several calculations made by him for the Schools Inquiry Commission, fixes this proportion at one in 7·2 of the entire population; and, while your Committee has adopted this proportion, the members thereof are unanimous in thinking that it seems somewhat small. But of course much depends on the fixing of the line between the labouring population and the middle-class; and in accepting the proportion of one-seventh, the Committee feels that the estimate of the labouring population—viz., six-sevenths—is an extreme estimate, and that, on the safe side of too much rather than too little.

Deducting, then, one-seventh of the entire population as belonging to the upper and middle classes, there remain 19,460,664 inhabitants belonging to the labouring classes, and benefited by the Parliamentary grant.

Now, one-six of the population is estmated to be of school age; and although other estimates have been given, your Committee considers this the safest and best to adopt. Consequently, one-sixth of 19,460,664 gives 3,243,444 as the number of children of school age. But in estimating the number of teachers required, much misapprehension would arise in taking this number as the basis for calculation. The whole of the number might be enrolled, but only a portion would be in average attendance. In 1869, the number of children in average attendance in the Annual Grant Schools of Great Britain was only 69·26 per cent. of the number enrolled. This is evidently too small a per-centage for a school system which is to be considered in any degree efficient. After very careful thought, your Committee is of opinion that in a satisfactory system, with compulsory attendance, the average number present ought to reach 85 per cent. of the pupils enrolled. This may seem a high estimate, but for that reason your Committee prefers accepting it.

Taking, then, 85 per cent. of the children of school age, we obtain 2,756,927 as the average attendance of the primary schools of England and Wales, when all children of suitable age are under education. This represents the work to be done. Two and three-quarter million children are to be under daily tuition in our national schools.

What number of certificated teachers is required to provide the schools containing these children with an efficient teaching staff? To estimate this number was your Committee's second effort. At Christmas, 1869, in the Annual Grant Schools of England and Wales, besides pupil teachers and uncertificated assistants, there was one certificated teacher at work for every 88·39 children in average attendance. The London School Board recommend that, in addition to pupil teachers, one certificated teacher be employed for every hundred children. Now, many schools employing certificated teachers have ample accommodation for an increase in their average attendance; and although under a more vigorous system, employing compulsory powers, this increase will most probably be realised, yet, in many instances, this will be done without any addition to the certificated staff of the school, as another pupil teacher or ex-pupil teacher will be employed. Besides the increase in the number of children enrolled, there will doubtless be considerable improvement in the attendance of children already on the books. Hence your Committee considers that the proportion of one certificated teacher (with the aid of pupil teachers) to 100 children in average attendance, will be the more probable estimate, when once the country is completely supplied with efficient schools. From this proportion then the number of certificated teachers required in a system of thoroughly well-appointed schools, covering the whole country, is 27,569.

Now, the number of certificated teachers actually at work at Christmas, 1869, was 12,027; and supposing this number to have increased by the students leaving college at Christmas, 1869 and 1870, in the same ratio as it had done in the two years previous to 1869, there will be employed in our Annual Grant Schools at the present time not less than 13,500 certificated teachers. Consequently, 14,069 additional certificated teachers will be required, before the country can be considered as adequately supplied with an efficient trained staff.

How is this additional number to be obtained? The colleges at present in existence can accommodate 2,500 students, and can consequently turn out annually 1,250 teachers who have had two years' training, a number sufficient to maintain a staff (when once established) of 25,000 teachers. But the Committee of Council, for the next few years, will allow students to leave college and take charge of schools at the end of their first year of training. If this permission were generally adopted, 2,500 trained teachers could leave college annually, and, allowing for waste, this number would represent an addition to the profession of 2,000 trained teachers per annum. This increase, together with what may reasonably be expected from Scotch colleges, where the number that can be trained is in excess of the requirements of Scotland, and together with the number provisionally certificated, will, in the opinion of your Committee, be amply sufficient to meet the present emergency; for this additional number of teachers will not be required immediately, but will extend over a number years. Consequently, in the way described, the extra demand may be met, and, in the course of eight or nine years, a staff of certificated teachers raised, numerically large enough to supply the schools necessary to educate the children of the labouring population of the land.

GEORGE'S CALORIGEN.

Mr. George has patented an invention for warming and ventilating rooms, of which the following is a description. Its principal merit consists in its carrying off the whole of the products of combustion absolutely, while allowing very little, if any, of the heat to escape; and at the same time it brings into the apartment a plentiful supply of pure, warm air.

The stove, D (Fig. 1), is a cylinder of thin rolled iron, closed at the top and bottom, so that the interior, containing the burner, is entirely cut off from the atmosphere of the room. It is furnished with two pipes (F F), one near the top, to carry off the products of combustion, and one near the bottom, to supply the flame with air. These two pipes terminate in a cylinder or chamber (E) outside the room, open only at top, causing the air entering the stove to come into contact with the heated air leaving it, acting as a natural regulator of the flow, and saving much waste in heat. Thus the fumes of the gas are carried out of the room, without draught, as there is no communication between the gas-light and the air of the room, the door of the stove completely cutting it off when shut.

When a chimney is used, the opening in front of the grate is fitted with an iron plate, a board, or otherwise, and it is then found to act in the same manner as a cylinder, viz., supplying cold air and carrying off fumes. Another feature in this invention is a coil of thin wrought iron tube in the interior of the cylinder, D; this coil communicates with the external air, as shown at G; the fresh air entering this coil is warmed in its passage, and constantly flows into the apartment (shown at H), thus providing not only warmth, but ventilation, and this without any draughts.

The same principle of warm ventilation is seen in (Fig 2) a stove for coal or other fuel, also made of thin rolled iron, and so constructed as to retain a deposit of carbon, thereby preventing the absorption of oxygen, and emission of hydrogen and oxide of carbon, some of the deleterious products resulting from the use of cast-iron stoves. It works with a very small amount of fuel—20lb. of coal for sixteen hours.

Fig. 1.

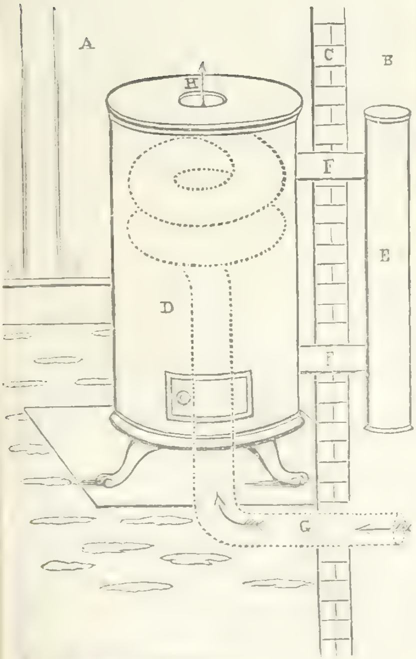
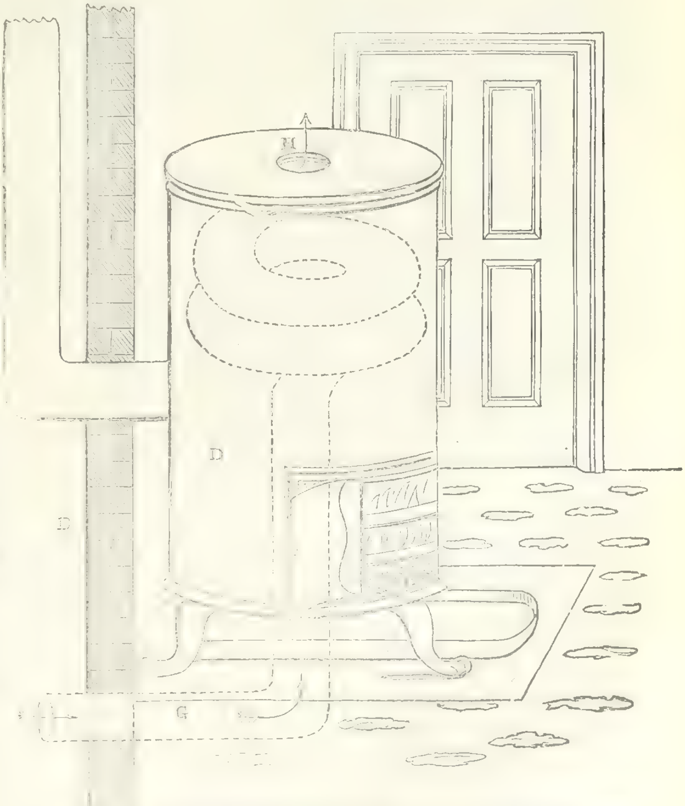


Fig 2.



A.—The interior of the room.
B.—Exterior of the building.
C.—Wall.
D.—The Calorigen.
E.—A cylinder.
F.—Pipes communicating to supply air for combustion and carry off product.
G.—Pipe for passage of cold air to Calorigen.
H.—Outlet for ditto after being made warm.

EDUCATIONAL NOTES.

The Bye-laws of the London School Board.—These have now been prepared by the committee, and will be considered by the Board after the recess. They include the putting in force of the compulsory clauses of the Act, and the remission or payment of the fees of indigent children, without restriction as to the school which the children attend. The machinery for putting these laws in action is proposed to consist of ten committees, one for each division of the metropolis, and consisting of the members for the division, with power to add persons to them who are not members of the Board. These divisional committees are to be divided into sub-committees to manage districts, and these will be, in fact, the school managers provided for in the Act, to whom school boards are allowed to delegate a considerable portion of their power.

The Irish Education Question.—On the 24th inst. an influential deputation, headed by the Lord Mayor of Dublin, and representing the Corporations of Dublin, Waterford, Kilkenny, Dungarvan, Clonmel, and other towns in Ireland, including a large number of Irish Members of Parliament, both Protestant and Roman Catholic, had an interview with Mr. Gladstone, for the purpose of presenting memorials praying for the introduction into Ireland of an educational system based upon the principle of perfect equality between Roman Catholics and Protestants. The former looked upon it as a grievance to be excluded from university education on account of their religious belief. Mr. Gladstone, in reply, said that with regard to higher education, he felt that the Roman Catholics of Ireland, and also the members of other communities, have a substantial grievance, and he fully admitted the pledges given by the government, who were prepared to give the question their best and earliest attention.

The Newcastle College of Science.—A public meeting was held at Newcastle on the 15th inst., to receive a report from the Executive Committee. The subscriptions now amount to £21,460. The election of professors in mathematics, geology, chemistry, and experimental physics, and the determination of the committee to open the college in October, were announced. It was recommended that the lecture fees should be such as may secure a large attendance of students, and it is suggested that five guineas yearly for each course, and one guinea entrance, would be suitable. The governing bodies of the college are proposed to be :—First, a body of forty-seven governors; second, a council of fifteen, elected out of and by the governors. Hopes were expressed that ultimately success in teaching physical science would enable them to enlarge the basis of the institution, so as to include all the higher branches of a liberal education.

The Study of the Law in General Education.—The *Times*, commenting on the debate now going on in the House of Commons upon the proposed Legal University, says :—"There was a time when law was one of the chief subjects at our universities, and liberal men complained that arts were neglected. A time may come again when a university law school may be a source of instruction to English gentlemen, whether they purpose to become 'practising barristers' or not, and when an acquaintance with a most important branch of human knowledge will not be left solely to those who propose to live by it. But for generations the study has been practically extinct at the great seats of English education, and the Doctorship of Civil Law has become so completely an idle title that it is conferred on every layman, political or literary, military or naval, whom the university desires to compliment."

The Physical Education of the Poor.—Sir Charles Trevelyan, in drawing attention to the importance of this subject, points out that "something besides 'book-learning' is wanted to rescue the lower population of London from their present state of physical and moral degradation," and quotes some remarks by Miss Octavia Hill upon the playground near the Regent's-park, given by Mr. Ruskin for the use of poor children. This lady says :—"The refining influence on the children has been something wonderful. Few people can imagine the state of their minds and habits when we opened the ground. They were quite indescribable. The restraint of school was not there; the respect to strangers, which makes even children reticent for a short time, wore off when we had been long hours among them, and the condition of their habitual thoughts revealed itself in hideous distinctness. Never can I forget those times. But gradually, little by little, the whole tone was raised. The civilising influence has partly been from the fact that the children are withdrawn from the terrible influence of the streets and courts; partly from the fact that they are gradually placed among pretty things that want care; and partly from the fact that the ground is a meeting-point for educated people, where they can influence that important part of a child's life—his play-time—unknown to himself." And further, in referring to the difficulty of getting subscriptions, she adds : — "It is wonderful to me that people seem to realise so little what this kind of work is worth. I could get almost any amount of money given to provide necessaries which men ought to provide for their own families, and which, as gifts, would corrupt and degrade them, and lower their wages; but the small expenses of our playground" are difficult to obtain. A leader in the *Daily News*, commenting on these remarks, says they "contain many points of serious and pathetic interest for all who are concerned in reclaiming for the little ones a natural right to the joyousness of living. Whatever good may be effected by the movement for the intellectual training of the destitute may be largely supplemented by encouraging in them a faculty and a desire for humanising recreation, the gratification of which at an early age is essential not only to their happiness, but to their moral improvement." The subject of playgrounds was discussed at the meeting of the London School Board on the 19th inst., when it was introduced by the Rev. Dr. Rigg, who suggested that where land could not be got round the schools, the buildings should be raised, so that there might be playgrounds under them.

CORRESPONDENCE.

HILL STATIONS OF INDIA.

Sir,—In your *Journal* of Friday last, the 14th inst., appeared two separate allusions to the hill stations of India. One of them suggested that all young soldiers arriving in India before attaining 21 years of age, should be sent to a hill station; and the other remarked that it did not appear that government was redeeming its promise of sending a fair proportionate number of the troops to such healthy localities.

Now, although the first suggestion would be most decidedly of vast benefit to such young soldiers, I do not think it would be at all to the advantage of the troops generally; for when we consider the limited accommodation as yet provided for the mass of troops serving in India, as far as hill stations are concerned, and the great numbers of young soldiers that have recently been sent out to that country, if such young soldiers were all sent to the hills, it would be to the detriment of the matured and efficient soldier, who had already been serving for years in the presidencies, and whose health would suffer in consequence of his not being able to receive the benefit of a change for a time from the enervating and unhealthy plains, where his constitution had been debilitated, to the exhilarating and bracing atmosphere of more elevated regions. It would certainly be far better, in the interests of efficiency, not to send such young soldiers out to India at all. With regard to the second point, viz., whether government is redeeming its promises or not, I would venture to remark, that it does appear the government is becoming alive to the necessity of providing a greater number of sanitaria on the hills, so as to accommodate a larger body of troops thereon, as they have recently determined upon the occupation of the "Puchmurree plateau" as a fitting site for recuperative purposes, this plateau being situated on the Puchmurree range, in the Salpoora hills, in the Hoosingabad district of the Central Provinces, and to which it is intended to send, as an experimental measure, 200 men from the stations of Kamptee and Saugur.

The above-mentioned plateau is about four miles long by two broad, and is about 3,500 feet above sea-level, and 2,000 feet higher than the plains at its base. The table-land has much open country, with a never-failing stream, named the Denva, flowing through it from the westward, which is subject to very high floods in the rainy season, so much so as to be at times impassable for days. A working party of 100 men have been employed to throw a dam across this stream, so as to form a lake, for the convenience of the troops about to proceed to this sanitarium.

The soil is sandstone, and carts can ascend the hill. Coffee and potatoes thrive on it, but it is considered too dry for tea. Cinchona cultivation was experimentally tried here in 1867, by the Forest Department, but the result was failure. However, the climate was found to be very healthy, as the European who had charge of the cinchona plants, and who has resided ever since at these hills, never had the slightest attack of fever. The rainy season is from June to the middle of September, and the average annual rainfall is 48 inches. High winds generally prevail in July during the rains. The plateau is a gently undulating plain, with a few pretty rocky peaks here and there, dotted thickly with small clumps of handsome trees, having a park-like appearance. The only game on the hills are a few hares and partridges, but in the ravines below and on the slopes, tigers, leopards, bison, sambur, and spotted deer are abundant.

There are some curious artificial caves on the hill, and some old ruined brick buildings, the remains of a former village or town, whose civilised residents have long departed, and who have been replaced by the wild tribe of Kowkoo, who are now the only dwellers on the hill; the village of Puchmurree has a population of about 300. Building materials abound on these hills, and lime is obtained down a ravine 800 feet deep, at a distance of four miles from the village, and good brick clay in large quantity is procurable close to the village.

This plateau is readily approachable from the Great Indian Peninsula Railway, as it is only distant about 45 miles from the station of Sohagpoor on that line, in the Nerbudda valley.

A military officer has already been appointed to command the depôt and superintend the construction of the necessary buildings, which I regret to hear are only to be of a semi-permanent character, but as the occupation is merely to be of an experimental nature, perhaps it is not thought prudent to establish habitations of a durable kind.

Now, though 200 men are but a very small proportion of the European army, yet, as there are a few other sanitaria, such as Nynee-Tal, Murree, Simla, Wellington, &c., already occupied by troops, this additional one does certainly show that government is taking some steps towards the redemption of its promise, and let us hope that this is only the first of a series of speedy formation.—I am, &c.,

A. Romaine Wragge, Lieut.-Colonel.

Old Charlton, S.E., July 17, 1871.

THE PSYCHIC FORCE.

Sir,—In your *Journal* of the 7th inst., pp. 651-2, reference was made to the experimental investigation of a new force, recognised by Mr. William Crookes, F.R.S., and by other scientific observers, recently, and it was stated:—"It is gratifying to learn that this matter is now receiving investigation at the hands of cool and clear-headed men of recognised position in science." So it is; and I hope that their investigation will include the phenomena recently mentioned in *Once a Week*, whereby, by means of some electric force, producing thought-reading, as the writer believed, or otherwise, some persons in America and elsewhere, peculiarly constituted, have the faculty even of ascertaining concealed writing, without personal knowledge of the writer, so as to answer it with a certain amount of accuracy, as if they had read it openly with such knowledge. The writer in *Once a Week* deemed this faculty or special gift worthy of investigation by men of science, as I do.—I am, &c.,

Christopher Cooke.

London, July 1, 1871.

OBITUARY.

Signor G. Sommeiller.—We regret to have to announce the death, on the 11th instant, of Signor G. Sommeiller, who with Signor Grattoni was engineer to the Mont Cenis Tunnel, and to whom the credit of the mechanical appliances used for the construction of this great work is due. Sommeiller, if not the actual inventor of the tunnelling machine, had at all events brought it to perfection, and had shown the practicability of the application of compressed air as a motive power; and if he has not lived long enough to see his great undertaking completed, he has had the satisfaction of seeing its success, and that the Alps no longer form a barrier between the railway systems of France and Italy.

GENERAL NOTES.

Labour in Italy.—In the gold mines of northern Italy, which are mostly situated high up on the mountains, the materials necessary for carrying on mining operations, such as timber, iron, gunpowder, oil, hammers, borers, &c., are all taken up to the mine by women, who carry them in baskets on their backs. These women receive about one franc per day, and carry a load of from one half to one hundredweight of material a distance of three or four miles up the rough mountain paths. Women's labour is also very largely used at the mines for washing and picking the ore, before it is sent to the reduction works.

The Patent Laws.—At a recent meeting of the London Patent Agents, held to consider the proposed changes in the patent laws, Geo. Haseltine, M.A., chairman, it was resolved:—1. That inventors have a right to the sole use of their inventions, which it is the duty of legislators to harmonise with the interests of the state. 2. That patents should no longer be granted to mere "first importers," but should be confined to actual inventors. 3. That the term of patent should be twenty-one years—now fourteen—without provision for extension. 4. That the official fees should be reduced from one hundred and seventy-five to ten pounds for the entire term, which is sufficient to defray the expenses of an efficient patent system. 5. That the French mode of granting patents—without official investigation of the merits of the application—should be adopted. 6. That in patent suits the right of patentees should be determined by a competent court of equity, dispensing with jurors and "expert" witnesses.

A Dressing for Barrels in Lieu of Pitch.—Some American papers gives the following mixture as being a good dressing for barrels, viz., 100 lbs. of rosin melted in a suitable vessel with two or three pounds of fat. This mixture runs well, sticks fast to wood, and does not crack away or blister.

The Royal Society.—The annual report of the Meteorological Committee of the Royal Society has been presented to Parliament. It states that the number of ships supplied with instruments by the office has been nearly doubled during the past year, the number of barometers afloat on the 1st January, 1871, being 124, as compared with 69 twelve months previously. In addition, all ships in commission in the Royal Navy have, as usual, received all their meteorological instruments from the office. Monthly charts of data for the west and south coasts of South America have been lithographed, and will shortly be published. As regards telegraphy and weather warning, no change of importance has been made in the system. At the end of April last, the stations where the drum signal is hoisted were 123 in number. With respect to the land meteorology of the British Islands, the report shows that the seven observatories are in active operation.

Art Workmanship.—The Masters, Wardens, and Court of Assistants of the Worshipful Company of Turners, in continuance of their action last year, propose to give each year their silver medal and the freedom of the company and of the City of London to any one workman or apprentice in the trade who may send in the best specimens of hand-turning for the year. The material to be used will be varied in different years, so as to include wood, ivory, metals, stone, spar, &c. The competition for this year will be in turning in wood. The following are to be the conditions of the competition. The qualities which will be considered in awarding the prize will be the following, viz.:—1. Working to exact dimensions, illustrated by a cylinder 6 inches long and 2 inches in diameter, or any other object which shall measure exact inches without fractions. 2. Exactness of surface and fit, such as is shown by a nest of cylindrical boxes with screwed lids, which shall drop out of one another and fit without shake; but these qualities may be otherwise illustrated at pleasure. 3. Exact copying, so that the two objects produced (such as two cups, vases, boxes, or chessmen) may be *fac-similes* in every part. 4. Neatness of design, symmetry of shape, and good form of mouldings. 5. Fitness of the work and design for the purpose proposed. 6. Ability to turn in different woods, of varied grain and degree of hardness. The candidate may make his own selection from the above list, but the one who best fulfils the largest number, including the most important qualities, will be preferred. The work must be all hand-turning, produced in the ordinary lathe, without special apparatus. The different objects must be delivered free at the Mansion House, London, during the week beginning Monday, October 2nd, and ending Saturday, October 7th. Specimens must not exceed 18 inches in height, and a foot in diameter. They must be each marked with a private mark or motto, and numbered, and accompanied by a list, showing for each number the grounds on which the prize is sought. They must be accompanied by a sealed envelope marked with the same mark or motto, and containing the name and address of the competitor, and his age, if an apprentice, and in all cases a certificate of good conduct, and a certificate or declaration that he is in the trade, and that the work is by his hands only. These will not be opened until the judges have made their report. The specimens sent will remain the property of the competitor; care will be taken of them, but the court will not hold themselves responsible for their safety. The candidates must remove the specimens at their own cost within a week of the decision being communicated to them. The successful candidate last year was Alfred Madden, 59, Peabody-buildings, Commercial-street, Shoreditch.

The Petroleum Bill.—The Committee of the Petroleum Association, together with Dr. Letheby, Mr. Dugald Campbell, and Mr. Boverton Redwood, Secretary and Consulting Chemist to the Petroleum Association, had an interview with the Earl of Morley, when his lordship consented to reduce the test standard to eighty degrees Fahrenheit, and to provide that such portions of the Act as relate to the test shall not come into force until February 1st, 1872.

Domestic Economy.—The Earl of Shaftesbury presided over an influential meeting, at the office of the Victoria Press, on Saturday afternoon, with a view of starting, on a co-operative basis, an educational institute, to counteract one of the evils which has recently received much attention, namely, the ignorance of our countrywomen in matters relating to household management. A provisional committee was appointed, consisting of Lord Shaftesbury, Lady Alfred Churchill, Mr. Brassey, M.P., Mr. Mundella, M.P., Mr. Sims, Sir. T. Erskine Perry, Miss Faithfull, and Mr. Bevan. The Marquis of Westminster and Sir Stafford Northcote, M.P., sent letters regretting their absence, and expressing interest in the undertaking. Lady Blanche Balfour sent a donation of £50, and £50 for shares, Mr. Peek £500, and several other handsome sums were promised. The institute will comprise a registry office, restaurant, and reading-room for ladies. Lord Lyttelton, Countess of Warwick, Mrs. Alfred Tennyson. Hon. Philip Stanhope, Mr. Hughes, M.P., Lady Collier, &c., have joined the undertaking.

Chinese Varnish.—Among the raw-stuffs sent by Dr. von Scherzer from Pekin was one called schio-lias, a kind of varnish which is employed for varnishing all kinds of wooden things, and has the property of making these articles watertight. Dr. von Scherzer has seen wooden chests in Pekin which have been over Siberia to St. Petersburg and back, and still remain sound and watertight. Even baskets of straw used for the transport of oil are, by means of this varnish, made perfectly fit for the purpose. Pasteboard, by its use, becomes, both in appearance and firmness, like wood. Most exposed woodwork is coated with schio-lias, which gives it an ugly, red appearance, but it gains in durability. This varnish was examined by the Australian Agricultural Department, and Dr. von Scherzer's communication was fully corroborated. The "Wiener Gewerberrein" also made trials with it. By mixing together three parts of fresh, beaten, defibrinated blood, four parts of slacked lime, and some alum, a thin, sticky mass is obtained, which is immediately ready for use. Articles which are required to be particularly watertight are varnished twice or at most three times by the Chinese. In Europe this varnish is not yet made, although it is one of the surest and best ways of making wooden articles perfectly watertight.

Coal Beds on the Isthmus of Panama.—An unexpected and most important discovery of coal-beds on the Isthmus of Panama, and within the past few weeks brought practically before public attention, seems likely to effect greater changes in steam navigation in the Atlantic and Pacific oceans than any discovery or project within our recollection. Singularly enough, the fact of the existence of coal on the isthmus is directly at variance with the theories of the great Humboldt and other eminent physical geographers, who were of opinion that coal could never be found of good quality and in large quantities in volcanic countries. As these coal-beds may be said to be inexhaustible, the importance of the discovery to commerce can hardly be over-estimated. There is water communication with the Atlantic by the way of the Rio Indio, on the banks of which the coal lies. The mines are situated at Uvero, at Joboncillio, and at Esterial—all lying inland and between Aspinwall and Panama. It is thought in America that this discovery will tend to divert commerce to China from the Suez route, the coal for which at Aden, &c., has to be taken from England.

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FRIDAY, AUGUST 4, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

OUR FOOD-PRODUCING RUMINANTS, AND THE PARASITES WHICH RESIDE IN THEM.

By T. Spencer Cobbold, M.D., F.R.S., F.L.S.

Lecture V.—Delivered Monday, May 15th, 1871.

The General Question of the Parasitism of Ruminants in Relation to Sewage and Public Health.

Mr. Chairman, Ladies, and Gentlemen,—As the course has proceeded our subject has enlarged, and we have not been able to overtake more than a comparatively few details; yet I have all along felt that it were better to do justice to a few matters than to scamper over the whole of this wide area of facts and thought irregularly. In addition to those particular forms of parasite which affect the welfare of our food-producing ruminants, and indirectly also man, there are many other ovine and bovine entozoa well worthy of consideration.

The first form I have to introduce to your notice this evening is the cestode termed *Tænia echinococcus*. The echinococcus is a larval parasite, which is liable to take up its residence not only in oxen, sheep, the deer tribe, and antelopes, but also in the horse, the ass, the zebra, certain carnivorous animals, and even in man himself.

Now, this parasite is of surpassing interest for us, and that it is so will be obvious to you, not merely from the statement I have just made respecting its wide distribution, but also on account of the graver circumstance that in Great Britain it occasions the death of some hundreds of our fellow-creatures annually, to say nothing of its more destructive effect elsewhere. In the higher larval condition, it commonly goes by the name of hydatid. The so-called hydatids are soft, globular masses, of variable size, often containing in their interior smaller vesicles, so that a large cyst, when opened, occasionally presents a bird's-nest like appearance. At slaughter houses and elsewhere, one may often see these bladder-worms lodged in the internal organs of their bearers, and especially in the lungs and liver. Here is a drawing of the lungs and liver of a sheep, on the surfaces of which you perceive a number of large, white, prominent spots. The projections in question are due to the presence of numerous hydatids.

What is the history of the development of these singular formations? It may be said that whatever characters they may happen to present, all of them originally came from an extremely minute parasite, which, in its adult condition, resides in the dog. In other words, the echinococcus vesicle of the sheep is only a phase in the life-history of the *Tænia echinococcus* of the dog.

I wish, if you please, to explain very precisely the history of the development of this singular creature. In the full-grown condition, this small cestode parasite, unlike the ordinary tapeworms, measures only one-fourth of an inch in length. By the illustrations on the wall, you perceive that it presents four segments only; the first comprising the head and neck, with its four suckers, and characteristic set of hooks; the second and third segments being narrow and sexually immature; and the fourth or last segment acquiring a much larger size and darker colour, and being furnished with a branched sac in its interior, which is crowded with eggs. The ova are very minute, individually measuring about the 1-1000 part of an inch in diameter. Each egg contains a six-hooked embryo, whose earlier stages of development correspond very closely with those observed in other tapeworms. The formation of the hydatid from the six-hooked tapeworm takes place very slowly. Thus, if you could watch the process of development of any single egg after it has been swallowed by the bearer, you would find that at the expiration of one entire month the young hydatid would only have attained one-fiftieth of an inch in diameter. You will bear in mind that, in order to have arrived at this early stage of growth, the six-hooked embryo must have bored its way through the walls of the alimentary canal; must have found for itself a comfortable position in the liver or lung, and in that situation have undergone the necessary transformation thus far. If you now examine this minute hydatid microscopically, you will perceive that it has parted with its six hooks, and has become converted into a minute sac, furnished with an outer covering, called the ectocyst, and an inner membrane, termed the endocyst. In another month this young hydatid will have acquired a diameter of one-fifteenth of an inch or thereabouts. Follow it on, and at the expiration of five months it will only yet have attained a length of half an inch. This is an exceedingly slow rate of development; and, to complete the process, I may add, that it requires a period of some twelve or eighteen months before its final stages of growth as an hydatid are fairly accomplished.

Having thus traced the development of the hydatid from the egg of the adult tapeworm up to the so-called bladder-worm stage, the next question is to determine the nature of the changes effected before the entire life-circuit shall have been accomplished. This is an exceedingly curious and intricate part of the subject, but I think I can make its leading features clear to you. If the internal membrane of a full-grown hydatid be examined microscopically, minute elevations will possibly be seen on the inner surface. These elevations occur in the condition of minute papillæ, whose internal granular substance subsequently becomes hollowed out, so that each papilla is eventually transferred into a very small sac. In the next place, this little sac develops on its exterior a number of other elevations, so that you have a mass of them, say ten or a dozen at one spot. By and bye, each one of these various sac-elevations presents four suckers, a double row of hooks, and a body, in which a number of little particles can be seen. These organised sacs are usually termed echinococci, or echinococcus-heads, each of which is destined, if the circumstances prove favourable, to be developed into the adult tapeworm. One maternal cyst may contain a prodigious number of these heads. The older observers thought the particles inside the heads were eggs, but they are rounded masses of carbonate of lime. I must mention, also, that some of the papillæ only develop a single echinococcus-head, and go no further, whilst others multiply, as it were, indefinitely. This budding process has practically no limit.

Certain papillæ, again, in place of forming brood-capsules, as the sacs sometimes are termed, or echinococcus-heads, form large vesicles without any head. These are called daughter hydatids or vesicles; and the odd thing is that they, in their turn, may develop in their interior other vesicles, which we call granddaughter hydatids; so that, by a proliferous budding of this kind you get a series of small hydatids floating inside the larger one, pill-box fashion. Very frequently these daughter and granddaughter vesicles remain in an infertile or barren condition; that is to say, they do not develop echinococcus heads in their interior. On the other hand, one large vesicle may develop a multitude of fertile vesicles, so that, eventually, an echinococcus head progeny, so to speak, is produced, which shall collectively number tens of thousands of individuals, or zooids, as it is better to call them.

There is yet another important stage in the developmental process before we arrive at the final adult condition. The best way to explain this is by assuming we are about to perform an experiment. If, for example, we collect a mass of the hydatids in the fertile condition, and we feed a dog with them, every echinococcus head attached to the hyatid internally will become transformed into a *Tænia echinococcus* in the intestines of your experimental animal. Thus, if you give a cyst, containing 5,000 or 10,000 heads, you will, in all likelihood, produce an equivalent number of tapeworms. This experiment has been successfully performed abroad by Leuckart, Von Siebold, Küchenmeister, and other helminthologists. The time requisite for the conversion of heads into tænia is seven weeks. Here I have specimens affording ocular proof of the success of an experiment performed in this country by Professor Nettleship. There are about 100 tape-worms in this little glass tube, but each full grown parasite is so small that at a few paces distant they cannot be seen. You can better realise the disparity of size between these small tape-worms and the ordinary tæniæ derived from beef, when I state that 100 of the largest of the specimens serially arranged in single file would not cover a distance of more than two feet, whereas 100 specimens of the beef tapeworm, if similarly disposed, would extend more than a quarter of a mile.

In the dog whence these specimens were derived, about nine thousand tapeworms were reared by a single feeding experiment. Now, as each of the final segments of this entozoon contain, on an average, at least 5,000 eggs, the total number of echinococcus's eggs existing in that dog at the time it was killed was, I reckon, about 40,000,000. If, therefore, this experimental dog had been set free and allowed to roam at large over the fields or about our streets, you can easily understand that the canine host would thus have been made the means of effectually dispersing some forty millions of eggs. This is no trifling matter, for, under favourable conditions, the eggs thus dispersed become hydatids in oxen, sheep, in various other quadrupeds, and, unhappily, also in ourselves. You perceive, moreover, that if our dogs were accustomed to play the part of host to this tapeworm, we must necessarily run great risk of infection. In any case, however, we should be less liable to suffer than our cattle, because not only is the water which we drink commonly purer than that supplied to cattle, but not a few of us indulge in the judicious habit of adding something to the water which has the effect of destroying the vitality of the eggs. I am sorry to disappoint the views of teetotallers. but I believe a small amount of alcohol is an admirable remedy against the ill-effects of tapeworm germs. It is not a pleasant reflection to consider that the mere act of drinking a glass of water containing a few eggs of this little tapeworm would, at the expiration of a few months, subject us to a formidable disease, which might terminate in a fatal issue.

But some of you may say, "We do not run that risk in this country, and consequently suffer little or nothing from these things." I take leave to reply, on evidence which I have been at some pains to obtain, that every year 200 or 300 persons die in England in consequence of their having swallowed the eggs of the *Tænia echinococcus.*

What may be the actual number of dogs infested with this minute entozoon in this country it is impossible to say, but it is certain that some few animals play the host in this respect. My friend and correspondent, Dr. Krabbe, of Copenhagen, has ascertained the proportionate number of dogs liable to harbour this parasite in Denmark and in Iceland. Out of 500 dogs examined at the veterinary college at Copenhagen, only two dogs were found to contain this parasite; but in Iceland, on the other hand, no less than 28 per cent. of the canine bearers harboured this destructive entozoon. I have not dissected a sufficient number of dogs to determine the per-centage of infection in our own country, but on such fragmentary evidence as I do possess, I should say decidedly that probably not one English dog in a thousand harbours this entozoon. If only one per cent. was infected, the mortality from this source would be terrible. It is fortunate we are so free; nevertheless, if dogs are allowed to roam at will; if, also, butchers, slaughterers, and others concerned are careless enough to throw away portions of meat containing hydatids, instead of having them burnt or buried, any stray dog eating such discarded portions may become infested. One mouthful of parasites is sufficient to produce a large number of these tænia. If we are more free from this parasite than our fellow-men are in other countries, it is because we not only possess a smaller number of dogs relatively, but our dogs have not the same ready access to discarded portions of meat containing these hydatids.

Let me now, by way of changing the current of your thoughts, say a few words on what may be called the philosophical bearings of this subject. When we consider the astonishing changes which are produced in the developmental history of a single creature of this kind, one asks oneself "What is an individual?" If you reply that an individual may be regarded as the sum total of the products of a single egg, see what a strange result you will obtain. From an ordinary hen's egg you have only one chicken developed, to constitute the individual; but in the case of our tænia one egg will beget a multitude of individualities. In other words, by the complicated processes of development I have this evening described to you, ten thousand tapeworms may proceed from a single germ. This is truly a strange outcome; and why it should have been ordained (if I may use such an expression) that these troublesome creatures, so low in the scale, should extend their species much more rapidly than creatures of higher organisation I cannot now attempt to explain. The sore fact that "evil things do fastest propagate" was fully recognised by our immortal Shakespeare; but I do not know that we are necessarily bound, on this basis, to reason out the matter, and thereby, after the fashion of our distinguished modern philosopher, establish a sort of non-Providence theory. For myself, I argue that if parasitism be an evil, it is only a unit in the huge category of recognised evils in general. In respect of parasitism, therefore, as also must happen when you are dealing with any other abomination—small-pox or scarlet fever, for example—your teleological or anti-finality deductions, as the case may be, ought not to be drawn from the offensive data alone, but from all the surroundings of the subject. The power of providing measures which shall prevent evil is surely a counterbalancing datum worth taking into consideration; but, unfortunately, there are those amongst us who, instead of exercising their high intellectual prerogatives in this matter, would be content to share the antiquated views of certain "peculiar people."

I have now, perhaps, dwelt long enough on this cestode parasite and its teachings. There are several other entozoa of great interest which I shall only just glance at, as I perceive our time is short. The cœnurus is another larval form of tænia, which, instead of being found in the lungs and liver, usually occupies the brain of the sheep. It is known to most of you, doubtless, as giving rise to the sturdy, staggers, or gid. This larva passes through changes very similar to those of the echinococcus. The cœnurus vesicle, which is also sometimes called an hydatid, is about the size, when full-grown, of a walnut, or rather larger; and, if you examine its surface, you will detect a number of small, projecting points. When examined microscopically, these points turn out to be heads, furnished with hooks and suckers. One single vesicle will frequently display from 300 to 500 heads on its surface. Now, if you feed a dog with a sheep's brain containing these polycephalous larvæ—for that is what they are termed technically—all these heads will attach themselves to the lining membrane of the alimentary canal of the dog, and become converted into the so-called *Tœnia cœnurus.* I have repeatedly performed this experiment. In one case, I found that they attained a length of 18 inches in nine weeks, but they had not quite completed their development. When, therefore, a butcher has received a giddy sheep, and thrown its brains carelessly to the dogs, the dogs thus fed soon play the part of host to these cœnuri, or rather to their adult representatives, the tæniæ, which become developed in their interior.

Furthermore, please to observe that if you have dogs going about with numerous specimens of these tæniæ in their bodies, they will necessarily disperse the eggs wherever they go over the fields, whilst the sheep and lambs eating the grass will in their turn swallow the eggs which have been dispersed by the dogs. This is the way in which our flocks become endemically affected by the gid disorder. In Hungary, and certain other countries, the number of sheep destroyed by gid is very great. In Iceland, the disorder is particularly common; and I find on reference to Dr. Krabbe's statistics that, whereas only one dog in 100 harbours the *Tœnia cœnurus*, in Iceland 18 per cent. are found to carry this peculiar tapeworm. These polycephalous hydatids are occasionally found in oxen as well as in sheep, and there are instances on record of their being developed within the spinal canal.

There is another animal very commonly playing the part of host to these cœnuri, namely, the common rabbit. In some of our warrens—Norfolk and elsewhere—the rabbits are very largely attacked by these cœnuri, and the odd thing is that they do not take up their residence in the animals' brains, but amongst the muscles. Now, this is a circumstance not generally known. It was first pointed out, some 40 or 50 years ago, by Mr. Caleb Burrell Rose, F.G.S., when residing at Swaffham, in Norfolk. His statements were overlooked by some and ridiculed by others, and thus his discovery did not receive that recognition which was due. Even the Dutch author, A. Numan (in his admirable work "Over den Veelkopblaasworm der Hersenen"), whilst recognising Rose's statements, seems to think that the polycephali must in such cases have strayed from their proper habitat—the brain and spinal marrow. The warreners term the animals thus affected bladdery rabbits, and it is quite clear, from the prevalence of the disorder, that Numan's interpretation of the facts is not correct. Moreover, I may mention that I have discovered cœnuri in the lungs of a lemur, whilst Engelmeyer found them in the liver of a cat.

Reverting to the round worms, I must briefly notice certain of the commoner forms. The little whip-worm is a curious creature, about 2½ inches long, the fine thread-like portion being the elongated neck, terminating in a pointed head, whilst the thick end corresponds with the body and tail. Scientifically, this parasite is called the *Trichocephalus affinis.* It is an abundant and widely-distributed entozoon. I have found it in almost every ruminant I have examined, including the giraffe; but as it does not appear to prove injurious to the host, I need not say any more about it.

The same statement, however, cannot be made in reference to the *Eustrongylus gigas*, a parasite, attaining the size of three feet in length. It takes up its residence in the kidney of various animals, but fortunately is extremely rare in mankind and ruminants.

There are two species of true strongle, namely, the *Strongylus filaria*, in the sheep, and *Strongylus micrurus*, in the ox, or rather calf, which demand a passing notice. Thousands of lambs die annually in this country, and in some seasons tens of thousands, from the presence of this *Strongylus filaria.* These strongles are minute creatures, filling up the bronchial tubes, so that the lambs become suffocated. I have not time to enter into the history of this species, but I may say that it has been pretty well ascertained that there are preventive measures by which flock-masters can, if they will, check the disorder. The *Strongylus micrurus* kills off calves in a similar way to that in which the *Strongylus filaria* kills off lambs, both being exceedingly destructive species, and each about three inches in length.

As our time will not permit us to enter upon the consideration of certain other parasites, I shall conclude this course of lectures by some remarks having reference to the subject of sewage. I ought, perhaps, to feel very much honoured, in that the editor of the *Lancet* has been pleased to bestow a leading article upon my doings in this connection. Since, however, the aforesaid leader places me in a very unfavourable light, I will endeavour to defend myself in respect of all the hard things there said.

It would be immodest on my part to read the flattering remarks with which this article begins. But you can judge what occurs when I just mention that in the matter of helminthology, or study of parasites, the writer, employing the editorial "we," says that he is prepared to "sit most humbly at my feet." Then he passes on to observe that when Dr. Cobbold "sets himself up for an oracle on sewage irrigation, we have a fair right to examine the facts upon which his reasoning is based." I wish to say, in this respect, that I have never set myself up as an oracle on sewage irrigation. I have only stated my belief that sewage irrigation will certainly disperse the ova of various kinds of parasites, and be likely to give rise to a much greater degree of parasitic disease than at present exists. In proportion to the extent to which the irrigation of fresh sewage is employed, there will be a corresponding increase of parasitism. That is the proposition I laid down, and to that I am prepared to adhere. After a while, the article proceeds as follows:—"But Dr. Cobbold has not helped us yet to enlighten them (*i.e.*, the butchers). For years past he has been engaged in search of parasites. No part of the animal kingdom has escaped his observation; no organ of their bodies (*i.e.* of the hosts) has he left unexplored. He tells us that cattle fed on sewage fodder die of parasitic disease by wholesale." I am really not aware that I ever made that last remark. "And yet we are compelled to retort that Dr. Cobbold has hitherto failed to produce a single specimen of beef or mutton measles which he has not himself artificially produced, and the history of which was not confined to his own experiments at the Veterinary College."

Now, I beg respectfully to submit that I have placed before those of you who have honoured me with your presence on former occasions the most cogent evidence of the presence of measles in beef that could possibly be produced. I showed you Dr. T. G. Hewlett's official report from Bombay, and also the report of the Sanitary Commissioner of India, and by these reports you saw that scores, not to say hundreds, of cattle were burnt in order that people might not eat those very things respecting the existence of which the editor of the *Lancet* says I have never produced satisfactory evidence. The thing is quite clear. It is in the Punjab of India that the cattle are chiefly affected with beef measles. And why are they more affected there than elsewhere? Because irrigation is extensively employed throughout the Punjab. Enormous numbers of cattle are sacrificed there, and those cattle have access to grounds which are extensively irrigated. "But, some one will say, "this is not sewage irrigation." That is quite true; nevertheless, I can explain that it comes pretty much to the same thing, because the water which is used to irrigate these fields is let off from tanks, pools, or ponds (call them what you will), to which both the natives and the animals have free access. The natives are not particular in their habits; many of them, to say nothing of our soldiers, being abundantly infested with the *Tænia mediocanellata.* So, when the editor of the *Lancet* says we have produced no facts, you see he is in error. But he says we have not seen a single specimen of beef or mutton measle in home-bred animals not subjected to experiment. The statement is correct as regards beef; but I have, on more than one occasion, removed cysticerci from joints of mutton brought to my own table. In the supplement to my large treatise on "Entozoa," I have figured a respectable cysticercus taken from the interior of a mutton chop. However, the writer goes on to say:—"Our conviction is, that the butchers, fleshers, and professors of veterinary art are practically right in refusing to adopt the opinion of Dr. Cobbold, that measled beef or mutton is produced to any great extent, or that there is any necessity for the public to adopt a vegetable diet, to avoid tapeworm." I am sure I should be the last man to encourage such a proceeding, and should be extremely sorry to adopt a vegetable diet myself. But the naughtiest thing I appear to have said is to the effect that "scores of animals are thoroughly measled." Now, what is the state of things in the Punjab? Only Saturday last, a gentleman, just arrived from India, came to talk to me about this matter. He is an officer in her Majesty's 92nd Highlanders, and it is his duty, as ordinary, to inspect the beef and other rations before they are served out. He has been giving me most valuable practical information. He is not acquainted with scientific matters, but he says:—"These are the steps we take when large portions of an animal are brought before us. We make a series of slices down the meat parallel to each other, and turn over these slices and inspect them. If we see any little cysts, we send the meat away to be burnt. If we only find one measle, the entire animal is burnt, or otherwise destroyed." Thus, you see, a valuable animal, worth many pounds, and enough to feed a whole regiment, is put aside and burnt. Now, the *Lancet* appears to think that that is exactly what I wish educated inspectors to do in this country. On the contrary, I protest that I never desired any such proceedings. I assert that the burning of these scores and hundreds of cattle is an entire mistake. Because you find a few measles, that is no reason for throwing away all this valuable food. What you have to do is, to instruct the men of the regiment that they have it well cooked; and, since even moderately well-cooked beef will preserve the men from danger, it were a sheer waste to burn the flesh of these animals. Now, the odd thing is that (according to my informant's statement) some of the authorities have very recently abandoned this stupid destruction of the flesh of cattle by burning. Why? Not because cooking will destroy the said measles, but, forsooth, because a medical gentleman has instructed the local government that these beef measles do not produce tapeworms. Was there ever such a farce? The authorities, you see, very properly put a stop to this unnecessary burning, but they do the right thing from instructions based on conclusions altogether erroneous. I venture to add that not one medical man in a hundred in England would display such ignorance as is hereby implied. We have proved incontestably that these little measles do produce tapeworms. The step to be taken, therefore, is simply this:—The cattle shall be inspected by one adequately accomplished man, and he shall pronounce whether the flesh is to be cooked with more care than is ordinarily observed. This would settle the whole matter.

The *Lancet*, turning to another part of the subject, says:—"Does Dr. Cobbold mean to say seriously that it is less dangerous to spread a field with manure than to irrigate it two or three times a year with sewage?" Certainly I do, if the sewage be freshly delivered. The irrigation process diffuses the eggs much more rapidly than any of the other processes; and I have been willing, on parasitic grounds, so to speak, to support what is called the dry-earth system. "But it is not only on the main question that Dr. Cobbold flounders in the mire. He is an advocate of the A B C process—[I think that it is a good one, but I do not say it is perfect]—and talks of the dry-earth system as though it were absolutely safe." I do not say that; I think it is better than the other, but not absolutely safe. So that you see the criticism of the editor is not accurate; it is not true. Well, after some other matters which are touched upon, he also says:—"On one point we may avail ourselves of Dr. Cobbold's observations; he tells us that the ova are destroyed—[That is not quite correct; I did not say ova, but larval parasites]—by a continued moist temperature of 175° Fahr." Yes, you are perfectly safe at that heat; even trichina will not stand that. A continuous moist temperature of 175°, or one considerably below boiling-point will kill trichina, and a temperature many degrees below 175° suffices to kill the cysticerci of our meat. If people will eat meat not raised throughout to a temperature of 140°, then they must take the consequences, and be liable to play the part of host. For my part, I should say that it serves them right. If they choose to put themselves in the same attitude in this relation as the Cossacks and natives of the Baikal regions, and as the Abyssinians do, then they must, like the natives, become parasite bearers. In the Baikal territory, all the natives play the part of hosts, being entertainers of the *Tænia mediocanellata.* And why? Because they do not cook their food; they eat it nearly raw; and therefore, of course, they rejoice in the privilege of being the hosts in which these creatures flourish. No doubt one may say it is possible to be benevolent, and to give these lower creatures a chance of existence; but I respectfully submit that the comfort of one man is of more value than the destruction of many tapeworms. "It is, therefore," concludes this not altogether unkindly-disposed article, "the duty of the government to have the whole subject thoroughly investigated." That remark is to me highly gratifying. Clearly some of the facts I have brought forward must have been present to the mind of the writer as important, otherwise he would never have made that statement. Unfortunately, it is added—"Although Dr. Cobbold has so far exceeded—[see what I have done!]—the bounds of scientific caution as to come to conclusions without proof." Now that is too bad. I have every desire, as a teacher in various branches of science, to make no statement which does not rest upon a sound basis of fact. No man has a right to pretend to be a teacher of science who is not pre-eminently cautious in this matter. Science is good for nothing if its positions are asserted in a random fashion. A man who stands up and speaks on matters of social importance, and who is at the same time loose in his expressions, should be asked to leave the room, for such a man is not an ordinary nuisance, but he does uncommon injury to his fellow-creatures. Lastly, in order to smooth matters, the writer says:—"We cannot doubt that he (Dr. Cobbold) would be able to render valuable assistance whenever questions relating to the natural history of parasites present themselves to the commission we propose." I need not say that if such a commission exists, I willingly leave it to their discretion as to whether or not my services be worth seeking. I have come here, however, by favour of the authorities of the Society of Arts, and have unfolded to you a number of details, which I think you will allow are strange, astonishing, and of real, practical, and social importance. As to the final issue of such expositions, I care little or nothing, so long only as I retain the honest conviction that I have not been untruthful; yet, if the facts which I have enunciated are true, then, depend upon it, they must produce beneficial results. We can no more stop the progress of truth than we can abrogate the revolutions of the planet on whose surface there are those who love to "play the parasite."

On the motion of the **Chairman** (Mr. Lacon), a cordial and hearty vote of thanks was tendered to the lecturer.

BRITISH ASSOCIATION.

The forty-first annual meeting of the Association commenced at Edinburgh on Wednesday, August 2nd, when Professor Huxley vacated the presidential chair in favour of Sir William Thomson, Kt., LL.D., F.R.S. In his opening address, after alluding to the origin of the Association, and paying a tribute to the memory of Vernon Harcourt, Sir John Herschel, and Professor de Morgan, the work of the Association during the past year was referred to. Speaking of the Kew Observatory, he said :—

The institution now enters on a new stage of its existence. The noble liberality of a private benefactor, one who has laboured for its welfare with self-sacrificing devotion unintermittingly from within a few years of its creation, has given it a permanent independence, under the general management of a committee of the Royal Society. Mr. Gassiot's gift of £10,000 secures the continuance at Kew of the regular operation of the self-recording instruments for observing the phenomena of terrestrial magnetism and meteorology, without the necessity of further support from the British Association.

The success of the Kew Magnetic and Meteorological Observatory affords an example of the great gain to be earned for science by the foundation of physical observatories and laboratories for experimental research, to be conducted by qualified persons, whose duties should be not teaching but experimenting. Whether we look to the honour of England, as a nation which ought always to be the foremost in promoting physical science, or to those vast economical advantages which must accrue from such establishments, we cannot but feel that experimental research ought to be made with us an object of national concern, and not left, as hitherto, exclusively to the private enterprise of self-sacrificing amateurs, and the necessarily inconsecutive action of our present governmental departments, and of casual committees. The Council of the Royal Society of Edinburgh has moved for this object in a memorial presented by them to the Royal Commission on Scientific Education and the Advancement of Science. The continent of Europe is referred to for an example to be followed with advantage in this country in the following words : — "On the Continent there exists certain institutions, fitted with instruments, apparatus, chemicals, and other appliances, which are meant to be, and which are made available to men of science, to enable them, at a moderate cost, to pursue original researches." This statement is fully corroborated by information, which I have received from Germany, to the effect that in Prussia "every university, every polytechnical academy, every industrial school (*Realschule* and *Gewerbeschule*), most of the grammar schools, in a word, nearly all the schools superior in rank to the elementary schools of the common people, are supplied with chemical laboratories and a collection of philosophical instruments and apparatus, access to which is most liberally granted by the directors of these schools, or the teachers of the respective disciplines, to any person qualified, for scientific experiments. In consequence, though there exist no particular institutions like those mentioned in the memorial, there will scarcely be found a town exceeding in number 5,000 inhabitants but offers the possibility of scientific explorations, at no other cost than reimbursement of the expense for the materials wasted in the experiments." With reference to a remark in the memorial that, in respect to the promotion of science, the British government confines its action almost exclusively to scientific instruction, and fatally neglects the advancement of science, my informant tells me that in Germany, "professors, preceptors, and teachers of secondary schools are engaged on account of their skilfulness in teaching ; but professors of universities are never engaged unless they have already proved, by their own investigations, that they are to be relied upon for the advancement of science. Therefore, every shilling spent for instruction in universities is at the same time profitable to the advancement of science."

Sir William Thomson said, in referring to recent advances in several branches of sciences :—

Accurate and minute measurement seems to the non-scientific imagination a less lofty and dignified work than looking for something new. But nearly all the grandest discoveries of science have been but the rewards of accurate measurement and patient long-continued labour in the minute sifting of numerical results. The popular idea of Newton's grandest discovery is that the theory of gravitation flashed into his mind, and so the discovery was made. It was by a long train of mathematical calculation, founded on results accumulated through prodigious toil of practical astronomers, that Newton first demonstrated the forces urging the planets towards the sun, determined the magnitude of those forces, and discovered that a force following the same law of variation with distance urges the moon towards the earth. Then, first, we may suppose, came to him the idea of the universality of gravitation ; but when he attempted to compare the magnitude of the force on the moon with the magnitude of the force of gravitation of a heavy body of equal mass at the earth's surface, he did not find the agreement which the law he was discovering required. Not for years after would he publish his discovery as made. It is recounted that, being present at a meeting of the Royal Society, he heard a paper read, describing geodesic measurement by Picard, which led to a serious correction of the previously accepted estimate of the earth's radius. This was what Newton required. He went home with the result, and commenced his calculations, but felt so much agitated that he handed over the arithmetical work to a friend ; then (and not when sitting in a garden, he saw an apple fall) did he ascertain that gravitation keeps the moon in her orbit.

Faraday's discovery of specific inductive capacity, which inaugurated the new philosophy, tending to discard action at a distance, was the result of minute and accurate measurement of electric forces.

Joule's discovery of thermo-dynamic law through the regions of electro-chemistry, electro-magnetism, and elasticity of gases, was based on a delicacy of thermometry, which seemed simply impossible to some of the most distinguished chemists of the day.

Andrews' discovery of the continuity between the gaseous and liquid states was worked out by many years of laborious and minute measurement of phenomena scarcely visible to the naked eye.

Great service has been done to science by the British Association in promoting accurate measurement in various subjects. The origin of exact science in terrestrial magnetism is traceable to Gauss's invention of methods of finding the magnetic intensity in absolute measure. I have spoken of the great work done by the British Association, in carrying out the application of this invention in all parts of the world. Gauss's colleague in the German Magnetic Union, Weber, extended the practice of absolute measure to electric currents, the resistance of an electric conductor, and the electro-motive force of a galvanic element. He showed the relation between electrostatic and electro-magnetic units for absolute measurement, and made the beautiful discovery that resistance, in absolute electro-magnetic measure, and the reciprocal of resistance, or, as we call it, "conducting power," in electrostatic measure, are each of them a velocity. He made an elaborate and difficult series of experiments to measure the velocity which is equal to the conducting power, in electrostatic measure, and at the same time to the resistance in electro-magnetic measure, in one and the same conductor. Maxwell, in making the first advance along a road of which Faraday was the pioneer, discovered that this velocity is physically related to the velocity of light, and that, on a certain hypothesis regarding the elastic medium concerned, it may be exactly equal to the velocity of light.

Weber's measurement verifies approximately this equality, and stands in science *monumentum ære perennius*, celebrated as having suggested this most grand theory, and as having afforded the first quantitative test of the recondite properties of matters on which the relations between electricity and light depend. A re-measurement of Weber's critical velocity on a new plan by Maxwell himself, and the important correction of the velocity of light by Foucault's laboratory experiments, verified by astronomical observation, seem to show a still closer agreement. The most accurate possible determination of Weber's critical velocity is just now a primary object of the Association's Committee on Electric Measurement; and it is at present premature to speculate as to the closeness of the agreement between that velocity and the velocity of light. This leads me to remark how much science, even in its most lofty speculations, gains in return for benefits conferred by its application to promote the social and material welfare of man. Those who perilled and lost their money in the original Atlantic telegraph were impelled and supported by a sense of the grandeur of their enterprise, and of the world-wide benefits which must flow from its success; they were at the same time not unmoved by the beauty of the scientific problem directly presented to them; but they little thought that it was to be immediately, through their work, that the scientific world was to be instructed in a long-neglected and discredited fundamental electrical discovery of Faraday's, or that, again, when the assistance of the British Association was invoked to supply their electricians with methods for absolute measurement (which they found necessary to secure the most economical return for their expenditure, and to obviate and detect those faults in their electric material which had led to disaster), they were laying the foundation for accurate electric measurement in every scientific laboratory in the world, and initiating a train of investigation which now sends up branches into the loftiest regions and subtlest ether of natural philosophy. The greatest achievement yet made in the molecular theory of the properties of matter is the kinetic theory of gases, shadowed forth by Lucretius, definitely stated by Daniel Bernoulli, largely developed by Herapath, made a reality by Joule, and worked out to its present advanced state by Clausius and Maxwell. Joule, from his dynamical equivalent of heat, and his experiments upon the heat produced by the condensation of gas, was able to estimate the average velocity of the ultimate molecules or atoms composing it. His estimate for hydrogen was 6,225 feet per second at temperature 60° Fahr., and 6,055 feet per second at the freezing point. Clausius took fully into account the impacts of molecules on one another, and the kinetic energy of relative motions of the matter constituting an individual atom. He investigated the relation between their diameters, the number in a given space, and the mean length of path from impact to impact, and so gave the foundation for estimates of the absolute dimensions of atoms, to which I shall refer later. He explained the slowness of gaseous diffusion by the mutual impacts of the atoms, and laid a secure foundation for a complete theory of the diffusion of fluids, previously a most refractory enigma. The deeply penetrating genius of Maxwell brought in viscosity and thermal conductivity, and thus completed the dynamical explanation of all the known properties of gases, except their electric resistance and brittleness to electric force. No such comprehensive molecular theory had ever been imagined before the 19th century. Definite and complete in its area as it is, it is but a well-drawn part of a great chart, in which all physical science will be represented, with every property of matter shown in dynamical relation to the whole. The prospect we now have of an early completion of this chart is based on the assumption of atoms. But there can be no permanent satisfaction to the mind in explaining heat, light, elasticity, diffusion, electricity, and magnetism, in gases, liquids, and solids, and describing precisely the relations of these different states of matter to one another, by statistics of great numbers of atoms, when the properties of the atom itself are simply assumed. When the theory, of which we have the first instalment in Clausius and Maxwell's work, is complete, we are but brought face to face with a superlatively grand question, what is the inner mechanism of the atom? In the answer to this question we must find the explanation not only of the atomic elasticity, by which the atom is a chronometric vibrator, according to Stokes's discovery, but of chemical affinity, and of the differences of quality of different chemical elements, at present a mere mystery in science. Helmholtz's exquisite theory of vortex-motion in an incompressible frictionless liquid has been suggested as a finger-post, pointing a way which may possibly lead to a full understanding of the properties of atoms, carrying out the grand conception of Lucretius, who "admits no subtle ethers, no variety of elements with fiery, or watery, or light, or heavy principles; nor supposes light to be one thing, fire another, electricity a fluid, magnetism a vital principle, but treats all phenomena as mere properties or accidents of simple matter." This statement I take from an admirable paper on the atomic theory of Lucretius, which appeared in the *North British Review*, for March, 1868, containing a most interesting and instructive summary of ancient and modern doctrine regarding atoms. Allow me to read from that article one other short passage finely describing the present aspect of atomic theory:—"The existence of the chemical atom, already quite a complex little world, seems very probable; and the description of the Lucretian atom is wonderfully applicable to it. We are not wholly without hope that the real weight of each such atom may some day be known —not merely the relative weights of the several atoms, but the number in a given volume of any material; that the form and motion of the parts of each atom, and the distances by which they are separated, may be calculated; that the motions by which they produce heat, electricity, and light, may be illustrated by exact geometrical diagrams; and that the fundamental properties of the intermediate and possibly constituent medium may be arrived at. Then the motion of planets and music of the spheres will be neglected for a while in admiration of the maze in which the tiny atoms run." Even before this was written, some of the anticipated results had been partially attained. Loschmidt, in Vienna, had shown, and not much later Stoney, independently in England showed, how to deduce from Clausius and Maxwell's kinetic theory of gases a superior limit to the number of atoms in a given measurable space. I was unfortunately quite unaware of what Loschmidt and Stoney had done, when I made a similar estimate on the same foundation, and communicated it to *Nature*, in an article on "The Size of Atoms." But questions of personal priority, however interesting they may be to the persons concerned, sink into insignificance in the prospect of any gain of deeper insight into the secrets of nature. The triple coincidence of independent reasoning in this case is valuable, as confirmation of a conclusion violently contravening ideas and opinions which had been almost universally held regarding the dimensions of the molecular structure of matter. Chemists and other naturalists had been in the habit of evading questions as to the hardness or indivisibility of atoms, by virtually assuming them to be infinitely small and infinitely numerous. We must now no longer look upon the atom, with Boscovich, as a mystic point, endowed with inertia and the attribute of attracting or repelling other such centres, with forces depending upon the intervening distances (a supposition only tolerated with the tacit assumption that the inertia and attraction of each atom is infinitely small, and the number of atoms infinitely great), nor can we agree with those who have attributed to the atom occupation of space with infinite hardness and strength (incredible in any finite body); but we must realise it as a piece of matter of measurable dimensions, with shape, motion, and laws of action, intelligible subjects of scientific investigation. The prismatic analysis of light, discovered by Newton, was estimated by himself as being "the oddest, if not the most considerable, detection which hath hitherto been made in the operations of nature." Had he not been deflected from the subject, he could not have failed to obtain a pure spectrum; but this, with the inevitably consequent discovery of the dark lines, was reserved for the nineteenth century. Our fundamental knowledge of the dark lines is due solely to Fraunhofer. Wollaston saw them, but did not discover them. Brewster laboured long and well to perfect the prismatic analysis of sunlight; and his observations on the dark bands produced by the absorption of interposed gases and vapours laid important foundations for the grand superstructure which he scarcely lived to see. Piazzi Smyth, by spectroscopic observation performed on the Peak of Teneriffe, added greatly to our knowledge of the dark lines produced in the solar spectrum by the absorption of our own atmosphere. The prism became an instrument for chemical qualitative analysis in the hands of Fox Talbot and Herschel, who first showed how, through it, the old "blowpipe test" or generally the estimation of substances from the colours which they give to flames, can be prosecuted with an accuracy and a discriminating power not to be attained when the colour is judged by the unaided eye. To Kirchoff belongs, I believe, solely the great credit of having first actually sought for and found other metals than sodium in the sun, by the method of spectrum analysis. His publication of October, 1859, inaugurated the practice of solar and stellar chemistry, and gave spectrum analysis an impulse, to which, in a great measure is due its splendidly successful cultivation by the labours of many able investigators within the last ten years. To prodigious and wearing toil of Kirchoff himself, and of Angstrom, we owe large scale-maps of the solar spectrum, incomparably superior in minuteness and accuracy of delineation to anything ever attempted previously. These maps now constitute the standards of reference for all workers in the field. Pluker and Hittorf opened ground in advancing the physics of spectrum analysis, and made the important discovery of changes in the spectra of ignited gases, produced by changes in the physical condition of the gas. The scientific value of the meetings of the British Association is well illustrated by the fact that it was through conversation with Pluker, at the Newcastle meeting, that Lockyer was first led into the investigation of the effects of varied pressure on the quality of the light emitted by glowing gas, which he and Franklin have prosecuted with such admirable success. Scientific wealth tends to accumulation, according to the law of compound interest. Every addition to knowledge of properties of matter supplies the naturalist with new instrumental means for discovering and interpreting phenomena of nature, which in their turn afford foundations for fresh generalisations, bringing gains of permanent value into the great storehouse of philosophy. Thus Frankland, led, from observing the want of brightness of a candle burning in a tent on the summit of Mount Blanc, to scrutinize Davy's theory of flame, discovered that brightness without incandescent solid particles is given to a purely gaseous flame by augmented pressure, and that a dense ignited gas gives a spectrum comparable with that of the light from an incandescent solid or liquid. Lockyer joined him; and the two found that every incandescent substance gives a continuous spectrum—that an incandescent gas, under varied pressure, gives bright bars across the continuous spectrum, some of which, from the sharp, hard and fast lines observed where the gas is in a state of extreme attenuation, broaden out on each side in nebulous bands as the density is increased, and are ultimately lost in the continuous spectrum, when the condensation is pushed on till the gas becomes a fluid no longer to be called gaseous. More recently, they have examined the influence of temperature, and have obtained results which seems to show that a highly attenuated gas, which at a high temperature gives several bright lines, gives a smaller and smaller number of lines, of sufficient brightness to be visible, when the temperature is lowered, the density being kept unchanged. I cannot refrain here from remarking how admirably this beautiful investigation harmonises with Andrews' great discovery of continuity between the gaseous and liquid states. Such things make the life-blood of science. In contemplating them we feel as if led out from narrow waters of scholastic dogma to a refreshing excursion on the broad and deep ocean of truth, where we learn from the wonders we see that there are endlessly more and more glorious wonders still unseen. Stokes' dynamical theory supplies the key to the philosophy of Frankland and Lockyer's discovery. Any atom of gas, when struck and left to itself, vibrates with perfect purity in its fundamental note or notes. In a highly attenuated gas each atom is very rarely in collision with other atoms, and therefore is nearly at all times in a state of true vibration. Hence the spectrum of a highly attenuated gas consists of one or more perfectly sharp bright lines, with scarcely a perceptible continuous gradation of prismatic colour. In denser gas each atom is frequently in collision, but still is for much more time free, in intervals between collisions, then engaged in collision, so that not only is the atom itself thrown sensibly out of tune during a sensible proportion of its whole time, but the confused jangle of vibrations in every variety of period during the actual collision becomes more considerable in its influence. Hence bright lines in the spectrum broaden out somewhat, and the continuous spectrum becomes less faint. In still denser gas, each atom may be almost as much time in collision as free, and the spectrum then consists of broad nebulous bands crossing a continuous spectrum of considerable brightness. When the medium is so dense that each atom is always in collision, that is to say, never free from influence of its neighbours, the spectrum will generally be continuous, and may present little or no appearance of bands, or even of maxima of brightness. In this condition, the fluid can be no longer regarded as a gas, and we must judge of its relation to the vaporous or liquid states according to the critical conditions discovered by Andrews. While these great investigations of properties of matter were going on, naturalists were not idle with the newly recognised power of the spectroscope at their service. Chemists soon followed the example of Bunsen, in discovering new metals in terrestrial matter by the old blow pipe and prism test of Fox Talbot and Herschel. Biologists applied spectrum analysis to animal and vegetable chemistry, and to sanitary investigations. But it is in astronomy that spectroscopic research has been carried on with the greatest activity, and been most richly rewarded with results. The chemist and the astronomer have joined their forces. An astronomical observatory has now appended to it a stock of reagents such as hitherto was only to be found in the chemical laboratory. A devoted corps of volunteers of all nations, whose motto might well be *ubique*, have directed their artillery to every region of the universe. The sun, the spots on his surface, the corona and the red and yellow prominences seen round him during total eclipses, the moon, the planets, comets, auroras, nebulæ, white stars, yellow stars, red stars, variable and temporary stars, each tested by the prism, was compelled to show its distinguishing prismatic colours. Rarely before in the history of science has enthusiastic perseverance, directed by penetrative genius, produced within ten years so brilliant a succession of discoveries. It is not merely the chemistry of sun and stars, as first suggested, that is subjected to analysis by the spectroscope. Their whole laws of being are now subjects of direct investigation; and already we have glimpses of their evolutional history through the stupendous power of this most subtle and delicate test. We had only solar and stellar chemistry; we now have solar and stellar physiology. It is an old idea that the colour of a star may be influenced by its motion relatively to the eye of the spectator, so as to be tinged with red if it moves from the earth, or blue if it moves towards the earth. William Allen Miller, Huggins, and Maxwell showed how, by aid of the spectroscope, this idea may be made the foundation of a method of measuring the relative velocity with which a star approaches to or recedes from the earth. The principle is, first to identify, if possible, one or more of the lines in the spectrum of the star, with a line or lines in the spectrum of sodium, or some other terrestrial substance, and then (by observing the star and the artificial light simultaneously by the same spectroscope) to find the difference, if any, between their refrangibilities. From this difference of refrangibility the ratio of the periods of the two lights is calculated, according to data determined by Fraunhofer from comparisons between the positions of the dark lines in the prismatic spectrum and in his own "interference spectrum" (produced by substituting for the prism a fine grating). A first comparatively rough application of the test by Miller and Huggins to a large number of the principal stars of our skies, including Aldebaran, α Orionis, β Pegasi, Sirius, α Lyræ, Capella, Arcturus, Pollux, Castor (which they had observed rather for the chemical purpose than for this), proved that not one of them had so great a velocity as 315 kilometres per second to or from the earth, which is a most momentous result in respect to cosmical dynamics. Afterwards, Huggins made special observations of the velocity test, and succeeded in making the measurement in one case, that of Sirius, which he then found to be receding from the earth at the rate of 66 kilometres per second. This, corrected for the velocity of the earth, at the time of the observation, gave a velocity of Sirius, relatively to the sun, amounting to 47 kilometres per second. The minuteness of the difference to be measured, and the smallness of the amount of light, even when the brightest star is observed, renders the observation extremely difficult. Still, with such great skill as Mr. Huggins has brought to bear on the investigation, it can scarcely be doubted that velocities of many other stars may be measured. What is now wanted is, certainly not greater skill, perhaps not even more powerful instruments, but more instruments and more observers. Lockyer's applications of the velocity test to the relative motions of different gases in the sun's photosphere, spots, chromosphere, and chromospheric prominences, and his observations of the varying spectra presented by the same substance as it moves from one position to another in the sun's atmosphere, and his interpretations of these observations, according to the laboratory results of Frankland and himself, go far towards confirming the conviction that in a few years all the marvels of the sun will be dynamically explained according to known properties of matter. During six or eight precious minutes of time, spectroscopes have been applied to the solar atmosphere and to the corona seen round the dark disc of the moon eclipsing the sun. Some of the wonderful results of such observations, made in India on the occasion of the eclipse of August 1868, were described by Professor Stokes in a previous address. Valuable results have, through the liberal assistance given by the British and American governments, been obtained also from the total eclipse of last December, notwithstanding a generally unfavourable condition of weather. It seems to have been proved that at least some sensible part of the light of the "corona" is a terrestrial atmospheric halo, or dispersive reflection of the light of the glowing hydrogen and "helium,"* round the sun. I believe I may say, on the present occasion, when preparation must again be made to utilise a total eclipse of the sun, that the British Association confidently trusts to our government exercising the same wise liberality in the interests of science. The old nebular hypothesis supposes the solar system, and other similar systems through the universe, which we see at a distance as stars, to have originated in the condensation of fiery nebulous matter. This hypothesis was invented before the discovery of thermo-dynamics, or the nebulæ would not have been supposed to be fiery; and the idea seems never to have occurred to any of its inventors or early supporters, that the matter, the condensation of which they supposed to constitute the sun and stars, could have been other than fiery in the beginning. Meyer first suggested that the heat of the sun may be due to gravitation; but he supposed meteors falling in to keep always generating the heat which is radiated year by year from the sun. Helmholtz, on the other hand, adopting the nebular hypothesis, showed, in 1854 that it was not necessary to suppose the nebulous matter to have been originally fiery, but that mutual gravitation between its parts may have generated the heat to which the present high temperature of the sun is due. Further, he made the important observations that the potential energy of gravitation in the sun is even now far from exhausted; but that, with further and further shrinking, more and more heat is to be generated, and that thus we can conceive the sun even now to possess a sufficient store of energy to produce heat and light, almost as at present, for several million years of time future. It ought, however, to be added that this condensation can only follow from cooling, and therefore that Helmholtz's gravitational explanation of future sun-heat amounts really to showing that the sun's thermal capacity is enormously greater, in virtue of the mutual gravitation between the parts of so enormous a mass, than the sum of the thermal capacities of separate and smaller bodies of the same material and same total mass. Reasons for adopting this theory, and the consequences which follow from it, are discussed in an article "On the Age of the Sun's Heat," published in *Macmillan's Magazine* for March, 1862. Most important steps have been recently made towards the discovery of the nature of comets, establishing with nothing short of certainty the truth of a hypothesis which had long appeared to me probable—that they consist of groups of meteoric stones, accounting satisfactorily for the light of the nucleus, and giving a simple and rational explanation of phenomena presented by the tails of comets which had been regarded by the greatest astronomers as almost preternaturally marvellous. The meteoric hypothesis, to which I have referred, remain a mere hypothesis (I do not know that it was ever even published until, in 1866, Schiaparelli calculated, from observations on the August meteors, an orbit for these bodies which he found to agree almost perfectly with the orbit of the great comet of 1862, as calculated by Oppolzer, and so discovered and demonstrated that a comet consists of a group of meteoric stones. Professor Newton, of Yale College, United States, by examining ancient records, ascertained that in periods of about thirty-three years, since the year 902, there have been exceptionally brilliant displays of the November meteors. It has long been believed that these interesting visitants came from a train of small detached planets circulating round the sun all in nearly the same orbit, and constituting a belt analogous to Saturn's ring, and that the reason for the comparatively large number of meteors which we observe annually about the 14th of November is, that at that time the earth's orbit cuts through the supposed meteoric belt. Professor Newton concluded, from his investigation, that there is a denser part of the group of meteors which extends over a portion of the orbit so great as to occupy about one-tenth or one-fifteenth of the periodic time in passing any particular point, and gave a choice of five

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[*] Frankland and Lockyer find the yellow prominences to give a very decided bright line not far from D, but hitherto not identified with any terrestrial flame. It seems to indicate a new substance, which they propose to call helium.

different periods for the revolution of this meteoric stream round the sun, any one of which would satisfy his statistical result. He further concluded that the line of nodes, that is to say, the line in which the plane of the meteoric belt cuts the plane of the earth's orbit, has a progressive sidereal motion of about 52·4″ per annum. Here, then, was a splendid problem for the physical astronomer, and, happily, one well qualified for the task took it up. Adams, by the application of a beautiful method invented by Gauss, found that, of the five periods allowed by Newton, just one permitted the motion of the line of nodes to be explained by the disturbing influence of Jupiter, Saturn, and other planets. The period chosen on these grounds is 33¼ years. The investigation showed further, that the form of the orbit is a long ellipse, giving for shortest distance from the sun 145 million kilometres, and for longest distance 2.895 million kilometres. Adams also worked out the longitude of the perihelion and the inclination of the orbit's plane to the plane of the ecliptic. The orbit which he thus found agreed so closely with that of Temple's Comet I., 1866, that he was able to identity the comet and the meteoric belt. The same conclusion had been pointed out a few weeks earlier by Schiaparelli, from calculations by himself on data supplied by direct observations on the meteors, and independently by Peters from calculations by Leverrier on the same foundation. It is, therefore, thoroughly established that Temple's Comet I., 1866, consists of an elliptic train of minute planets, of which a few thousands or millions fall to the earth annually about the 14th of November, when we cross their track. We have probably not yet passed through the very nucleus or densest part; but thirteen times, in Octobers and Novembers, from October 13, A.D. 902 to November 14, 1866, inclusive (this last time having been correctly predicted by Prof. Newton), we have passed through a part of the belt greatly denser than the average. The densest part of the train, when near enough to us, is visible as the head of the comet. This astounding result, taken along with Huggins's spectroscopic observations on the light of the heads and tails of comets, confirm most strikingly Tait's theory of comets, to which I have already referred, according to which the comet, a group of meteoric stones, is self-luminous in its nucleus, on account of collisions among its constituents, while its "tail" is merely a portion of the less dense part of the train, illuminated by sunlight, and visible or invisible to us according to circumstances, not only of density, degree of illumination, and nearness, but also of tactic arrangement, as of a flock of birds or the edge of a cloud of tobacco smoke.

Sir William Thomson concluded his address as follows:—

The essence of science, as is well illustrated by astronomy and cosmical physics, consists in inferring antecedent conditions, and anticipating future evolutions, from phenomena which have actually come under observation. In biology, the difficulties of successfully acting up to this ideal are prodigious. The earnest naturalists of the present day are, however, not appalled or paralysed by them, and are struggling boldly and laboriously to pass out of the mere "natural history stage" of their study, and bring zoology within the range of natural philosophy. A very ancient speculation, still clung to by many naturalists (so much so that I have a choice of modern terms to quote in expressing it) supposes that, under meteorological conditions very different from the present, dead matter may have run together or crystallised or fermented into "germs of life," or "organic cells," or "protoplasm." But science brings a vast mass of inductive evidence against this hypothesis of spontaneous generation, as you have heard from my predecessor in the presidential chair. Careful enough scrutiny has, in every case up to the present day, discovered life as antecedent to life. Dead matter cannot become living without coming under the influence of matter previously alive. This seems to me as sure a teaching of science as the law of gravitation. I utterly repudiate, as opposed to all philosophical uniformitarianism, the assumption of "different meteorological conditions"—that is to say, somewhat different vicissitudes of temperature, pressure, moisture, gaseous atmosphere—to produce or to permit that to take place by force or motion of dead matter alone which is a direct contravention of what seems to us biological law. I am prepared for the answer, "our code of biological law is an expression of our ignorance as well as our knowledge." And I say yes; search for spontaneous generation out of inorganic materials; let any one not satisfied with the purely negative testimony of which we have now so much against it, throw himself into the inquiry. Such investigations as those of Pasteur, Pouchet, and Bastian are among the most interesting and momentous in the whole reign of natural history, and their results, whether positive or negative, must richly reward the most careful and laborious experimenting. I confess to being deeply impressed by the evidence put before us by Professor Huxley, and I am ready to adopt, as an article of scientific faith, true through all space and through all time, that life proceeds from life, and from nothing but life. How, then, did life originate on the earth? Tracing the physical history of the earth backwards, on strict dynamical principles, we are brought to a red-hot melted globe on which no life could exist. Hence, when the earth was first fit for life, there was no living thing on it. There were rocks, solid and disintegrated, water, air all round, warmed and illuminated by a brilliant sun, ready to become a garden. Did grass and trees, and flowers, spring into existence, in all the fullness of ripe beauty, by a fiat of Creative Power, or did vegetation, growing up from seed sown, spread and multiply over the whole earth? Science is bound, by the everlasting law of honour, to face fearlessly every problem which can fairly be presented to it. If a probable solution, consistent with the ordinary course of nature, can be found, we must not invoke an abnormal act of Creative Power. When a lava stream flows down the sides of Vesuvius or Etna, it quickly cools and becomes solid; and after a few weeks or years it teems with vegetable and animal life, originated by the transport of seed and ova, and by the migration of individual living creatures. When a volcanic island springs up from the sea, and after a few years is found clothed with vegetation, we do not hesitate to assume that seed has been wafted to it through the air, or floated to it on rafts. Is it not possible, and if possible, is it not probable, that the beginning of vegetable life on the earth is to be similarly explained? Every year thousands, probably millions, of fragments of solid matter fall upon the earth—whence came these fragments? What is the previous history of any one of them? Was it created in the beginning of time an amorphous mass? This idea is so unacceptable that, tacitly or explicitly, all men discard it. It is often assumed that all, and it is certain that some, meteoric stones are fragments which had been broken off from greater masses and launched free into space. It is as sure that collisions must occur between great masses moving through space as it is that ships, steered without intelligence directed to prevent collision, could not cross and recross the Atlantic for thousands of years with immunity from collisions. When two great masses come into collision in space it is certain that a large part of each is melted; but it seems also quite certain that in many cases a large quantity of *débris* must be shot forth in all directions, much of which may have experienced no greater violence than individual pieces of rock experience in a land-slip or in blasting by gunpowder. Should the time when this earth comes into collision with another body, comparable in dimensions to itself, be when it is still clothed, as at present, with vegetation, many great and small fragments carrying seed and living plants and animals would undoubtedly be scattered through space. Hence and because we all confidently believe that there are at present, and have been from time immemorial, many worlds of life besides our own, we must regard it as probable in the highest degree that there are countless seed-bearing meteoric stones moving about through space. If at the present instant no life existed upon this earth, one such stone falling upon it might, by what we blindly call natural causes, lead to its becoming covered with vegetation. I am fully conscious of the many scientific objections which may be urged against this hypothesis, but I believe them to be all answerable. I have already taxed your patience too severely to allow me to think of discussing any of them on the present occasion. The hypothesis that life originated on this earth through moss-grown fragments from the ruins of another world may seem wild and visionary; all I maintain is that it is not unscientific. From the earth stocked with such vegetation as it could receive meteorically, to the earth teeming with all the endless variety of plants and animals which now inhabit it, the step is prodigious; yet, according to the doctrine of continuity, most ably laid before the Association by a predecessor in this chair (Mr. Grove), all creatures now living on earth have proceeded by orderly evolution from some such origin. Darwin concludes his work on "The Origin of Species" with the following words:—"It is interesting to contemplate an entangled bank clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us." . . . . "There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning, endless forms, most beautiful and and most wonderful, have been and are being evolved." With the feeling expressed in these two sentences I most cordially sympathise. I have omitted two sentences which come between them, describing briefly the hypothesis of "the origin of species by natural selection," because I have always felt that this hypothesis does not contain the true theory of evolution, if evolution there has been, in biology. Sir John Herschel, in expressing a favourable judgment on the hypothesis of zoological evolution, with, however, some reservation in respect to the origin of man, objected to the doctrine of natural selection, that it was too like the Laputan method of making books, and that it did not sufficiently take into account a continually guiding and controlling intelligence. This seems to me a most valuable and instructive criticism. I feel profoundly convinced that the argument of design has been greatly too much lost sight of in recent zoological speculations. Reaction against the frivolities of teleology, such as are to be found, not rarely, in the notes of the learned commentators on Paley's "Natural Theology," has I believe had a temporary effect in turning attention from the solid and irrefragable argument so well put forward in that excellent old book. But overpoweringly strong proofs of intelligent and benevolent design lie all around us, and if ever perplexities, whether metaphysical or scientific, turn us away from them for a time, they come back upon us with irresistible force, showing to us through nature the influence of a free will, and teaching us that all living beings depend on one ever-acting Creator and Ruler.

REPORT OF THE COMMITTEE ON INDIAN FINANCE.

The report of the Committee appointed last February to inquire into the finance and financial administration of India has been published.

The Committee state that they have examined numerous witnesses respecting the circumstances under which the revenue of India has been raised to its gross amount of £50,901,081, shown in the account for 1869-70; the conditions under which it is collected; and the contingencies which may influence its amount in future; but finding it impossible in the present session to conclude this branch of their investigation, or to proceed with the inquiry respecting the nature of the expenditure and its relation to the revenue, they recommend that the Committee be reappointed at the commencement of the next session. The Committee add:—"Your Committee have, however, been much impressed with the evidence which has been laid before them respecting the directions which were given by the Secretary of State for India in Council, in the year 1862, to extend the system of permanent settlement of the land revenue, prevailing in some of the Bengal provinces, to other parts of India. They have not yet been able to receive the evidence of those by whom the directions were either recommended or issued. While, therefore, they abstain from expressing any opinion on the subject, they think it right that the attention of the Secretary of State for India in Council should be called to this evidence, in order that he may reconsider the subject, and, in the meantime, determine whether steps should not be taken to suspend any further proceedings, to carry out the despatch of his predecessor. Your Committee have found that the evidence presented to them is in some respects wanting in precision, in consequence of the accounts in India not having been prepared in such a manner as to show the results which should be known, to enable a judgment to be formed on important questions affecting the finances. Your Committee therefore recommend that instructions should be given by the government of India to some competent officer, to ensure statements of account being prepared on a uniform basis, and in sufficient detail, by the officers of account for each of the subordinate governments, with exact explanations of important changes of system, and of the causes of increase or decrease of amounts in each case, for the year 1856-57, and the years 1869-70 and 1870-71, in order that these statements may be laid before the Committee at the beginning of the next session. The questions which have been put to the witnesses already examined, and their replies, will sufficiently indicate the nature of the accounts required, and the estimates laid upon the table of the House for the naval, military, and miscellaneous civil expenditure, both for the effective and non-effective services, by her Majesty's government, will explain the extent to which information is afforded to the House of Commons respecting the public expenditure. Your Committee also desire that in all cases where the Indian government has embarked in any special enterprise, such as harbours, railways, irrigation, and other public works, telegraphy, transport, and banking, a balance-sheet for the past two years, at least, should be prepared, manifesting the sources of income and the expense as charged under the various heads of the accounts of general expenditure; also statements showing, for a suitable series of years, the amount of capital expended and the balance of profit and loss. Your Committee are further of opinion that it would facilitate their investigations if the officer by whom the preparation of the desired statement of accounts is supervised should personally bring them before the Committee, to give whatever explanation may be required. It will be observed that the evidence already taken has been chiefly derived from official sources, but your Committee would be glad to receive the evidence of any inhabitant of India, whether of Indian or European extraction, who may desire to appear before them for the purpose of giving accurate and useful information which, by its comprehensive intelligence, may be likely to assist the Committee in their inquiries and future deliberations."

EDUCATIONAL NOTES.

The Education Vote.—This was agreed to on Friday last, the total amount being £1,103,402, which is an increase of £543,000, due partly to the change from the old into a national system, partly to the exceptional expenses of carrying out the change, but chiefly to an increase in the number of schools and scholars. In proposing the vote, Mr. W. E. Forster mentioned that the increase in the grant to day and evening scholars was £355,000, and that the estimated increase in the number of scholars was from 1,200,000 to 1,500,000. The grant per head had been increased. The building grants had risen from £35,000 to £80,000, representing 450 more separate schools, and the training scholars had risen from 2,600 to 2,900, involving an increase of £20,000 in the vote. There was a special charge of £70,000 for carrying the new Act into operation, under which the country had been divided into 64 educational districts, each with an inspector and an inspector's assistant, and they were engaged in parcelling out the country into school districts, and ascertaining the sufficiency of education in each. Of the 222 boroughs in the country, 96, representing a population of 4,379,000, had formed school boards, and he anticipated that in a year or two all the children of the real workers would be at school. A vote of £176,179 for the Department of Science and Art was also agreed to.

The Teaching of Extra Subjects.—A writer, signing himself "M.A. (Oxon)," speaking of the recent debate on elementary education in the House of Commons, on the motion of Sir J. Lubbock, "to give more encouragement to the teaching of extra subjects" in our elementary schools, refers to the lofty ideal of elementary education, as formulated by the London School Board, in contrast with the low ideal which now obtains in our elementary schools under government inspection. "The wisdom of the London School Board," he says, "in adding British history, elementary science, geography, elementary social science, and elementary drawing, to the three R's, was vindicated by the mass of authorities and opinions quoted by Sir J. Lubbock. A stronger chain of evidence in favour of variety and enlargement of studies for the young could not be established than the testimony adduced during the debate. It was shown that the leading scientific and educational bodies in the kingdom had all urged upon the government the necessity and the advantage of teaching 'extra subjects.' It was shown that government inspectors of schools, that masters of training colleges, and (which was most to the point) that even the committee appointed by the House of Commons, in 1868, on primary education, after taking a vast mass of most valuable evidence, had recommended that elementary instruction in drawing, in physical geography, and in the phenomena of nature, should be given in elementary schools. Amongst the commonplace objections to a variety and extension of studies, it is sometimes urged that it is better to ensure a thorough training in the three elementary subjects of reading, writing, and arithmetic, by an exclusive devotion of the student's time to them, than to dissipate his efforts and his time amongst a variety of subjects. Against this objection, it was conclusively shown that, as a rule, the variety of studies tends to unbend the mind and to renew the interest of the pupil, and that the singular slowness with which the children of our national schools learn to read is, in some degree, to be attributed to the unwise concentration of the labours of the school on that single object. It is a matter of simple fact, and testified by government inspectors, that those schools are by far the most successful instructors in reading, writing, and arithmetic where other subjects are taught in addition. If, as we trust, the primary schools of England will become the worthy nurseries of whatever genius may be found amongst our poor, as our school boards intimate, it becomes more than ever necessary that a variety of subjects should be introduced into our elementary schools; and this debate will have done no slight service to the cause of popular education."

Use of Prayers and Hymns in Schools.—A very interesting discussion on this subject took place at the meeting of the London School Board on the 26th ult. It is remarkable that a question of this kind should have elicited so little difference of opinion amongst the members, on the main principle as to the desirableness of offering prayers and singing hymns in schools. But those who hold peculiar views upon the point seem content to waive them, and to acknowledge that the Board is bound to regard itself as a representative body, elected to carry out the views of its constituents; and as there can be no doubt that the majority of these would prefer the adoption of these religious observances, little or no opposition was offered. The resolution proposed by Lord Sandon stood thus:—(1) That, in accordance with the general practice of existing elementary schools, provision shall be made for the use of prayer and hymns in schools proprovided by the Board at the "time or times" when, according to section 7, sub-section 2, of the Elementary Education Act, "religious observances" may be "practised." (2) That the arrangements for such "religious observances" be left to the discretion of the teacher of each school, subject to the approval of the managers, with the right of appeal to the Board. Provided always: *a*. That in the selection of the prayers and hymns, the provisions of the Act in Sections 7 and 14 be strictly observed, both in letter and spirit, and that no attempt be made thereby to attach children to any particular denomination. *b*. That in regard to any particular school, the Board shall consider and determine upon any application by managers, parents, or ratepayers of the district, who may show special cause for the exception of the school from the operation of these resolutions, in whole or in part. Alderman Cotton proposed, as an amendment to resolution (2) "That the arrangement of prayers to be used, and the hymns to be sung, be left to the discretion of this Board;" and this proposal was strongly supported by Professor Huxley. It was lost, however, by 26 to 5, and ultimately resolution 2 was agreed to in the following form:—(2) "That the arrangements for such religious observances be left to the discretion of the teachers and managers of each school, with the right of appeal to the Board by the teacher, manager, parents, or ratepayers of the district. (*a*) That in offering any prayers, and in the use of any hymns, the provisions of the Act in sections 7 and 8, be strictly observed, both in letter and spirit, and that no attempt be made to attach children to any denomination." Commenting on this debate, the *School Board Chronicle* says:—"The whole debate resolved itself into the question whether the School Board or the school managers and teachers should arrange for the use of prayers and hymns, and be responsible for the method and character of the observances. And, finally, it was left to the managers of and teachers. This removes a cause of controversy from the Board-room. The members in Board or committee assembled would hardly have known what to do about those prayers and hymns which they would have undertaken to provide; but the managers and teachers will take to the duty as a congenial habit, and we do not expect that any difficulty will arise; for the bugbear of denominationalism is rather an image of fancy than of fact. After all that has been said and done in this matter, the school manager or teacher who should attempt to utilise a School Board school in the interests of proselytism would be little better than a lunatic. It is impossible not to indulge in a hope, in connection with the working of this Education Act, that it will tend to reduce the virulence of sectarianism in this country. Hitherto no sort of stigma has attached to the sectarian zeal displayed by individuals or by bodies of men; but this controversy has served to make very prominent in men's minds the evils resulting from a too strict separation of

Christians on account of differences in religious opinion. The sort of repugnance with which distinguished members of the London School Board, attached to particular branches of the Church, speak of the divisions and distractions of the sects is something fresh and refreshing in connection with questions of this sort. It may lead to a wider and deeper sense, in this generation, of that true tolerance which we are as yet but beginning to learn to understand."

Mr. Ruskin on Education.—Referring to the sum of £1,000 which he has determined to present to the public. to be invested in land, which is to be "treated thoroughly at once, putting unlimited manual labour on it, until we have every foot of it under as strict care as a flower-garden—the labourers to be paid sufficient, unchanging wages"—Mr. Ruskin says:—"Their children are to be educated compulsorily in agricultural schools inland, and naval schools by the sea, the indispensable first condition of such education being that the boys learn either to ride or to sail; the girls to spin, weave, and sew, and, at a proper age, to cook all ordinary food exquisitely; the youth of both sexes to be disciplined daily in the strictest practice of vocal music; and for morality, to be taught gentleness to all brute creatures, finished courtesy to each other, to speak truth with rigid care, and to obey orders with the precision of slaves. Then, as they get older, they are to learn the natural history of the place they live in; to know Latin, boys and girls both; and the history of five cities—Athens, Rome, Venice, Florence, and London."

GENERAL NOTES.

Japanese Coal.—The *Nangasaki Gazette* states that Japanese coal is in future to be used by English vessels in Japanese seas. It is reported that the coal from Takosima is equal to the best English coal. This mine at the present time produces about 200 tons per week, and it is said to be capable of producing 500 tons.

British Medical Association. — The thirty-ninth annual meeting of the British Medical Association will be held at Plymouth, on Tuesday, Wednesday, Thursday, and Friday, the 8th 9th, 10th and 11th of August. The "Annual Museum" of this association will be open during the four days of the meeting, for the exhibition of:—1st. The latest inventions in medical and surgical instruments, and appliances of every kind. Also, for the special exhibition of ancient and modern fracture apparatus, or diagrams of such, thus setting forth the history of the treatment of fractures from the earliest records down to the present day. 2nd. New drugs and their preparations. 3rd. New articles of diet for invalids. 4th. Pathological specimens; also photographs, casts, &c., illustrating disease. 5th. New works on medicine, surgery, &c. 6th. Models of drawings of any object of professional interest not included in the above list.

Commerce of Genoa.—The Austrian Consul at Genoa, in his report on the trade at that port, in 1870, gives the following statistics of the value of the exports and imports, which amounted in that year to 324,052,687 frs., against 266,923,258 frs. in 1869, showing an increase in favour of 1870 of 27,129,429 frs. Of this amount, 19,950,961 frs. were in the exports, and 7,178,468 frs. in imports. The Franco-Prussian war, which caused a great draw in the exports from other ports in Italy, has had quite a contrary effect at Genoa, from which port large quantities of provisions, liqueurs, and arms were sent to France, whilst manufactured goods were exported in large quantities which formerly were supplied from France and Germany, The commerce of Genoa forms alone one quarter of the total imports, and one-ninth of the exports of the kingdom of Italy.

Influence of the Solar Eclipse on the Earth's Magnetism.—Mr. Diamilla Müller published, a short time ago, in the *Gazetta Officiale del Regno d'Italia*, some observations on the course of the magnetic needle during the eclipse. On the 22nd of December last, the needle followed its usual course until the commencement of the eclipse, then it went backwards till 1.58 p.m., when it attained its maximum declination at the time when the eclipse became total. Afterwards it resumed its movement westward, until it exactly took up the position it occupied before the commencement of the eclipse.

Population and Wheat.—In the seven decennial periods which have now just elapsed since the taking of the first census, the population of England, Scotland, and Wales has rather more than doubled, having increased by about 12,230,000. The *Chambers of Agriculture Journal* says the ratio of increase has been tolerably uniform, the average increase for the whole period having been at the rate of about 175,000 a year, while in the two latest divisions (ten and nine years) it has averaged 210,000 and 255,000 a year respectively. The rapid increase in the importations of corn is surprising. It appears that the average number fed by foreign wheat in each year for the period of ten years ending 1850 was 3,500,000, and the corresponding figures for each year of the nine last in the table are 8,600,000. It appears, too, that free trade was the turning point in the history of our agricultural production. Since 1850, the home growth of wheat has steadily diminished; it maintained only 15,400,000 on the average of the past nine years, compared with 16,000,000 then.

The Use of China Clay in Weaving.—The following representation has been sent to the Medical Department of the Privy Council:—"To the Right Honourable the Lords of the Privy Council.—The humble representation of the undersigned weavers of the district of Todmorden, in the counties of Lancaster and York, sheweth:—That for several years a material called kaolin, or China clay, has been introduced into the manufacture of calicoes and other grey goods. That in some mills, sizing, including China clay, is laid on the warps to the extent of 40, 60, and even 100 per cent.; that before the American war the per-centage was 20. That ingredients believed to be poisonous are used to make the China clay adhere to the warps. That to prevent the warps breaking, through the dryness of the atmosphere, it is necessary to close the ventilators in the weaving sheds. That through the closing of the ventilators the weavers are compelled to inhale the dust of the China clay that rises from the warps, mixed with the poisonous ingredients. That, working in these sheds, they suffer from excessive heat and thirst, and are greatly distressed, especially in summer, when they are frequently compelled to leave their work to breathe the fresh air outside; that the inhalation of this dust causes difficulty of respiration, loss of appetite, bronchitis, and consumption; that the strong may bear up for a time against the injurious effects of the sizing, but that it tells upon them, apparently creating—certainly accelerating—lung diseases; that many are compelled to give up weaving, being forbidden by medical men to return to the weaving sheds while China clay is used, that others work for a few weeks, and are then compelled to abstain for days or weeks; that the beginning of fatal illness may apparently be traced to the working in weaving sheds wherein China clay is used. The undersigned, therefore, humbly pray that your lordships will be pleased to send a medical inspector to inquire into the sizing system generally, especially into the use and effects of China clay and such other ingredients as may be necessary to make China clay adhere to the warps, so that your petitioners may be delivered from the evils they now labour under.—And your petitioners, as in duty bound, will ever pray."

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ANNOUNCEMENTS BY THE COUNCIL.

THE LIBRARY.

The following works have been presented to the Library :—

A Compendious Grammar and Philological Handbook of the English Language. By John S. Colquhoun, Esq. Presented by the Author.

Abstracts of the Reports of the Surveys and of other Geographical Operations in India for 1869–70.

Report of the British Association for the Advancement of Science. Presented by the Association.

A Set of the Publications of the Cobden Club. Presented by the Club.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

EDUCATIONAL COLLECTION.

It will be remembered that this portion of the Exhibition was brought together under the auspices of a committee appointed by the Council of the Society of Arts, under the presidency of H.R.H. the Prince of Wales. The collection was briefly described in the report of the Society's Educational Officer, read to the Conference held in June last. The official reports upon it are now published, and though they appear somewhat late, they will form most useful guides to those studying this collection, as well as valuable records of the present position of educational works and appliances in this and other countries. The following is a list of the reports, which are published by Messrs. J. M. Johnson and Sons, and are models of clear and accurate printing :—"School Buildings, Fittings, &c.," by Alfred Chas. King, Esq.; "Books, Maps, Globes, &c.," by E. P. Bartlett, Esq.; "Toys and Games," by G. C. T. Bartley, Esq.; "Materials for Science Teaching," by J. F. Iselin, Esq.; "Materials for Art Teaching," by George A. Stewart, Esq.; "Musical Instruments, Books, &c.," by John Hullah, Esq.

The reports on specimens of school work are by various writers, as follows :—"Examination Papers," by the Rev. Muirhead Mitchell; "Drawing and Design," by George A. Stewart, Esq.; "Mechanical Drawing," by F. Alf. Bradley, Esq.; "Needlework in Schools," by Mrs. Le Neve Foster; "Work in Prisons, &c.," by Captain E. F. Du Cane, R.E.; "The Blind and the Deaf and Dumb," By Edmund C. Johnson, Esq.

The first report that calls for notice is by Mr. A. C. King, and is on

School Buildings, Fittings, and Furniture,

Most of the objects being arranged in the theatre over the western portico of the Albert Hall. Mr. King begins by pointing out that "the planning and erection of school-buildings, as a special branch of the architect's art, and the construction of school furniture as a prosperous branch of trade, are alike of comparatively recent origin; for though the old foundation schools were usually well provided with buildings, the furniture and fittings were not unfrequently of the quaintest and most incommodious description. At Westminster, and in other grammar schools, men still in the prime of life will tell us that in their day no provision existed either for artificial light or warmth. In winter, the boys wore their great-coats in school, if they pleased; and when, in the masters' judgment, the daylight failed, school broke up. So long as the teaching in schools, even of comparatively humble rank, largely consisted of 'grammar,' that is to say, Latin and Greek, demanding much quiet and individual preparation on the part of the scholar, almost any style of school furniture was thought to suffice. The boys had their forms, often indeed too high and too narrow, and invariably without the modern luxury of backs—forms on which, as an American writer says of some of the school benches of his own country, 'to sit was an exceedingly active verb.'

"With the introduction of the rival systems of education for poor children, known respectively as Dr. Bell's or the Madras system, and the Lancasterian system, so named from its founder, Joseph Lancaster, some attention began to be paid to the arrangement and furnishing of school-rooms, under the auspices of the National Society and the British and Foreign School Society.

"From an early period of its existence, building grants were made on a liberal scale by the former society, and on a smaller scale by the latter. Between 1834 and 1839, considerable sums were annually voted by Parliament towards the erection of school buildings, and these grants were administered through the agency of the two societies; but notwithstanding these efforts the condition of school buildings throughout the country was often very deplorable. The late Mr. Harry Chester, in a lecture delivered at South Kensington, on the 12th December, 1859, says :—'The buildings were low, thin, dingy, ill-drained, often without means of warming, often without proper conveniences; with no furniture but a teacher's desk, a few ricketty forms, a rod, a cane, and a fool's cap. The floors were almost invariably of brick—the worst kind of floor, as it is tenacious of moisture, cold to the feet, easily abraded into red dust, and soon worn into holes. There were rarely any porches or lobbies for the caps and cloaks of the children. If there were a house for the teacher, it was seldom such a house as a teacher of the present day would like to inhabit.'

"The Committee of Council on Education was appointed on April 10, 1839, "to superintend the application of any sums voted by Parliament for the purpose of promoting public education." One of its first acts was to issue a minute, dated February 20, 1840, accompanied by a series of plans of school-houses, for the guidance of the promoters of elementary schools. These plans were prepared with reference to the requirements of schools managed on what was termed the mixed method—a modification of the system of mutual instruction, by the employment of better instructed and paid monitors, combined with some features of the simultaneous method. The arrangement of desks and seats best adapted to this method was shown on the plans, accompanied by detailed estimates of their cost. But so strong was the hold of the two systems already referred to on the respective supporters of the National and the British and Foreign Society's Schools, that alternative plans of fittings were added, also accompanied by estimates, should the builders of new schools determine to adhere to one of these two systems.

"As the influence of the Committee of Council became greater, the fittings and internal arrangements of schools were modified to meet its recommendations, backed as these recommendations were by special grants to facilitate necessary alterations. Parallel desks, in groups of three rows, with not more than eight children in each row, were strongly insisted on, and almost universally adopted, the groups being arranged along one side only of the room, and separated from each other by curtains. In 1851, the opinions of the various school inspectors, as to the best form of school-house and the most successful modes of organisation, were, so to speak, codified by the central office, and a memorandum on the rules to be observed in the planning and fitting up of schools was issued, much more authoritative in tone than the minute of 1840. With some modifications in detail, this memorandum has continued in force till the present day, and a new edition has just been issued by the Committee of Council, accompanied by plans, elevations, and specifications for schools to contain from 48 to 200 children. In the thousands of school-houses erected or restored during the last twenty years, these plans have been very generally followed, modified, of course, to meet peculiarities of site, surrounding buildings, etc. Happily, some of the best architects have supplied designs for elevations, thus ensuring variety of style; and the national school, while possessing certain distinctive features by which it can generally be at once recognised, is not unfrequently the most graceful and pleasing edifice in its town or village.

"Meanwhile, a new and flourishing trade had been growing up—that of manufacture of school furniture. The careful adaptation of desks and forms to the stature of the children, the relative proportions to be observed, and the various contrivances by which the furniture of the day-school could be made 'a double debt to pay;' all these had taxed the ingenuity of school builders.

"Various expedients readily presented themselves for altering a sloping desk into a level table, or for letting down the front portion of the desk to give space in boys' schools for drill, &c., and in girls' schools for needlework, or for ready ingress and egress. The other needs have been met by the invention of the convertible desk, of which various examples are included in the present exhibition. In all of these, a piece of furniture, apparently an ordinary sloping school desk, with form, is more or less readily altered into a comfortable seat, with a sloping back, suited for the Sunday school or meetings, while, by other transpositions, it becomes a broad level table, with seats on either side, ready for a harvest dinner or annual school festival."

Mr. King then proceeds to describe some of these desks, as exhibited, but he points out the liability to injury that all such rather intricate contrivances present. For these descriptions the reader is referred to the report itself, which will form a most useful companion in the exhibition.

The reporter then leaves these convertible desks, and turns to various models which profess to answer well the one purpose only for which they are designed, and which are characterised by no special contrivances. "First among these are two of the old-fashioned box desks, providing a separate locker for each pupil, with a lifting lid. The objections to these desks have been repeatedly stated; they are said to be serious impediments to discipline, to give opportunities for shirking, and for a multitude of school-boy misdemeanours. Notwithstanding all this, they are greatly in demand in schools where much quiet preparatory work is required from the pupils, and it is no small advantage for a boy to have his own permanent assigned place in the schoolroom, and his books, &c., readily within reach."

Other non-convertible desks are also described, as well as some specimens of teachers' desks; and the writer passes on to models and designs for school-buildings, in which, he says, little of importance is contributed by England. "The Home and Colonial School Society sends a model of an infant-school well designed to meet all the requirements of the government system; and Dr. White, of Chiswick, sends a drawing of the decorated interior of a class-room in his school, accompanied by a full-sized example of a map to occupy one of the wall-panels. The municipality of Vienna exhibits a large portfolio of well-executed designs for school-houses in that city—lofty and stately edifices, often of many stories in height; while from Hungary comes a collection of photographs of the various schools in Pesth. The liberal amplitude of the buildings in each of these collections is very striking. From Belgium comes a useful compilation by L. Blandot, architect, of elevations, plans, and constructive details of schools erected in Belgium during the last ten years, designed for from 30 to 150 children. Since 1852, the state has exercised considerable influence over school architecture in that country; these drawings show with what result. The practical details and adaptations of plan to site appear good, but the elevations, chiefly in the style of a suburban vestry-hall, are rarely of a character likely to find favour in this country.

"The remainder of the section is occupied by the ordinary fittings of a well-appointed school, easels, black-boards, pointers, reading-stands, &c.; in none of these is there any novelty of construction, and they are too well known to call for detailed notice."

The reporter then gives a brief account of the Swedish school-house, which has been erected in the garden to the west of the Woollen Machinery Gallery. "In form, dimensions, and general details, this is an accurate reproduction of an ordinary village school; but as the whole fabric, which is of pine wood, stained and varnished, was constructed in Stockholm, it is by no means of such substantial materials as would have been the case had it been intended to encounter the rigorous winters of Sweden. To an English visitor, the furniture presents many novel and interesting features, especially the provision of a separate seat and desk for each pupil. Although this has long been customary in the United States and Canada, as well as in Spain and some other Continental countries, it is very rarely if ever to be met with in English schools. It certainly presents many and obvious advantages. There is also a desk for girls, with seat and foot-board, to be raised and lowered at will. The teacher's desk is singularly complete. It is provided with a surprising variety of closets and drawers, together with an ingenious sliding map-stand. A framed black-board, revolving on pivots at top and bottom, with easel attached, is cleverly constructed; and it has on one side a large map of Sweden, with the sites of towns marked by wire pegs only; small blocks of wood, each bearing the name of a town, are provided, and these the scholars are required to place on their appropriate pegs. We shall doubtless soon meet with maps on this system in our own educational depositories—indeed, there is much in this room which cannot fail speedily to receive the tribute of imitation.

"As a special report will be issued on the collection of educational appliances in the Indian Court, it is only necessary here to direct attention to its great interest and value."

In conclusion, Mr. King says:—"School managers, teachers, and others practically interested in school building and fitting, will perhaps regret that the Educational Section is not more complete in various details, such as modes of warming, lighting, ventilation, approved systems of flooring, movable partitions, draining, fencing for playgrounds, &c. Some of these will be found incidentally illustrated in other sections of the present exhibition; others will naturally come within the range of the scheme proposed for future years; while in the building and appointments of the exhibition itself, including the Albert Hall, many suggestions may be gathered, bearing on more than one of these points; and the buildings and fittings of a village school may not improbably owe much both of beauty and convenience to the ingenuity and practised skill employed on these great edifices."

BRITISH ASSOCIATION.

The following address was delivered by Professor Fleeming Jenkin, President of Section G (Mechanical Science):—

In addressing you on the subject of mechanical science in our ancient university, I propose to speak on the somewhat threadbare topic of technical instruction. The panic with which some persons regarded the rapid improvement made abroad in manufactures has subsided, but I hope that you will be all the more ready on that account to listen to a few suggestions, as to steps which may be immediately taken to improve the education of those who apply science to practical ends. The subject does not owe its prominence to any events of to-day or of yesterday; it has long been, and will long be, of paramount importance to this country that the education of the producers of wealth should be such as will enable them, not merely to compete on advantageous terms with foreigners, but rather to master the great forces of nature by which we work. That we have gained some triumphs can be no reason for relaxing our efforts. With each advance further advance becomes more difficult, and requires more knowledge. The first rude implements and processes employed by man certainly required for their explanation or acquirement no book-learning; but as processes become complex, and implements develop into machines, as the occupations of men differ more and more, practice alone is found insufficient to give skill, and study becomes the necessary preparation for all successful work. Our first engineers were not learned men; strong good sense and long practice enabled them to overcome the comparatively simple questions with which they dealt. All honour to those great men; but we who have to deal with more complex, if not with vaster problems, cannot trust to good sense alone, even if we possess it, but must arm ourselves by the study of science and its application to the arts. This being granted, how shall it be done? I need not trouble you by refuting the absurdities of a few men, who would have those things taught at schools which have hitherto been taught by practice. What has been taught by practice must still be taught by practice. The business of the school is to teach those things which practice in an art will not teach a man. Let us apply this principle to engineering—the most scientific of all professions. It will be most useless to lecture on filing and chipping; it will be useless to describe the mere forms and arrangements of vast multitudes of machines; one kind of knowledge of the properties of materials can only be acquired, as it always has been acquired, by actually handling them; and the knowledge of the arrangement of a machine is far better learnt by mere inspection than from fifty lectures; moreover, it can be acquired by an intelligent man, even if he be wholly unlettered. Book-learning about estimates, the value of goods, methods of superintending work, and dealing with men, is foolishness. Written descriptions of puddling a clay embankment, excavating, and such operations, give no knowledge; and yet a vast mass of such knowledge must, at some time of his life, be acquired by the engineer, and the student cannot be employed as an engineer until he has laid up a store of such knowledge. Colleges cannot give him this; he must serve an apprenticeship in fact if not in form; young foreigners taught in colleges serve their apprenticeship, at the cost of their employers, during the first few years of their professional life. We call the tyro an apprentice or pupil, and he pays his master instead of being paid by him. I have the strongest feeling against any attempt to substitute collegiate teaching for practical apprenticeship; so far as colleges attempt to teach practice, they are and will be a sham in this country and in all others. The work of a college is to teach those sciences which are applied in the arts, but it can go a little further, and indicate to its students how the application is made in at least a few selected instances. Applying this dictum to the education of an engineer, his college can teach him mathematics, natural philosophy, chemistry, and geology. No one can doubt that a youth well trained in these branches of knowledge will, even with no further teaching, learn more during his apprenticeship, and during his whole professional life will take a higher standing, than the man of equal intelligence untrained in science. College can, however, do more than this; it is found that a lad will go through a considerable number of books of Euclid, and yet see so dimly how his knowledge is to be connected with practice that he may be unable even to compute the area of a field, the dimensions of which are well-known to him; and far more is it seen that a man may be fairly grounded in mathematics, and yet have very little idea how to apply his knowledge to mechanical problems. It is the business of those who hold such chairs as mine to point out the connection between pure science and practice; to show how mathematics are employed in mensuration and in mechanical calculations; to show how the truths of physics are made use of in designing economical machinery, as when we teach the connection between the laws of heat and the steam engine. The student who has once grasped the fact that there is a real connection between practice and theory will seldom be at a loss how to find or search for that connection in after-life. The student thus prepared knows what he has to learn from practice, and need not lose precious time in blundering over the numberless scientific problems which practice is sure to suggest but can never solve. The education of the architect, the practical chemist, the manufacturer, and the merchant, must be similar, *mutatis mutandis*, with that of the engineer. Assuming, then, that the education of those who are to follow more or less scientific pursuits must consist in acquiring, first, that theoretical knowledge which practice cannot give, and, secondly, the practical knowledge which schools should not attempt to give, there remains the question whether the theoretical preparation should be given in special colleges, or universities such as our own. I have no hesitation in preferring the university. Mathematics, physics, chemistry, geology, botany, languages, all form elements required in various combinations in the education of all our students. There is but one kind of mathematics, one kind of pure physics, and so forth. Surely it is better that we should teach the men belonging to different professions side by side, so long as the matter taught is to be the same. There are many dangers in an opposite course. There are not a sufficient number of competent teachers to allow of much differentiation. Segregation at an early age is apt to foster professional peculiarities and narrow-mindedness. There is great danger, if physics are to be taught specially to engineers, that a special kind of physics, erroneously supposed to be specially useful to them, will be invented. Lastly, the contact of students and professors of one faculty with the students and professors of other faculties is very beneficial to all. Do not, therefore, cripple old universities by withdrawing from them a portion of their students and their professors, to set up special, professional, or technical colleges of a novel kind, but rather add by degrees to the power and usefulness of old institutions, and found new colleges and universities after the model of those which are found to have done good work. As an example of what may be safely done, I consider that in Edinburgh we require a chair of architecture, and lectureships on navigation and on telegraphy. There is, further, much want of a teacher of mechanical drawing. The professors of physics and chemistry require additional accommodation for practical laboratories, and additional assistance. If these additions were made, our college would, in my opinion, meet all the requirements for superior technical education in this part of Scotland. For £2,000 per annum all these additions might be made. Notwithstanding the acknowledged importance of education, establishments for giving the higher kinds of instruction are never self-supporting, and students must everywhere be bribed to come and learn. Immediate prizes, in the form of bursaries, scholarships, and fellowships, are required to induce men to cultivate the older fields of learning; and similar bribes are needed to promote the tillage of the more recently colonised domains of applied science. The Whitworth scholarships are a noble example of munificence thus directed, although, in my opinion, the examination requires considerable reform. I hope that further benefits of this kind will be conferred on those colleges which give efficient teaching. Local ambition is most effectually stirred by local prizes, and I regret to find a certain apathy among students here with respect to the Whitworth competition. This appears to arise partly from dissatisfaction with the mode of examination, and partly from the fact that the examiners are men not well known in Scotland. Leaving the question of technical training for the upper classes, and the still larger question of scientific teaching in second grade schools, the consideration of which would lead us too far a-field, I purpose to say a few words on the technical education of the skilled artisan. This we must treat on the same principles as have been applied to professional teaching. We must endeavour to prepare the lad in school, by teaching him those things which he cannot learn in workshops, but which will enable him to work with greater intelligence while acquiring and applying his practical knowledge. I shall not now speak of that general education which should make him a good man, and which should open to him those great sources of rational enjoyment arising from culture; I will restrict myself entirely to his preparation for becoming an efficient workman. I have in many places said, and I cannot say too often, that the great want of the workman is a knowledge of mechanical drawing. Unfortunately, I can obtain little attention from the general public to this demand for the workman. Very few persons not being engineers know at all what mechanical drawing is. I am sorry to say that some examiners in high places, who direct the education of the country, know very little more than the general public, and teachers who should give bread give chaff. I have lived much abroad, and come into close contact both with English and foreign workmen, and I unhesitatingly say that the chief, if not the only inferiority of Englishmen has been in this one branch of knowledge. I must explain to some of my hearers what mechanical drawing is. It is the art of representing any object so accurately that a skilled workman, upon inspecting the drawing, shall be able to make the object of exactly the materials and dimensions shown, without any further verbal or written instructions from the designer. The objects represented may be machines, implements, buildings, utensils, or ornaments. They may be constructed of every material. The drawings may be linear, shaded and coloured, or plain. They must necessarily be drawn to scale, but various geometrical methods may be employed. The name of mechanical drawing is given to one and all those representations the object of which is to enable the thing drawn to be made by a workman. Artistic drawing aims at representing agreeably something already in existence, or which might exist, and for the sake of the representation; mechanical drawing aims at representing the object, not for the sake of the representation, but in order to facilitate the production of the thing represented. Now, I say that it is this latter kind of drawing which is so vastly important to our artisans, and hence to our whole wealth-producing population. Very few workmen, or men of any class, can hope to acquire such excellence in artistic drawing that their productions will give pleasure to themselves and others; but a great number of workmen must acquire some knowledge of the drawings of those things which they produce; and there is not one skilled workman or woman who would not be better qualified by a knowledge of mechanical drawing to do his work with ease to himself and benefit to the public. Mechanical drawing is a rudimentary acquirement, of the nature of reading, writing, and arithmetic. In order that a man may understand the illustrated description of a machine, he must understand this kind of drawing. To the general public, an engineering drawing is as unintelligible as a printed book is to a man who cannot read. The general public can no more put their ideas into such a shape that workmen can carry them out, than a person ignorant of writing can convey their meaning on paper. Reading and writing on mechanical or industrial subjects is impossible without some knowledge of the art I am pressing on your attention. This art is taught abroad in every industrial school; a great part of the school time is given up to it. In a Prussian industrial school one-third of the whole time is given to it. A French commission on technical education reported that drawing, with all its applications to the different industrial arts, should be considered as the principal means to be employed in technical education. Now, I deliberately state that this subject is not taught at all in England, and that the ignorance of it is so great that I can obtain no attention to my complaints. A hundred times more money is spent by government to encourage artistic drawing than is given to encourage mechanical drawing, and I say that mechanical drawing is a hundred times more important to us as a nation. Moreover, the little *quasi*-mechanical drawing which is taught is mostly mere geometrical projection, a subject of which real draughtsmen very frequently, and with little loss to themselves, are profoundly ignorant. Descriptive geometry and geometrical projection are nearly useless branches of the art, and the little encouragement which is given is almost monopolised by these. Mechanical drawing proper is confined to those who pick it up by practice in engineering offices. These draughtsmen are often excellent, and on their behoof I claim no other teaching. I speak for the artisan who makes and for him who uses machinery. There are two ways in which our shortcomings may be remedied. First, the schools of art now established in this country should be enlarged so as to teach real mechanical drawing, and the examinations conducted by the Science and Art Department should be greatly modified; secondly, the drawing which is to be taught in the schools under the superintendence of the new school boards may be and ought to be mechanical drawing. Freehand drawing, as a branch of primary education, will, I fear, be a useless pastime; but whether that be so or not, I am certain that the accurate and neat representation of the elementary parts of machinery and buildings would be popular with the pupils, and could be effectively taught. This kind of drawing educates hand and mind in accuracy, it teaches the students the elements of mensuration and geometry, and it affords considerable scope for taste where taste exists. The chief difficulty will be to obtain competent teachers. I should occupy you too long were I to attempt to show how these must themselves be trained. My chief aim to-day has been to claim attention for a most important and wholly neglected branch of education. I shall probably be expected to urge the teaching of other natural sciences in our primary schools; nothing, indeed, would give me greater pleasure than to think this could be done. I confess I doubt it, and while our second grade schools are what they are in this respect, and while the Cambridge examination for a degree in applied science is what it is, I dare not think of natural science classes in our primary schools. I shall be delighted if I am mistaken, but I am certain that mechanical drawing deserves our first attention, as most immediately useful to the artisan, and most easily taught. The very books on natural science which are published in England cannot be properly illustrated for want of competent draughtsmen, and children would be unable to follow the illustrations and diagrams if ignorant of the principles on which they are constructed. I look rather to good reading books, explained by intelligent masters, as the best manner of teaching the elementary and all-important truths of natural science. No man could do better service than in compiling such reading-books, and there are few wants more urgent than that of masters competent to enlarge upon texts which would thus be put into their hands. The education of our workmen is far more incomplete than that of our professional men. Small additions to existing institutions will meet the want of the latter; but for the former the institutions have to be erected almost from the foundation.

THE WORKING OF THE ALKALI ACT.

Seven years ago, the Alkali Act was passed, and actual experience serves to show its beneficial character. This statute requires that every alkali establishment shall condense at least 95 per cent. of the muriatic acid gas evolved therein. Thus the law demands that the escape shall in all cases be less than 5 per cent. The *Standard* says:—

For some months after the passing of the Alkali Act, as much as 16 per cent, of the gas was commonly allowed to escape, and in certain cases the amount was as high as 40 per cent. Many alkali makers believed that the law demanded an impossibility, and that any very refined condensation was out of the question. But before the end of the year (1863) in which the Act was passed, habitual complete condensation had already been achieved in several instances. Dr. Angus Smith, who was appointed inspector under the Act, had himself become familiar with the effective method of condensation, and was so satisfied of its practicability that he entered on his duties with the firm persuasion that the law was reasonable and right. While dealing tenderly with the interests involved, the inspector, aided by his staff of assistants, was able to report at the close of the first year that the average escape of muriatic gas was only 1·28 per cent. The total amount of salt decomposed per week was 5,762 tons. This would give out 3,325 tons of dry acid, or about 13,000 tons of strong commercial muriatic acid in a liquid state. The whole of this would have escaped into the air had there been no condensation. As it was the weekly escape was kept down to 43 tons. In the second year the average escape was only 1 per cent., or 5 tons per day out of 500 tons. In 1866. the average escape was 0·73 per cent., or about one-seventh the quantity allowed by the Act. In 1867, the average escape was reported as still less, namely, 0·615 per cent., the difference between these last two returns being equal to several hundredweight per day. We may consider the amount as still coming under 1 per cent. A further allowance has to be made for what are called "leakages," and during the last three years Dr. Smith has endeavoured to grapple more effectually with this latter item. During 1870, no one was prosecuted under the Alkali Act, although many parties had their furnaces stopped because of escapes more or less approaching 5 per cent. or going considerably above it.

In 1868 Dr. Angus Smith commenced some interesting and important inquiries into the state of the atmosphere, as indicated by the matters discoverable in rain. These are continued in 1869, and the report for 1870, just issued, shows that these inquiries were carried on during that year also. Dr. Smith appears to look upon this part of his work as pretty well accomplished, so far as he is concerned, and he records the results for the guidance of those who may take up the question with the view of carrying it further. First among his tables we find the chlorides. The sea air will naturally give these; but they may also be artificially produced by the combustion of coal and sulphur acids. An excess of chlorides does not of itself demonstrate a bad atmosphere; but a local excess found inland is a certain proof of impurities thrown into the air. The second table, relating to the sulphates, is more striking in its character. Sulphuric acid is taken as a measure of manufacturing activity, and also of decomposition. It is said to be part of the oxydised, and therefore purified, sewage of the air. It increases inland, even without smoke, on account of the decomposition of vegetable and animal matter. Valencia, on the west coast of Ireland, being taken as the standard with 100 degrees, the inland country places of England have 202; German specimens show 600; London, 750; St. Helen's, 1,216; Liverpool, 1,450; Manchester, 1,758; Glasgow, 2,571; and the vicinity of an alkali works, 2,680. Taking the chlorides and sulphates together, the total acid ranges from 10·6 in the inland country places of Scotland to 153·6 at Glasgow, Valencia being 100. The great amount of chlorides in the Valencia specimen shows that the pure salt of the sea air ought really to be deducted from the reckoning. When the salt comes from coal it is accompanied by other substances, and becomes one measure of impurity. In like manner salt in water is often a result of sewage contamination; but the rule fails when we deal with the sea.

The ammonia table, with Valencia as unity, shows London with 19 degrees, Manchester with 36, and Glasgow 50. The ammonia thus present is considered a measure of the sewage in the air. It was in no case free. In the towns it was combined partially with chlorine or sulphuric acid. In country places, where the proportion was much less, it seems to have been united to carbonic acid. Albuminoid ammonia is a still more formidable ingredient, being a measure of what we may term the raw sewage of the atmosphere. It includes the most dangerous substances, germs of living things, vegetable or animal. Taking Valencia as unity, the inland country places of Scotland have 1·26 degrees; the inland country places of England, 3·15; Liverpool, 4·67; London, 6; six manufacturing towns in England, 6·26; Manchester, 8·32; and Glasgow, 8·82. In the next place, we come to nitric acid, which is taken as a measure of purified sewage, or oxydised nitrogenous bodies. The amount is a guage, not only of the impure matter, but of the progress made in purifying or cleansing it. Taking Valencia again as unity, Liverpool has 1·57; London, 2·27; Manchester, 3·15; Glasgow, 6·59; and a few specimens from Germany, 7·80. The unfortunate pre-eminence of Glasgow in most of the foregoing tables stands in striking accord with the great mortality of that town.

We have quoted comparative quantities thus far. The absolute amounts are given in a long series of tables, some of which afford curious results for different localities in London. The fire-engine stations of the Metropolitan Board of Works have been extensively used for this purpose, with the aid of Captain Shaw. Ammonia figures for 4·57 parts per million in the N. and N.W. districts of the metropolis. In the S.W. and S.E. districts the average is 10·13, in the E. and E.C. 11·93, and in the W. district only 3·42. These figures, however, are exclusive of Regent-street and St. Giles's, the former of which is charged with 22·15, and the latter 26·90. Woolwich has only 6·5, while Greenwich has 1·47. Albuminoid ammonia is 0·27 at Highgate, 0·75 in St. Pancras, 0·65 in Holborn, 0·20 at Hammersmith, the same at Greenwich, and 0·33 at Woolwich. Doubtless these results need to be checked by further observations, and Dr. Smith expresses his hope that what he has done may be of use in all future sanitary inquiries in which the chemical method is adopted.

That this method will become popular with scientific observers is what he ventures to believe. Everybody will at least be ready to agree with the alkali inspector that, if this mode of operation can be relied upon, it would be a wiser and a better thing to examine the air by a few chemical experiments than to wait until its unhealthy condition is demonstrated by a rise in the rate of mortality.

THE COMMERCIAL TREATY WITH FRANCE.

The Treaty of Commerce between France and Britain expired in February last, but, not having been formally renounced, it continues in force, in accordance with Art 21 of the treaty, "until the expiration of a year, counting from the day on which one or the other of the high contracting powers shall have announced its intention to put an end to it." The treaty will thus shortly require to be renewed, or revised, or set aside.

Last year having been occupied by war, it will be interesting to compare the trade of the two countries during the ten years beginning with 1859, the year before the adoption of the treaty, and the year 1869. The first table shows imports and exports between the two countries, and the increase in value and per cent.; the second one, by way of comparison, our imports and exports to all countries:—

I.

	1859.	1869.	Increase.	Per cent.
Imports from France	£16,900,723	£33,527,377	£16,626,654	98
Exports to France	9,594,827	23,277,222	13,682,395	143
Total	£26,495,550	£56,804,599	£30,309,049	114

II.

	1859.	1869.	Increase.	Per cent.
Imports from all countries	£179,182,355	£295,460,214	£116,277,859	65
Exports to all countries ...	155,692,976	237,015,052	81,322,077	52
Total	£334,875,333	£532,475,266	£197,599,936	59

Although similar commercial treaties were made with many other European nations, the increase of our entire foreign trade only amounts to 59 per cent. in ten years, or 5·9 in average yearly, while the increase of our trade with France during the same period amounts to 114 per cent., or 11·4 in average yearly. The effect of the treaty may thus be compared to a new machine, by which the momentum of the progressive movement of commerce has been raised to a very high degree, or to the influence which railways and telegraphs have had upon the industries and trade of the world.

The results of the treaty are still more prominently brought out by comparing our French trade previous to the treaty with the last ten years. During fourteen years before its adoption, our exports to France show an increase of 94 per cent., or 6·7 per cent. a-year in average, while the foregoing table exhibits an increase of 143 per cent. in ten years, or 14·3 per cent. a-year on an average.

Distinguishing British produce from foreign and colonial produce exported from this country to France, we find that the exports during three years previous to the treaty averaged £4,766,000, and in the last three years of the operation of the treaty, £12,866,000, showing an increase in nine years of 170 per cent., while to all other foreign countries the increase for the same period only amounts to 84 per cent.

It must be obvious how the excessive duties which M. Thiers proposes to levy upon nearly 30 per cent. of our whole exports of foreign and colonial produce (nearly £13,000,000 out of a total of £47,000,000) would restrict, obstruct, and cripple our entire trade with those countries from which that produce was sent to us in exchange for our manufactures.

In order to illustrate our exports to France by a comparison with other countries, we may state they are only a trifle less than those to the United States; they are about one-twentieth larger than those to the East Indies; they are more than twice as large as those to Australia; they are four times as large as those to British America; and they are five times as large as those to China; and ten times as large as those to Portugal. As regards France, her trade with us must be of still graver importance for herself than for us—our portion representing one-third of her entire exports, and one-sixth of her entire imports.

Going a little into details, we find that the imports of eggs, which amounted to £281,999 in 1857, had risen to £974,895 in 1869—nearly a million pounds sterling of eggs, upon which M. Thiers proposes to levy an export duty. Gloves have risen from 4,000,000 pairs, and £345,988, in 1857, to 9,500,000 pairs and £1,022,766, in 1869. Wine has risen from 796,760 gallons, and £528,895 in 1857, to 4,255,483 gallons, and £1,585, 858, in 1869. Raw silk had risen from 345,665 lbs. weight, and £618,991, in 1857, to 2,109,784 lbs. weight, and £3,050,007, in 1865, but has, in consequence of Lyons having superseded London as the chief market of raw silk, decreased gradually to 950,561 lbs. in weight, and £1,448,513, in 1869. But most astounding was the rise of silk (stuffs and ribbons) from 428,600 lbs. weight, and £1,063,618, in 1857, to 3,192,494 lbs. weight, and £8,064,830 in 1869, or nearly 660 per cent. in twelve years, or 55 per cent. a year.

If such brilliant results have arisen from an exceedingly moderate reduction of duties, what effects would the complete removal of all restrictions and perfect freedom of trade have on the prosperity of both countries? Alas, M. Thiers does not think so. He describes himself "as an old Protectionist, and a Protectionist still."

EDUCATIONAL NOTES.

Equality in Education.—At the meeting of the London School Board, held on the last Wednesday in July, Professor Huxley brought up the second report of the Scheme of Education Committee, having reference to the scale of fees to be paid in the schools. One essential feature of the report was, that the fees in the "discretionary" subjects should be extra—in other words, all the subjects beyond what are termed "essential" subjects, should be charged for in extra fees, so as to be self-supporting. When at the following meeting the adoption of the report was moved by Mr. Macgregor, Mr. Lucraft moved as an amendment that all words having reference to the payment of extra fees for the higher subjects should be struck out. He said his class did not want free education, but they wanted all the subjects taught to be paid for in one payment. To demand an extra payment for teaching the poor man's child what was taught the child of the richer man would be to perpetuate those class distinctions which had existed too long, and were an evil in themselves. He did not ask that school fees should be the same in all localities, but only that they should be the same in each particular school, and he would not have two boys who were in the same school marked out for a different education because the father of one was able to pay extra fees while the father of the other could not. Sir Thomas Tilson seconded the amendment, which was also supported by Lord Sandon, M.P., and others; and when Mr. Macgregor was called upon to reply, he said his sympathies and feelings were with Mr. Lucraft. The amendment was thereupon carried, so that the weekly fees of the School Board will cover all the instruction given. It was also agreed that the fees of the schools should not be less than 1d. nor more than 9d.; that the instruction in the discretionary subjects should not interfere with the efficiency of teaching of essential subjects, and that the half-timers should pay half-fees, but not less than 1d. a week.

School Ventilation.—This subject, so important in a sanitary point of view, is referred to in some of the year's reports from Her Majesty's Inspectors of Schools, which contain several notices of unhealthy schoolrooms. Mr. Jolly, reporting on schools in Scotland, states that the instances are very numerous in which there are no means of ventilation whatever, other than by cross draughts through open windows. Frequently these are not hung. Where the windows do come down, the draught is such as to make it necessary to wear a hat. Sometimes there are what he terms "rheumatism holes" in the roof, throwing a cold air fall into one part of the room, which he avoids in crossing as he would an open trap door in the floor. Many new schools err by excess in air openings. The result of such bad provision for ventilation is that it is very commonly not used, and the air is allowed to become vitiated, stifling, and exhausting. In such cases health suffers, the work is done listlessly, and the discipline, from nervous restlessness, is either defective or too severe. Mr. Jolly maintains that roof ventilation is inferior to that produced by small openings in the side and end walls, with self-acting shutters. Mr. Routledge, who inspected Church schools in Kent, remarks that ventilation seems left to chance, and he is constantly finding it unsatisfactory, and the children kept in rebreathed air. He recommends that the windows should be open at the top, and that a few perforated bricks should be placed high up on an exterior wall or into a chimney. Mr. Parez, reporting on Church schools in the North of England, has to notice the bad ventilation of class rooms, even in schools aided by a government grant. He observes that where windows are so placed that if open the draught would be intolerable, the children will be kept without fresh air. He is of opinion that ventilation by other means than by windows ought always be secured. It is not to wondered at that schools should be defective in this respect, considering how very imperfect is the ventilation of most of our houses and many of our public buildings.

Compulsory Education.—Orders of Her Majesty in Council are published in the *Gazette* of the 1st of August, sanctioning bye-laws for the compulsory attendance of children at school, made, with the approval of the Education Department, under the 74th section of the Education Act, by the School Boards of Oxford and Birmingham.

CORRESPONDENCE.

HORSES TO INDIA.

Sir,—The following account of the trade is taken from a report of the chief inspector of live stock in New South Wales, that recently appeared in the *Sydney Morning Herald*:—

"There are five descriptions of horse that find sale in India:—

"1st. Cavalry remount.—For this purpose is wanted a compact, well-bred horse, from 14 hands 3 inches to 15 hands 2 inches. The price in the Calcutta market is about £65, and in Madras about £57.

"2nd. Artillery.—For this purpose the horses are required to be of the same height, but rather stronger, and the price is about the same.

"3rd. Gentlemen's hacks and chargers.—These are required to stand from 15 hands to 15 hands 3 inches and their prices range from £100 to £150.

"4th. Racehorses.—These fetch a fancy price, which has ranged from £300 to £600.

"5th. Carriage-pairs.—Horses of this class, from 15 to 16 hands high, have realized from £200 to £300 per pair.

"During the last ten years, the shipment to India has been at the rate of about 250 horses per annum. The average length of the voyage is about sixty days; and the cost of transhipment amounts to about £23 10s. per horse, of which about £12 10s. goes to the ship for freight, and the remainder is spent in food, wages, and miscellaneous charges. The fitting-up of a vessel in Sydney for horses generally costs about 20s. or 22s. per stall. It is necessary to take one groom for every ten horses, whose wages are at the rate of £2 per week, with a bounty of 20s. per head for each horse landed safely. The "super." also generally receives the same bounty. The speculation is a somewhat hazardous one, as, apart from the risks of the passage, horses rejected by the government buyers are at once so depreciated as to be scarcely saleable."

On reading this, the question arises, now that the opening of the Suez Canal has shortened the passage from England, and the journey to Calcutta can be made by steamer in 35 to 40 days, is it possible to supply part of the demand from this side. Cavalry and artillery remounts of the kind required are to be purchased at the fairs and other country markets, here and in Ireland, for £25 or so, probably a better bred and more enduring horse than the colonial. Any additional cost of feeding and attendance will be more than met by the reduced length of voyage; and the expense of fitting up ought not to be greater than what is mentioned as that on board ship. The only formidable item to be dealt with is freight, and if arrangements could be made with the steamboat companies to carry the horses at a rate not too unfavourable, it might prove the most advantageous to themselves, by the encouragement it would give to speculative dealers to move in the way of exportation.

In India, the stud is a heavy burden upon the financiers, and the government would doubtless welcome any well-considered scheme that might eventually enable them to put it on a reduced scale, if they did not take a more active interest in furthering the attempt. Amongst the Indian officers at home there will be many who are well acquainted with the subject; and a very instructive paper might be got up and read to the Society, could one of them be prevailed upon to undertake it.—I am, &c.,

G. B.

THE WILD BEASTS OF INDIA.—PROVINCE OF OUDH.

Sir,—A short time back, I sent to your *Journal* a description of the various kinds of wild beasts that had been destroyed in Madras during the last three years, and I now forward you a similar detail for the Province of Oudh for the last two years.

The entire extent of this province is about 23,992 square miles, all under cultivation, with the exception of about 10,745 square miles of waste land, so that its wild beasts may be said to have a *carte-blanche* to roam over about half of this territory, whose natural northern boundary is the lower range of the Nepal hills. The whole of it is one great plain, slightly undulating in places, but generally flat, with several rivers flowing through it; and much saline matter is contained in the soil of many localities. The country is studded with large jheels, and swamps abound in the Terai at the foot of the Nepal Hills. May is the warmest month, when the temperature in the shade, at 2 p.m., attains 104° Fahr., but from November to February the weather is cold, healthy, and delightful. It has a population of 11,220,232, with 285 miles of railway at present traversing it, and has a fair amount of forest land.

Wolves are very numerous, and, strange to say, very often make off with children, which they bring up with their own cubs; and, not many years back, a child which had been so stolen was recovered by some native cavalry soldiers, when proceeding to drink water at a river side with the family of the wolf who had spared his life; he fought the cavalry men very determinedly, biting them severely to prevent his re-capture, and finally passed into the possession of a lady, by whom he was treated with great kindness, but who endeavoured vainly to make him speak.

The wolves seem to maintain their position tolerably well, as the number destroyed was greater in 1870 than in 1869; and in the year just past the destruction of tigers was 150 per cent. greater, and that of hyenas only only one-fourth of what it was in 1869, so that it would appear that tigers have increased while hyenas have diminished in number; snakes are still somewhat numerous; and a considerable warfare has been waged against dogs.

The following table shows the numbers for which rewards were paid:—

DESCRIPTION.	NUMBER.		RATE OF REWARD.		AMOUNT PAID.	
	1868-69.	1869-70.	1868-69.	1869-70.	1868-69.	1869-70.
					£ s. d.	£ s. d.
Wolves	566	589	8s. to 12s.	8s. to 12s.	326 14 0	341 12 0
„ Cubs	618	659	6d. to 4s.	6d. to 4s.	62 7 0	66 3 6
Hyenas	31	7	6s.	4s. to 6s.	9 6 0	2 0 0
Dogs	2,876	3,783	3d. to 1s.	3d. to 1s.	37 1 3	47 4 0
Tigers	14	36	10s. to 20s.	10s. to 20s.	10 10 0	18 10 0
Snakes	7,960	5,625	1½d. to 1s.	1½d. to 1s.	138 3 3	196 9 11½
	12,065	10,699			584 1 6	672 9 5½

Although snakes still show a bold front, it may concluded that their number is diminishing, as although the sum of Rs. 583 6 additional was expended on their destruction in 1870 than in 1869 (indicating the payment of a higher reward for their slaughter), a smaller number were brought in.—I am, &c.,

A. Romaine Wragge, Lieut.-Colonel.

Old Charlton, 29th July, 1871.

THE POLLUTION OF RIVERS.

Sir,—The Commission appointed to make inquiries into the pollution of rivers have published the result of their investigations, but owing to these inquiries being principally restricted to pollution caused by the flow of certain refuse matters resulting from various manufacturing operations into our rivers, the report nowhere refers to their general management.

The Commission further recommends that all such refuse and sewage should undergo some process of deodorisation and disinfection, under a system of fines and penalties, previous to being discharged—that is to say, to be converted into pure water, a proceeding only worthy of the philosophers of Laputa.

The great fact is quite lost sight of, that, owing to the physical laws of nature, rivers form the natural drainage of the countries through which they flow, and that any interference with those laws will ultimately entail terrible retribution, both in purse and in health.

The free flow of our rivers is prevented by every possible obstruction, from their origin to the sea. Every inch of fall is made available for water-power, by means of weirs and sluices. Large quantities of water are drawn off for the supply of canals and irrigation, and, under the erroneous notion of diminishing the disastrous effect of sudden inundations, the waters of a river in flood are often allowed to spread over large districts. The tendency of all these operations is unduly to raise the bed of the river, so as to exasperate the evils wished to be avoided. That river can only be in a healthy state that freely flows from springhead to mouth without any artificial interruption whatever, in which case we should hear but little of the pollution of rivers, now becoming unbearable.

As a case in point, this town of Reading is situated on the river Kennet, which diverges into numerous branches and canals, running through the town, some in open channels, many under the streets and buildings, all impeded by innumerable dams and sluices, required either for water power or canal navigation. As a rule, all the dwellings on or near these channels have waterclosets, sink drains, and dust holes projecting their filth into the streams, the whole of which is slowly carried into the Thames, just below the town, and from thence to London.

There are 50 or 60 towns and villages on the Kennet and its tributaries above Reading, and perhaps as many below on the Thames, all contributing their quota of filth to the so-called pure water pumped up above London for the supply of a large portion of its inhabitants; and these same circumstances are taking place, more or less, on every river in England. But if our rivers had their natural flow without impediment, the effect of the influx of sewage would be barely perceptible, because the conferva and aquatic plants, together with organic life of every description, would entirely destroy the baneful effects of sewage in the river between town and town. Of course the poisonous deposits from wholesale manufactories must be absolutely prohibited but if the town of Reading were to be compelled to consume its own sewage, its deposition and purification would poison the country round; and it is well-known now that sewage, cannot be used for surface manure with impunity to any branch of organic life.

Inland navigation is now become a farce, when compared with the traffic of the country; and vested rights in water privileges can never be put in competition with public health.

Both these industries are now in a deplorable condition, for the dams and locks are all in a complete state of rottenness, with no funds for their renewal. The tolls upon either canals or roads never, in the best of times, paid more than bare interest, and are all now helplessly in debt.

The only mode of rectifying this mischief, and at the same time the cheapest, is for the country to buy up all such improper privileges and vested rights at any cost, and clear the rivers of all obstructions. No legitimate objections, however, can be made to pumping any quantity of water out of our rivers, provided it be done by steam-power, and not by water-wheel, which would require, of course, the objectionable dams and sluices.—I am, &c.,

Henry W. Reveley.

Reading.

MONTHLY NOTES ON SCIENCE.

For a long series of years, the subject of binocular vision, in connection with the stereoscope, has been allowed to fall into abeyance, those by whom it was at one time so cleverly discussed having either succumbed to the common lot of mortals, and "ceased from their labours," or directed their talents for investigation into other channels. How is it that, when looking with both eyes at objects in various planes, we see them solid? How is it that, when looking at a picture in the stereoscope, we see it represented in all the solidity of the natural objects? The sensation of nearness and distance is conveyed by the convergence, in varying degrees, of the optic axes. When an object is held within a few inches of the face, the point of convergence of these axes is instantly and intuitively felt to differ from that when the object is at a distance of a mile; hence, Brewster and others have laid it down as a law, that the phenomenon of binocular relief is caused in this way:—When we look at an object in nature, whether it be a man, a statue, or a landscape, the optical axes are converged in rapid succession upon the nose, the eyes, the ears, or upon objects in the foreground, the middle and the remote distances in the landscape; and the relative distances of all those points from the eye are readily perceived. At this point, the inquiry has recently been taken up by Prof. Joseph Le Conte, who asserts that we distinctly perceive depth of space, or the relative distance of objects, while gazing steadily at one point, even in those cases in which we are unassisted in our judgment by any other form of perspective. Stereoscopic relief, it is well known, is distinctly perceived by the light of an electric spark, the duration of which, according to Wheatstone, is the 1-24,000th part of a second, or by a flash of lightning, which has been estimated to last about 1-500th part of a second. It being quite out of the question that in such a short space of time the eye could wander, or even dart, from point to point of the object looked at, so as to vary the convergence of the optic axes, it is evident, according to Prof. Le Conte, that some other explanation is demanded. This he furnishes by a chain of reasoning, of which the following is a condensation:—When objects in the foreground of a stereoscopic picture are united, objects in the background are seen double, the images being homonymous; and when objects in the background are united, then objects in the foreground are seen double, the images being heteronymous; and when objects in the middle-ground are united, then are both foreground and background doubled, but in different directions. Now, in looking at a picture in the stereoscope, as the eye ranges rapidly from foreground to background, and *vice-versa*, the idea of depth or space is introduced. But even when looking at any one point in the middle-ground, without allowing the eyes to stray from it, the depth of space is still preserved as in nature under similar circumstances, and for this reason, that the eye or mind instinctively distinguishes between homonymous and heteronymous images, referring the one to a position beyond, and the other to a position on this side the point of sight. From this, therefore, is deduced what Prof. Le Conte considers the true theory of binocular relief, viz., that the eye, even when fixed steadily on one point, perceives the relative distance of objects by means of double images, as just explained; but that this perception is made much clearer by the ranging of the eyes back and forth, uniting successively the images of near and distant objects.

Has the moon really any influence on the weather? In an age so sceptical as the present, it was only to be expected that many would fall away from the faith implanted into them during their early years relative to this matter. A small contribution towards the settlement of this question has recently been made by Mr. Pliny Earle Chase, who, in consequence of a paper read before the American Philosophical Society, considers that, in the Atlantic States at least, signs of fair weather may be most confidently trusted during the ten days preceding full moon, and signs of rain during the eight days following.

In making some experiments with Liebig's extract of meat, Dr. H. Weidel has discovered a new organic base, *carnin*, present in the extract, in about the proportion of one per cent. Carnin, when pure, is a crystalline solid, insoluble in cold, but readily soluble in boiling water, and insoluble also in alcohol and ether. It has a bitter taste, a neutral re-action, and is not precipitated by neutral acetate of lead. The mode of preparing carnin is, in the meantime, a tedious and complicated process.

A new method of rendering woven fabrics waterproof, without filling up the interstices of the cloth, so as to prevent the passing off of the perspiration, has been discovered by Prof. Balard. Acetate of alumina is prepared by disolving 30 grammes of acetate of lead in half a litre of distilled water, and 24 grammes of sulphate of alumina in the same quantity of water. These solutions having been mixed and filtered, the cloth to be rendered waterproof is immersed in it for a quarter of an hour, and is then drained and dried in a current of air.

Preparations are already being made to observe, in a manner becoming the occasion, the eclipse of the sun in December next, which will be visible, as a total one, in India, Ceylon, and Australia. The Astronomer Royal is superintending the adaptation of instruments already in his possession for use in India, while the President of the Royal Society has arranged to have instruments of the newest and most approved kind sent to Australia. The Royal Society of New South Wales is organising an expedition to Cape Sidmouth, and it is expected that Ceylon will, for a time, be taken possession of by a staff of observers from England. From the experience so recently acquired in connection with the solar eclipse of last winter, it is not too much to expect that the result of the observations of the forthcoming one will be a great addition to our knowledge of solar physics.

The proposed College of Physical Science at Newcastle-on-Tyne, is rapidly approaching consolidation. Several of the professors have been appointed, and of the £35,000 required, in addition to the Durham University endowment, to carry out their plans, the larger portion has already been subscribed. The opening of the College is fixed to take place on October 7th. In connection with colleges in the north, it is worthy of being recorded that a gentleman, whose name we have not ascertained, has made an offer of £2,000 towards founding a chair of Applied Physics in Anderson's University, in Glasgow.

The practice of dry-plate photography (that is, photography practised upon sensitive plates which have been prepared and stored away, ready for exposure in the camera weeks or months afterwards), has of late made more rapid and satisfactory progress than it has for a long time past. The wet collodion process supplies, in respect of sensitiveness and quality of picture, nearly all that can be desired. It is subject, however, to the drawback of the photographer being necessitated to take with him, as travelling companions, not merely the various chemicals, baths, and other appliances for preparing, developing, and fixing his negative, but also a tent or dark room in which to perform the various operations required. Now in respect of convenience, these have proved almost restrictive to the amateur, whose desire, it may be, is confined to the securing of a few pleasant pictorial reminiscences of a tour in the country, and to whom the *impedimenta* necessary for practising the wet process would prove a serious incubus. For many years dry processes have been known and practised, and these have approved themselves as most convenient for the amateur, for the plates may be prepared at home, exposed during the tour, and developed after the return home, thus dispensing with the aid of chemicals on the journey. But such plates hitherto have been so insensitive as to require a long exposure in the camera. Among those who have recently been endeavouring to obtain the maximum of sensitiveness in these dry plates, Mr. William Blair has succeeded in bringing to perfection a process in which, to the general good qualities of the dry processes hitherto in use, is superadded a degree of sensitiveness little if at all inferior to wet collodion when practised under the most favourable circumstances. The process is as follows:—The plate is coated with collodion, sensitised, and washed in just the same way as is practised in almost every dry process in their preliminary stages. A mixture is then composed as follows:—

Gum arabic	1 ounce
Sugar candy	½ ounce
Water	4 ounces

with liquor ammonia enough to render the solution decidedly alkaline to test paper. To any required portion of this is added an equal quantity of a solution of tannin of the strength of 10 grains to the ounce of water. This mixture is poured over the surface of the washed plate, and after allowing it to remain for a minute or two, so as to permeate the film, it is rinsed off in a bath of water. When dry, the plates prepared in the above way are exceedingly sensitive to light. The image is developed by means of a three-grain solution of pyrogallic acid, rendered faintly alkaline by means of carbonate of ammonia. During the few weeks that have elapsed since this process was published, it has been tried by many photographers, many of whom have testified to its excellence.

At a meeting of the Aeronautical Society of Great Britain, held during the past month, a letter from Mr. Proctor was read, in which he expressed his opinion that the principle of the gyroscope would enter importantly in the construction of the ærial machine of the future. An ingenious American has also lately published a method by which ærial motion is proposed to be obtained by the use of large wings, moved by the muscular power of the leg acting though the agency of a kind of stirrup. The weight of the body, or much of it, is presumed to be materially lessened by means of hydrogen gas in a suitable reservoir, the wings both aiding in this, and also being used to influence the direction in which progress is to be made.

GENERAL NOTES.

Cotton Prospects in the United States.—The Department of Agriculture reports that the area of cotton under cultivation in the United States shows a decrease of 1,330,000 acres as compared with last year. The crop is below the average in every State, and is not expected to exceed 3,500,000 bales, which an unpropitious season may reduce to 3,000,000 bales.

Solvent for Indigo.—The extensive employment of indigo makes a new solvent of importance. In the first place, Venetian turpentine, heated to the point of ebullition, disolves indigo with the same blue colour as does sulphuric acid or aniline. After cooling, magnificent copper-red crystals separate. The crystals can easily be freed from the solvent by ether or alcohol. Boiling paraffin is an equally good solvent. A somewhat dilute solution of indigo in paraffin can with difficulty be distinguished from alcoholic solution of fuchsine. Petroleum dissolves indigo with carmine red solution; so also spermaceti and stearic acid, the first with carmine violet, the last with blue colour.

The American Census of 1870.—From the recent tables issued by the Census Bureau at Washington, it appears that the total population of the United States is 38,538,180, showing an increase in the last decade of 7,094,859. In relation to population, a comparison of the condition of the various sections of the country with the enumeration of 1860 furnishes some instructive facts. The New England States are about at a stand-still, New Hampshire and Maine even showing a small decrease. The Middle and Southern States are slowly increasing, while the great increment has added itself to the Western States and Territories. The following will show the totals for both enumerations:—

	1870.	1860.	Gain pr.ct.
Total of Territories,....	42,500..	259,577..	..
,, ,, States,........	38,059,680..	31,183,744..	21·1
,, ,, United States..	38,538,180..	31,433,321..	22·6

The Wine Trade at Marsala.—The exportation and manufacture of wine at Marsala was established towards the end of the last century, by the English firm of Woodhouse and Co. At the present time the three principal firms that are engaged in this trade are Messrs. Woodhouse and Co., Ingham, Whitaker, and Co., and Florio and Co., who have their principal establishments at Marsala. Many other firms are also engaged both in the making and export of wine, but only on a limited scale. The wine is generally exported in casks, called butts or pipes, a pipe containing about 88 gallons. The following shows the quantity of wine shipped at Marsala from 1866 to 1869:—

	To foreign ports. pipes.	To Italian ports. pipes.	Total quantity. pipes.
1866	13,520	5,504	19,024
1867	16,576	9,461	26,037
1868	9,371	7,956	17,327
1869	15,472	7,497	22,969
Average..	13,735	7,604	21,339

The production and exportation was divided amongst the various firms in the following manner:—

	1866. pipes.	1867. pipes.	1868. pipes.	1869. pipes.
Woodhouse & Co.	1,542 ..	2,120 ..	1,057 ..	2,035
Florio and Co. ..	3,191 ..	3,047 ..	3,487 ..	3,364
Ingham, Whitaker, and Co.	4,642 ..	5,388 ..	5,258 ..	6,069
Various other firms	9,649 ..	15,482 ..	7,525 ..	11,501

The wine exported during the above-mentioned years was principally to Malta, England, Tunis, America, Germany, and France; and to home ports, to Palermo, Licata, Girgenti, Genoa, Leghorn, Cagliari, Trapani, Messina, Naples, and Civita Vecchia. The adulteration of wines in the Sicilian factories consist chiefly in adding a certain quantity of alcohol to the natural wine. However, a considerable quantity of unadulterated wine is annually exported to Malta and Algeria, where it is mixed with other wines for common use. The greater part of the adulterated wine is shipped for England, where it finds a ready sale, under the title of sherry or port. The alcohol used is almost entirely obtained by distilling from wine, and by far the greater part is produced at the distilleries of Alcamo, the property of the firm of Ingham and also of Florio. There are also extensive distilleries at Riporto, in the province of Catania, and at Vittoria, in the province of Syracuse. This spirit, at 60° Fahr., contains in volume 80 per cent. of absolute alcohol. The alcoholic strength of the wines of the north-west coast of Sicily varies from 12° to 15° by the hydrometer of Gay-Lussac, so that the average may be taken at 13½°. With the exception of the Façon Porto and the brown Syracuse, the wines of Marsala are white. The wine called *sifone* is not exported, but is used to strengthen other wines. The brown Syracuse is almost a liqueur, and is only exported in small quantities.

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FRIDAY, AUGUST 18, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

THE LIBRARY.

The following works have been presented to the Library :—

A Compendious Grammar and Philological Handbook of the English Language, by John S. Colquhoun, Esq. Presented by the author.

Abstracts of the Reports of the Surveys and of other Geographical Operations in India for 1869-70.

Report of the British Association for the Advancement of Science. Presented by the Association.

A Set of the Publications of the Cobden Club. Presented by the Club.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

EDUCATIONAL COLLECTION.

Books, Maps, Globes, Instruments, &c.

The official report on this section is by E. P. Bartlett, Esq. The whole collection of books, which will be found in the western theatre, balcony floor, of the Royal Albert Hall, has been classified, without regard to the exhibitor or to the country from which the contribution is sent, into the following divisions, each division having generally two or more subdivisions, viz. :—English language, mathematics, technology, geography, history, Greek language, Latin language, French language, German language, Asiatic and other foreign languages, natural philosophy, natural history, dictionaries, writing, drawing, music, hygiene and physical training, mental and moral science, political economy, theology, juvenile and miscellaneous works, and educational works from Austria.

In his introduction, Mr. Bartlett says:—"For the opinions which may be expressed in this report, on defects which I shall venture to point out, in the system which prevails in some elementary, commercial, and middle-class schools, of teaching certain subjects of education, I am alone responsible. I have often thought that a great deal more might be done for the lasting good of the student if the teacher were only to make his teaching more attractive and less of drudgery to the young beginner; if the lasting advantages which result from an educated taste for reading could be put side by side with the enormous disadvantages which result from that deadly system of cramming. Want of proper training, love of money, and the desire to make a show, on the part of the teacher, are some of the roots of this evil, and in proportion as these prevail, so there will be fewer imitators of that great model teacher, the late Dr. Arnold, whose chief characteristics were a thorough earnestness and conscientiousness in educating his pupils."

In treating of the first division, the English language, the reporter, after specifying the principal contributions (for which the reader is referred to the report itself), points out what he believes to be defective in the usual method of teaching the English language. He observes: —"Judging from results, in many of our primary schools the children are taught to read and to speak their own language in much the same way as a parrot is taught to scream out a sentence, their teacher teaching in a mechanical way, as though he were either ignorant of, or did not care for, the natural instinct of his pupils. The Royal Commissioners appointed to inquire into the state of education have reported that competent teachers of our own tongue are not to be found. In our middle-class schools, public schools, and the universities (the London University excepted), evidence is not wanting of the almost total neglect of our mother-tongue. Speaking of the undergraduates fresh from the grammar schools, an examiner at Oxford is reported to have said—'An absence of ordinary facility in spelling or constructing a sentence in English is among the unhappy characteristics of the class.' For this same fault, too, the Civil Service Commissioners reject a large number of the candidates who present themselves for examination. Hitherto the great stumbling-blocks to the study of our mother-tongue have been, probably, indifference to or ignorance of its importance, and inefficient and conflicting methods of teaching, and when once these obstacles have been removed, we shall undoubtedly be in possession of one of the best and most practically useful means of mental culture and discipline."

In treating of the works on mathematics, Mr. Bartlett says:—"The observations made on the defects in the present method of teaching the English language apply almost equally to the important study of mathematics, which, more than any other, educates the powers of observation, and developes the reasoning faculties. In the teaching of arithmetic especially, not the least important of the 'three R's,' there is the same dreary infliction of 'rote' work. Long columns of figures are set to be done without any explanation of the reason why; and, in the case of beginners, without any attempt to simplify the calculations by the employment of means which are not rigidly mechanical. French authorities have reported with truth that our system of teaching arithmetic is confined to *le calcul*, and that we exclude *les principes*. Teachers are too apt to treat the subject merely as an art, and not as what it really is, an art and a science. No works are more deserving of special notice than the logically-arranged treatises of Barnard Smith. The use of such books, and the employment of good teachers, would do much to bring about more satisfactory results than are obtained under the prevailing system, which seems to overlook the chief purposes of the study as a mental discipline, and for its practical utility in after-life. The importance of a knowledge of geometry has been long felt. Over the door of Plato's academy at Athens was written, 'Let none ignorant of geometry enter here;' yet the 'Elements of Euclid' is the only text-book used in very many of the more important schools. The absence from the Exhibition of various standard editions of Euclid, and the introduction of the French and German systems, may be regarded as evidence of fresh efforts to reform the long-lived practice of teaching geometry in our schools by means of Euclid's Elements alone."

Referring to the collection exhibited by the International Decimal Association, he speaks of the inconvenience of our present system of weights and measures, and the expediency of adopting the metric system, the reasons urged in favour of it being "that it is easy to learn; that it will secure an immense saving of time in education; that it is now in use, in an obligatory, partial, or permissive manner, amongst as many as

451,000,000 persons; and that it will best pave the way for the introduction of an international coinage."

Passing to the subject of geography, the author observes:—"The fact that the study of geography is, to the majority of students, a 'dry' one, may be again attributed to defective text-books and faulty methods of teaching. Page after page of long series of names of places, &c., with scarcely a word besides to excite the attention or interest of the pupil, reduces the study of the subject to a wearisome task. In this way, that which should be the motive power, viz., interest, is lost. The practice of teaching geography by rote, as much the fault, perhaps, of parents as teachers, is probably the worst feature in the present mode of instruction. Greater efforts might be made, both by authors and teachers, not to cram the pupil with geography *per se;* but rather to combine it with history—to connect the names of places with the historical associations which make them memorable and interesting."

In speaking of atlases, Mr. Bartlett draws special attention to one sent from Austria, with the political and physical features on opposite pages, a method of arrangement which he commends to the attention of English publishers.

Referring to the larger sized maps, he states that "with the exception of Mr. Hughes's, those contributed by British exhibitors are generally conspicuous for their bright colours, and for the absence of any attempt to illustrate the earth's natural features and aspects. It is to be feared that, at the present time, the value of a map is too often estimated by the clearness with which the boundaries of counties, &c., are defined by means of distinctive colouring, and by the large number of names of towns and places which can be inserted. Owing to the encouragement which is given by English teachers to such as these, they become the most saleable, and the publisher does not, in consequence, care to entertain any proposal for improvement, by making them, more strictly speaking, physical maps."

Touching upon the historical works exhibited, the reporter says:—"Unlike the study of geography, the student has instinctively a desire to become acquainted with history; but this natural taste may be easily vitiated by an injudicious manner of teaching. There are chronological facts which must be systematically learnt; if these be introduced too early, and with a view to cramming the pupil, the study becomes wearisome, and both time and knowledge are lost. The late Dr. Arnold, in speaking of the best way to obtain a real knowledge of history, and after acknowledging his obligations to Mrs. Trimmer's illustrated histories, said, 'Let the boy gain, if possible, a strong appetite for knowledge to begin with; it is a later part of education which should enable him to pursue it sensibly, and to make it, when obtained, wisdom.'"

The collection of classical works is described as in every respect satisfactory. As to the relative value of a classical education, Mr. Bartlett observes:—"It is a prevailing opinion now-a-days that a knowledge of Latin and Greek is of little or no use. This opinion gains favour from the fact that the results of instruction in these subjects are so small, that the study interferes with others more useful, and because it is said to be of so little practical value in after-life. Whatever of truth there may be in the first two of these objections, the latter statement is undoubtedly false. It has been admitted by the highest authorities that a study of the history of Greece and Rome is of the utmost value; that it is one of the most powerful aids to mental discipline and mental culture, as well as to a complete knowledge of our own language. If we expel Latin and Greek from our schools, we at the same time expel the many and great advantages which are to be gained by a knowledge of the past; we lop off so many centuries of the world's experience, and limit our studies and knowledge to little else than the present."

In the division of modern languages, it appears that grammars, exercises, and reading-books are well represented.

Passing to the subject of natural philosophy, the reporter takes the opportunity of referring to the work done by the Science and Art Department, as showing the progress made in the study of science in this country:—"Ten years ago, there were 1,330 persons receiving instruction in science in 82 classes examined by that Department. In 1870, the number of classes had risen to 2,204, and the number of students to upwards of 34,000. It is difficult to understand how it is that the wondrous applications to human interests of scientific inventions should have remained so long undiscovered, and that the evils of excluding natural science from our regular system of education should not have been earlier felt. For practical utility in after-life, few, if any, subjects of study can be more important than that of the natural sciences, and yet, until recently, it has been one of the most neglected."

There appears to have been great progress also in the study of Art:—"As in science the growing importance of instruction in drawing may be best estimated by the statistics which are annually published by the Science and Art Department. These show a very large increase within the last few years, in the number of schools, classes, and students examined. As a significant fact, I may mention that in the last three years, ending with the examinations held in 1870, there has been a total increase of 1,146 schools, 76,412 candidates examined, and 160,167 worked exercises."

In conclusion, Mr. Bartlett refers to the "valuable and complete permanent collection of educational works and appliances which is contained in the South Kensington Museum. There, the educational library, as it is called, possesses nearly 30,000 publications, including those most recently issued from the press. Besides these, there are about 8,000 educational appliances, in the form of school fittings, philosophical apparatus, and diagrams illustrative of the various branches of knowledge which constitute a sound education. The number of readers in this library increases year after year, with a growth (now at the rate of about 2,000 annually) that proves the popularity and value of a complete and systematically arranged collection of educational works."

CENTRAL NATIONAL ART-TRAINING SCHOOL FOR TEACHERS.

The Central National Art-Training School for Teachers at South Kensington has closed for the summer vacation. The following are some of the results of the instruction given in the annual report of the Science and Art Department, just laid before Parliament:—40 students in training and 19 national scholars have received allowances of from 10s. to 40s. a-week; six students in training have been appointed to masterships of schools of art. As a normal school, the number of students of all classes who paid fees during the year ending 31st July, 1870, was 565 males and 429 females; total, 994. The amount of fees was £2,623 14s. Of this sum, £442 12s. was paid by evening students, and the balance, £2,181 2s., by day students. The fees have increased over those of the preceding year £38 18s. The number of individual students has increased from 895 to 994. In this number are included 114 artisans, 14 schoolmasters, and 17 schoolmistresses. The schools were open 205 days during the year, and the smallest attendance recorded was 171, on the opening day; the largest, 460, on February 4th, 1870. The total number of attendances recorded for the whole year was 60,959, and the average daily attendance 297.

The results of the annual examination, in 1870, were as follows:—Of certificates of the 3rd, or highest grade, 13 were taken, seven first, or elementary, being taken by students not then in receipt of allowances.

At the national competition, three gold medals, two silver medals, six bronze medals, six books, or Queen's prizes, and thirteen third-grade prizes in the elementary stages or local prize section, were won by students of the male school; four silver medals, four bronze medals, six books, or Queen's prizes, and 28 third-grade prizes in the elementary stages, or local prize section, were won by students of the female school. These results have been exceeded during the year just completed, so far as the number under instruction is concerned, while the fees paid have increased from £2,623 to £2 821.

The schools will re-open on the 2nd of October next, when all new candidates for admission will be required to pass, or to have passed, an examination in freehand drawing.

ON THE INFLUENCE OF A COVERING OF SNOW ON CLIMATE.

In a communication to the *American Journal of Science and Art*, M. A. Wojeikof, Member of the Imperial Russian Geographical Society, says:—

The influence of a layer of snow, resting on the earth's surface in the colder portions of the earth during winter, has, to my knowledge, never been considered in its general bearings on the climate and the conditions of the population living in these countries.

The first and most apparent influence of snow is the protection it affords to our crops from the cold of winter. Where the snow-mantle appears regularly, winter crops are always sure, be the cold ever so intense. In the steppes of south and east Russia, where little snow falls in winter, and this small quantity is often blown away by the strong winds, winter crops are scarcely attempted at all. On the northern coasts of the Black Sea, summer wheat and Indian corn are very good, but winter wheat is a precarious crop, while to the north, in Podolia, it is the principal crop. There the forests afford a protection against the wind, the snow falls more copiously, and cannot be blown away.

As a bad conductor of heat, the snow isolates the warmer soil from the cold air above, and there is no doubt that it renders also the winter cold more intense, as the air cannot receive heat from below. In countries where the snow-covering is not permanent, as Western Europe, this influence of snow is well known, and people expect great cold where a layer of snow has fallen and the sky clears. In countries where snow usually lies the whole winter, as Russia and the northern parts of America, this is not generally understood, and in Russia people say it is colder without snow than with it. This feeling is quite natural. The first frosts of autumn are more severely felt, because the human body is not accustomed to them, and also because the air is drier than with snow, and a cold, dry wind is more severely felt than a cold, moist one.

The great relative humidity of the air is a most important feature of the countries covered with snow in the winter. It is as easy to account for it as for the humidity of an island in the middle of the ocean, or of a place situated in an extensive swamp-tract. The wind may come from every side; it has always to pass over a large evaporating surface, and absorbs moisture if it was originally dry. In countries where cold strong winds predominate, as in the greater part of North America and Eastern Asia, this will be less the case, as the winds, rapidly passing over the land, have not the time for absorbing much moisture, and the dryness of the air in the United States is felt by Europeans going there. But in countries situated like Europe and Western Asia, where the cold winds are usually weak, and only the warm southerly winds strong, the air will be always nearly saturated, when the soil has a snow-covering, as the cold winds, in their slow progress, have the time for absorbing moisture. This feature of climate is extremely important in the examination of storms. It was one of the chief merits of Espy to have pointed out the importance of vapour in the origin and progress of storms, and this is now generally admitted. If a storm is signalised, and the beginning of its path stated, it is important to know the quantity of vapour disseminated in the countries where it is likely to pass, and the quantity which may be expected to be condensed as rain and snow. Now, the lower the temperature falls, the more uncertain are observations of the psychrometer, and I am of the opinion that it is not a sure guide below the freezing-point. This stated, it is very important to have some general idea as to the quantity of vapour over the cold spaces of the earth's surface. Now, in countries situated like Europe, relative humidity will scarcely fall below 75—80° so long as the earth is covered with snow, so that the quantity of vapour in the air of these regions may be very nearly known if we know the temperature. In an examination of the barometric range in European Russia and Siberia, some time ago, I have stated that not only the pressure of the air rises in winter as we advance from the western coast of Europe into the interior of the continent, but the barometric minima rise even more, so that, for example, in Nertschinsk, in Eastern Siberia, the middle barometric minima of January, reduced to the sea-level, are 30·23 inches, and the lowest pressure happening in seventeen years, in this month, was equal to 29·93. If we consider that at this place the temperature never rises above 14° F. in January, the effect of cold and small quantity of vapour in the air in arresting the progress of storms in winter will be clearly seen. In European Russia, the barometric minima are lower in winter than in the other seasons. This shows that the storms of the Atlantic take their course over our country. Speaking generally, the path of storms is from N.W. to S.E. in winter, because they cannot advance in an eastward direction as they began, being arrested by the cold. The colder the temperature is, the sooner the storms must turn to the southward, and this will be much more the case in January than in November and March, when the storms of Europe sometimes advance into the interior of Siberia.

Another feature of the snow is that of arresting the progress of temperature above the freezing-point so long as it lies. In rising above, the heat is employed in melting the snow, or, in the language of the mechanical theory of heat, it is transformed into work. We have some striking facts of this kind in Russia. For example, Barnaul, in Western Siberia, has a winter temperature lower than St. Petersburg, by nearly 18° F., yet the thermometer sometimes rises as high as in this last place in winter, because Barnaul has the Kirghi-steppes to the south-west. As they are seldom covered with snow, warm winds can pass across them and without losing their heat, while, before arriving at St. Petersburg, they must lose much of their heat in melting the snow over an extensive track. The result is, that seldom a winter month passes without temperatures above freezing-point, but in January and February the thermometer does not rise above 39°, while at Barnaul a temperature of 42° may occur at that time (for example, on the 4th, 5th, and 6th February, 1855).

I have mentioned already the effect of the snow in checking the rise of temperature, and employing more abundant heat in melting. This is most felt in spring, and lowers much the temperature of this time of the year, as, for example, while in Central Europe, at some distance from the sea, April has nearly the same temperature as October, in the same latitude in Russia the warmth of the sun's rays cannot raise the temperature of the air so much, and April is generally 4° F. colder than October, while May has the same temperature as September. As soon as the snow is melted, our climate assumes its true continental character. In more northern parts of Russia, it is May which stands behind September; as, for example, at Archangel, Berezoe, and even Yakutsk, in one of the most continental climates of our planet, in this last place May is more than 3° colder than September, while March is 13½° warmer than November.

I must now state a last point, the influence of forests in equalising the layer of snow, and giving to it all its beneficial effects. Without the forests, a great mass of snow is often a check to all communication, as, for example, at this moment in South Russia, where most of the railways are stopped. The unusually great mass of snow is blown in all directions by the wind, unimpeded by trees, as some of these places were always steppes, in others man was too short-sighted to let the trees stand. The effect of the melting of snow on the rising of rivers will be quite different in a wooded and a bare country. In the first, the snow will lie sometimes a month longer than the last, and accordingly the floods of the rivers will be longer continued but less high and devastating. Everyone who has inhabited the country will be struck by this fact, and its bearing on the climate and the well-being of the population all round. Generally speaking, as I have stated, the effects of a layer of snow are beneficent to man. The proportion of the crops is of enormous economical worth. The greater moisture of the air is also good; and even the cold of spring, caused by the melting of snow, has its good side. The too rapid advance of vegetation in early spring is checked by it, and protracted to a time when the vegetables have less to fear from night frosts. Northern Europe, for example, suffers much less from this curse than the south, where the returns of cold in spring cause great damage every year. Only two serious effects are sometimes felt, the interruption of communication in snow storms and the great floods of spring. But both of these drawbacks can be avoided by the foresight of man, as forests arrest the progress of winds and cause a slow melting in spring, so as to store a great quantity of water to supply our rivers.

COCHINEAL REARING IN THE CANARIES.

Amongst the commercial reports received at the Foreign Office, and published at brief intervals, is an elaborate treatise by Mr. Consul Grattan, on the method of rearing cochineal in the Canary Islands. The cactus plant, upon which the insect thrives, is described as being so hardy that it grows luxuriantly in volcanic countries, where pumice-stone and black scoria abounds, and upon rocky spots, where the soil is scarcely enough to fill the crevices. In a wild state the plant brings forth abundance of fruit, and it formerly supplied one of the principal articles of food to the inhabitants of the island. The fruit is found to debilitate the plant when used for the purpose of rearing cochineal; it is, therefore, carefully removed as fast as it buds. By the end of May or June, the plantation is ready to receive the insect, at which time four or five branches may be seen springing from each trunk, with a good supply of dark green leaves denuded of the fleshy spines and prickles.

The growers on the south side of the island of Teneriffe cultivate the cochineal in the winter, so as to bring it to maturity in time for the great crop, which is planted from the latter end of May to the end of July or August, the insects being carried to the north of the island in boxes supplied with trays, in which they are laid to the depth of two inches. Each box is constructed to hold about 40lbs., and is carried on a man's shoulders over the mountain during the night, so as to be as little exposed to the heat of the sun as possible. In Grand Canary, the most extensive planters reserve a portion of their land for the production of "madres:" the state of the weather during their growth, and the temperature during spawning, has so great an effect upon the amount of seedlings produced, that it is impossible to fix the quantity per acre. About a table-spoonful of the "madres" are put into small bags of a gauze material, about eight or nine inches long, and shaped somewhat like a sausage, and then hung over a leaf in the cochineal plantation. The young, as they are born, walk out of the bag into the cactus, and spread over the surface of the leaf. The quantity of insects spawned in a given time will vary according to the heat of the weather and the age of the "madres." If the insect is allowed to spawn too freely on each leaf, the crop will be deficient in quality. The obtaining of a fair average number of insects on each leaf is therefore one of the most important points to be looked at in the cultivation of cochineal, and one which requires experience and constant supervision on the part of the grower. There are other ways of conveying the spawn to the leaves, but the mode described is most generally adopted.

The cochineal planted in June and July being the great crop of the year, prepared principally for drying at once into silver cochineal, should be gathered before it begins to spawn. Thus, during August and September, the grower watches for the first symptoms of spawning, and as soon as they appear not a moment is lost in proceeding to immediate gathering, for the weather being then quite as warm and bright as in June, the same rapidity in ripening is observable, and the loss of weight is serious if the spawning is allowed to proceed for even a few hours. The proper manner for gathering varies according to the object to which the plants are devoted; but, as a general rule, the leaves on which the bags are placed are sharply cut off with a knife, close to the branches, and the cochineal is swept off them into broad baskets, closely woven to prevent loss. After the leaves are all cut off and swept, they are dropped into ridges, where they are left. Another set of gatherers carefully scrape off the insects which have passed into the branches or trunk of the plant. Leaving even one or two insects in these branches is injurious to the health of the plant, as they spawn and absorb the strength of the branches, and this is fatal to the future crop. The leaves which have been cut off at the gathering of the crop should now be chopped up into small pieces and dug into the ground, as they serve to lighten it, and by their fermentation they warm the roots of the plant, and act as excellent manure.

As the cochineal is collected, care should be taken that the baskets do not remain long filled, the insects that lie at the bottom being injured by the weight. The person in charge should immediately empty the baskets on removing them from the plantation, and spread out the cochineal on trays, or even on a sheet on the ground, not deeper than from two to three inches, otherwise the grain will assume a reddish tinge, which considerably diminishes its value. The cochineal gathered during the day is collected in this way, and towards evening it is put into an oven heated at about 150° Fahrenheit; there it is left for four or five hours, the temperature being carefully kept up; afterwards the oven is allowed to cool gradually until the morning, when it will be found that the insects are still moist. Exposure to the sun for a few days in summer will complete the drying; and it is found that there is less loss of weight when the cochineal is dried in this manner than would occur if subjected to greater heat, or if left a longer time in the oven, in order to dry it at once. Some growers do not use the oven. A table-spoonful of wood-ashes is spread over a pound or two of cochineal—it kills it in a couple of hours; the dust or ashes are then shaken off from the grain in a sieve, and the cochineal is dried in the sun. Others prepare the cochineal by putting it into sacks in moderate quantities; two men grasp the sacks at each end, and shake the grain briskly backwards and forwards. This process gives the cochineal a brilliant polish, and though less weight is finally obtained from a given quantity of green cochineal, the price it commands in the London market compensates for the loss of weight. But the best processes are known only to a few, who keep the secret jealously; the oven is, therefore, still almost universally used for drying.

After the grain is thoroughly dried, it is well sifted, in order to free it from a white powder which to the last clings to it. Numbers of prickles which have fallen from the leaves have also to be removed. Excellent machines have been invented for this purpose, both in England and America. The cochineal being thus dried and cleaned. it is packed for exportation into bags containing about 150lbs. each, which are carefully sewn up. This is done by the trader, who buys it of the cultivator, the latter rarely exporting the grain on his own account. The results obtained by different growers of cochineal vary so much, in consequence of the peculiar circumstances to which the crops are exposed in different localities, that it is impossible to fix upon the actual value of an average yield per acre, but it is universally admitted by the landowners in the Canary Islands that no other branch of agriculture is as remunerative. The management of the insect gives employment to a large number of women, and it can almost exclusively be conducted by them. The larger proprietors employ most of their hands during the whole year, so as to command a full number when the labour of the season comes on. The successful culture of the cochineal requires experience and patient attention on the part of the grower; he will receive his reward by obtaining a return of from 25 to 30 per cent. upon the capital employed.

THE MINERAL SPRINGS OF ST. MICHAEL'S.

Amongst the advantages enjoyed by the island of St. Michael's is the possession of hot mineral springs, which are found in the valley of the Furnas, at the east of the island. The probability that more regular means of communication, by steamers, may soon make this spot far easier of access from Great Britain, has induced Mr. Consul Monson, in his report upon the Azores, to make mention, at some considerable length, of a natural sanitarium of undoubted efficacy, the remote position of which has hitherto been an almost insuperable obstacle to its proper development. The waters of two of the springs (described the one as a hot saline and the other a cold chalybeate, were analysed some thirty years ago, by Professor Graham, of University College, London. This analysis was necessarily subject to the disadvantage of being made with water some time bottled, and cannot be regarded as so satisfactory as it would have been if made on the spot. The result showed that the quantity of silex held in solution by the water of this "Caldeira" is considerably greater than that found in any of the thermal springs of Germany, but is less than in the geysers of Iceland. The large quantity is owing to the very high temperature of the water giving it a greater solvent power, and also to its alkaline nature, which makes the silex more soluble. The analysis of the *aqua ayeda* gave from one pint of water twenty-seven cubic inches of carbonic acid gas, and nearly two grains of saline matter. This latter consisted principally of chloride of sodium, carbonate and sulphate of soda, and a salt of potash, with a trace of silica, and carbonates of lime and iron. It contained nearly eight-tenths of its bulk of carbonic acid gas. But besides these two springs, there are at least three others, the waters of which are employed for baths; one, the "Quenturus," a hot carbonated chalybeate water, situated about a quarter of a mile from the Caldeira Grande, issues from the earth at a temperature of about 145°. The water is strongly impregnated with carbonic acid gas, and deposits a bright red oxide.

During the past year, mentioned in Mr. Monson's report, we learn that the local authorities decided upon the creation of a regular medical directorship over the establishment of the baths, and a young Portuguese physician of considerable intelligence was appointed to the post of director. It was likewise their intention to invite a distinguished analytical chemist to visit the Furnas, in order that a complete and careful analysis of the waters might be made on the spot. Circumstances have prevented this intention from being yet carried into effect, but it is confidently stated that the proposed analysis will be made this summer. It is most desirable that this step should no longer be delayed, because the only analysis made on the spot, to the record of which the medical men in the island pay attention, dates as far back as 1826, and was the work of Dr. Luiz Mouzinho. The situation of the valley of the Furnas renders it somewhat difficult of access. It is evidently the crater of a vast extinct volcano, and the sides of this crater are so precipitous, and composed of such friable material, that the carriage road is invariably partially destroyed, or at least rendered impassable by every winter's rains. This road traverses the north of the island, the mountainous nature of the south having hitherto prevented the construction of a more direct route from Ponta Delgada and Villa Franca. A road might, however, easily be made from the baths to a small fishing village on the south coast, from which it is proposed to run a small screw steamer along the coast during the summer months, and thus give to the inhabitants of the towns greater facilities for visiting the baths than they at present enjoy. A large tract of land in the neighbourhood has recently been purchased by an English medical man, resident in London, and there are some hopes that this purchase may eventually be utilised as a sanitarium.

The foreigners who, from time to time, find their way thither are amazed at the extent to which insular apathy and ignorance are allowed to check the introduction of the most ordinary improvements; and the stranger who finds himself domiciled in the miserable huts which are let on high terms as lodgings during the bathing season, can only conclude that the spread of civilisation, tardy enough throughout the rest of the island, has been absolutely arrested by the lofty mountains which surround the Furnas, and which enclose a valley intended by nature to be an earthly paradise, but in which, owing to the prejudices and want of energy of the inhabitants, none of the comforts, and few of the decencies, of civilised life are to be found. It is, indeed, hard to understand how it happens that the rich proprietors, of which there are very many resident in St. Michael, are so incapable of profiting by the great natural advantages which they have at their command in these thermal springs. The reason appears, however, from the condition of the upper classes of the Azorians, who are described as generally very much wanting both in energy and in the desire to encourage progress. Travelling infrequently, and isolated by their position in the mid-Atlantic, they know but little, and perhaps care but little to know, of the advances of civilisation on the continents of Europe and America. The strain of Moorish blood which yet lingers in their veins, tinges their habits and customs with a quasi-Oriental exclusiveness, surprising and even ridiculous to strangers, who find it hard to enter into the exaggerated notions entertained by them of their own importance and intelligence; whilst for the agricultural classes increased facilities for education, and especially the establishment of primary schools in the various villages, appear to afford the only prospect of raising their moral tone. At present they are lamentably ignorant, a peasant of either sex able even to read being rarely to be met with, while the knowledge of the art of writing renders the rustic who possesses it a social phenomenon.

THE COAL FIELDS OF NEW SOUTH WALES.

In the *Newcastle* (New South Wales) *Chronicle*, of May 16, appears an elaborate report by Mr. William Keene, F.G.S., as to the state of the coal-fields of New South Wales. At a time when the question of the coal supply is engaging considerable attention, and the report of the Royal Commissioners is looked forward to, a few facts and figures from this distant land of fuel may not be devoid of interest. The first colliery in the catalogue is the A. A. Company's, Newcastle. Here the depth of working shaft from the surface to the bottom of the working seam is 186 feet 6 inches. The whole seam is worked, and is all of one quality. The bord and wall method of working is exclusively adopted, *i.e.*, bords, or working spaces, are turned off four yards wide, and when four yards from the heading, are laid out to eight yards wide, the length of pillar varying from fifty to sixty yards. Headings are six feet wide. There are thirty horses and ponies employed underground at present, but an underground engine of 25-horse power is now ready for work, hauling the coal from the dip workings, which will replace a number of the horses. There are 400 men and boys employed on the surface and underground at this pit; and between January 1 and November 22, 1870, there has been raised a total of 168,483 tons of coal, of which 35,108 tons was small coal, and 230 tons consumed at the works. The average get of best coals per week is about 3,000 tons. The next is Waratah Company's Colliery. The seam is approached by two tunnels, but only one is worked at present. The seam is of one quality throughout of good coal. The usual bord and wall system of working is adopted, the two lowest portions of the seam being worked first, and then the 2ft. 6in. of top coal brought back. Fourteen horses are employed underground; no engine power. There are 144 men and boys employed, and raise at present about 150 tons per day of best coal. We then find the familiar name of Lambton Colliery; depth of working shaft, 35ft. 6in.; 9ft. diameter. The depth of the ventilating shaft is 112ft.; diameter 7ft. The depth of the south pit is nearly 400 feet, and at the bottom of this shaft there is at present erecting the largest ventilating furnace in the colony, having a fire surface of 200 feet area. The coal is worked on the pillar and wall principle, the bords being eight yards wide, pillars varying from three to fifteen yards. The total number of men and boys employed varies from 270 to 280; of these 230 are miners. Miners can earn on a fair average about 12s. each per day. The coal sells at the highest rates, and, with other coals from New South Wales, was tested by the English Government, at the Woolwich yards, and found to be equal to good English coal. The average daily production of sound coal is 650 tons. In New Lambton Colliery the seam furnishes 8 feet 1 inch of good coal, of one quality throughout, and is the same as that worked by the Lambton and Waratah Companies. The method of working adopted here is the usual bord and wall system of the district. There are 21 horses employed underground; there is also a 12-horse power engine underground, for hauling coal from the dip workings to a station near the working pit. There is one 25 horse-power engine at the surface, for winding coal and pumping water from the working shaft. Direction of the dip of the seam is south to east two degrees. There are 315 men and boys employed underground, and above ground 38; in all 353. The pit is raising on the average 350 tons per day of best coal. Here, too, as on Tyneside we find a Wallsend Colliery. The depth of the pit from the surface to the bottom of the seam in this colliery is 265ft. 9in. The seam is eight feet thick, and the whole of the seam is worked, and the coal is of one quality throughout. The method of working is the usual bord and wall system of the district, *i.e.*, bords eight yards wide driven on the face of the coal for 50 yards, then brought into six yards wide, and holed over on each side at right angles (or heading course) for 6 yards. Pillars are also taken out. There are 330 men and boys employed underground at the B and C pits, and 75 on the surface; total 405. The pits together raise 800 tons of best coal per day. The co-operative principle has apparently been applied to mining operations in New South Wales, there being a colliery of this nature under the title of Messrs. Laidley, Ireland, and Co. A tunnel is used here for bringing the coal to the surface. The whole of the coal in the seam is worked, and is of good quality throughout. A new shaft has been lately sunk for a pumping and furnace shaft, about 800 yards from the mouth of the present tunnel. The usual method of the district is adopted here in working, viz., bord and wall, *i.e.*, bords are driven eight yards wide for 50 yards, walls 6 feet wide, pillars left four yards wide, but afterwards taken out. The next colliery is the Red Head Tunnel, Burwood, in which only 5 feet 3 inches of the seam is worked at present, and is all of one quality. The pillar and wall method is adopted here, similar to that of the Australian Agricultural Company. There are 51 men employed both underground and surface, and are raising on an average 80 tons per day. At Woodford Colliery the depth of the working pit is 103 feet 6 inches from the surface to the floor of the seam, and the seam yields 5 feet 11 inches of good coal. The bord and wall system of working is generally adopted. The coal has not yet found a market, as the colliery only resumed operations in August last. Samples of the coal have been sent to the Sydney and Melbourne Gasworks and to the New England steamer, and their reports of the quality of the coal are favourable. There then follow several minor collieries in which the daily average extractions range from 10 to 30 tons. Mr. Keene also states that the progress of the railway towards Bathurst has given great activity to the opening of the main coal seam in the Western District, which extends over a large area, and is about 10 feet in thickness, the coal being of good quality. The principal trial drifts are at Bowenfells and Lithgow Valley; and when the railway shall be completed to Bathurst there will be a considerable demand for this coal. Mr. Brown, Mr. Andrew Brown, Messrs. Saywell and Garsad, Messrs. Mackenzie, Messrs. Wooley, Anderson, and Poole, are all actively engaged in efforts to develop the coal resources of the district. There is thus abundant evidence that the coal field of New South Wales is an extensive and fruitful one; and from the concluding words of the report—"other mines as they may be opened will be reported"—it may be inferred that the resources admit of yet much greater development.

WINE GROWING IN THE CHARENTE.

The department of Charente, which borders on the Gironde, has hitherto been almost exclusively devoted to the production of brandies, the wine for which the latter is celebrated being exported in very trifling quantities. Mr. Consul Vereker, in his report upon the trade of Tounay, Charente, makes some useful suggestions respecting the advantages that might arise were greater attention given than at present to the manufacture of wine. He directs notice to the augmentation in the exports of wine, the quantity being seven times greater in 1869 than in 1868; this rapid increase, it may be hoped, was an indication of a coming regular trade in that article. The published figures of the last five years demonstrate that the foreign exports of wine have been, up to the present, unimportant and irregular, insignificant even as compared with the export of brandies; but the very extent of the latter trade proves that the capabilities of this district for the production of wine are enormous. Besides, in addition to the quantities required for distillation, the wine of local production forms the main beverage of the mass of the population; foreign wines, beer, and even the *ordinaire* clarets of the districts from the Gironde to the Herault, being, in fact, luxuries of the upper classes.

Mr. Vereker propounds the question, whether an important trade, in which England would be the principal customer, might not be established with mutual advantage by exporting wines, the produce of this district, and he answers in the affirmative, for the following reasons:—The wines of this district usually contain more strength and body than the French wines exported to England from Bordeaux, as is shown by the alcohol and brandy the former more largely produce; they thus seem to offer a less abrupt change from the beverages in use among the people of Great Britain than the light French wines now introduced. That the wine of this district, when pure, is a wholesome beverage, may be assumed in view of the rude health of the country population, who, nevertheless, often live under unfavourable conditions as to other aliment, drainage, &c. Some special localities are even celebrated for the longevity of their inhabitants. It is also quite possible that the remarkable absence of crime from this district, and the fact that it is, indeed, rare to find here any Frenchman who has drank to excess, may be attributed to the circumstance that the ordinary drink of the people is the pure wine of the country, as they rarely take brandy in any manner. For establishing a trade such as is here roughly glanced at, conditions, preliminary but easy of fulfilment, are required, both of the British merchant and the French producer. It is notorious that, in localities not so favourably circumstanced as the two Charentes, a large trade has been created, and celebrity obtained for the wines produced, especially by attention in choosing vines, and in the subsequent preparation of the wine. Beaugency on the Loire, where both soil and climate are inferior, and the cultivation of vineyards more expensive, and Macon, which lies in about the same latitude as La Rochelle, may be mentioned as cases in point. Even in Charente-Inferieure, the Medis white wine, being carefully prepared, has obtained some reputation.

The question then proposed by Mr. Vereker is, whether commercially it would be more profitable to export hence wine, as such, or as converted into brandy. An answer to this he thinks may be found in the proceedings of the producers in the past year; for when, in consequence of the unexpectedly favourable vintage, the prices of brandies fell considerably, many farmers determined not to convert their wine, and they are stated to have gained more by selling their wine, as such, than they would have done had it been made into brandy. The tendency to this result increases with the augmenting prices of wine, and would be intensified were a demand for exportation added to the present demand for local consumption. The moral aspects of this question are also worthy of consideration.

EDUCATIONAL NOTES.

Examination of Teachers.—Sir Francis Sandford, in answer to a question from the London School Board regarding the examination of teachers, says:—"So far as my Lords can judge from the number of candidates for certificates whose names have been sent in to this department, it does not seem likely that any additional places of examination will be required at Christmas next. If it should appear, however, on the 1st of October, the last day on which names are received, that any extra provision requires to be made this year for the convenience of teachers in the district of the School Board for London, the necessary arrangements will be made. The appointment of an additional time of examination next year must, in like manner, depend upon the number of candidates applying for examination. The holding of a second general examination would involve so much departmental inconvenience that the cost of it cannot be incurred except upon a clearly proved necessity. Assistant teachers are admitted to examination, under Article 47 of the New Code, on the same terms as principal teachers; but no grant is made to the schools in which they are engaged unless the principal teachers are certificated."

The London School Board and Ragged Schools.—In the House of Lords on the 14th inst., the Earl of Shaftesbury asked the Lord Privy Seal at what time it was probable that any schools to be erected by the London School Board would be ready for the reception of children. His reason for making this inquiry was that these schools would gradually, if not immediately, displace the various ragged schools which, supported by voluntary contributions, had hitherto been carried on for the benefit of the poorest class of the population, and that until the new schools were ready, a large number of ragged children would be turned upon the streets, as they were before ragged schools were established. He had all along foreseen that the contributors to the latter, very poor persons, would not be prepared to pay the school rate as well as their voluntary contributions; and in a great many instances—the School Board having already begun to levy the rate—this had happened, so that in a short time several hundred children in the metropolis would be turned into the streets. With regard to the persons employed by the Board to pick up children who ought to be at school, the movement was intrinsically a very good one, but a great deal of discrimination ought to be exercised, for if every lad found in the streets were to be taken before a magistrate, sent to an industrial school, and maintained at the public expense, large numbers of the people would be pauperised. Lord Halifax agreed that great discrimination was necessary, for it would be monstrous to saddle upon tho public, children whose parents were able to maintain them. He could give no precise information as to the time when the new schools would be ready.

School Drill in Australia.—The Melbourne correspondent of the *Times* says:—"We are here recognising the necessity of national arming by training the school children to the use of the rifle and concerted movement. An edict has gone forth for the drilling of the national school boys wherever such drilling is possible, and most of the large private schools have corps of their own. Thus the boys, when they pass from the playground to the business of life, will carry with them an aptitude for self-defence, and will need only a very little concession of time throughout each year to keep up their military facility. It is scarcely right to term adult drill here Volunteering, since five years' attention to the drill officers' commands —and these consist of moonlight and half-holyday musters—yield the pleasant reward of 20 acres of land wherever land is open for selection. This is an easy way for a young man to become a landed proprietor, in addition to his other acquirements."

CORRESPONDENCE.

LAWS OF ORNAMENTATION.

Sir,—Several of your correspondents have suggested that canons of taste should be laid down for the guidance of ornamentists and their appreciators, but at present the bold task is unaccomplished. I say unaccomplished rather than unattempted, because many theorists have insisted upon certain laws, which have received only a brief or limited acceptance. Also, your correspondent, whose letter appeared in the *Journal* of 7th July, expressed his disappointment that the lengthened discussion which has appeared in the pages of the *Journal* has not brought out some practical principles, to guide us to true and elevated thought on the subject of ornament.

It appears to me that, instead of the establishment of a set of universal canons of taste, we must look only for so many "schools," where opposing dogmatists may each be practising the art truly in his limited way, even while each is denouncing his brother as a false teacher. I adhere to my opinion, previously expressed, that the components of truthful ornamentation are, humanly speaking, infinite; suggested by the intuitive power or genius of the designer, which cannot be shackled by a set of rules and limitations other than those suggested by common sense; for no limit can be conceived to the variety and scope of the expression of beautiful forms and combinations. The capacity of the sense of beauty to receive pleasure is just as unlimited as are the beautiful objects and combinations of nature, the ever-increasing offspring of heaven and earth, and the infinite conceptions of mind. Nature scatters upon the fields and along the hedge-banks her thousands of bits of colour and form in wild disarray, yet the earth is truly ornamented thereby; and, as to fitness, this ornamentation is as appropriate to the dancing feet on the merry meadow as to the step of the mourner on the sward of the solemn cemetery. To depict upon the walls of a cemetery chapel groups of carousing bacchanalians and dancing goats would be a pictorial offence to the mourner, and obvious to common sense would be the unfitness of the decoration. When pictorial aids are introduced in decoration, they should be of a character sympathetic with the purposes of the place or object decorated, or at least they should not outrage the sentiment connected therewith. It is also within the province of common sense to decide that there are some positions where such pictures would be misplaced altogether, as, for instance, in a carpet, as hinted by Mr. Newton in his conception of the pond-and-water-lily carpet and tiger hearth-rug. There is no mysterious discernment necessary to avoid or detect absurdities of this kind; common sense will do it. But most ornamental art is neutral in this respect; it produces a pleasant sensation, not a sentiment; and we shall fail in endeavouring to find an exclusive fitness in this or that style of ornamentation to this or that object, if ornamentation be proper there at all. Especially will this neutrality, or generality of fitness, be found to belong to strictly invented or ideal forms of ornamental art.

I will now beg leave to allude respectfully to the opinion of your correspondent referred to above, that "order, precision, and definiteness are the weakest points of ornament. The stars would not be half so beautiful or interesting set in order, in rows of lines and squares." He also says, "one of the greatest mysteries of the science is that those are often the most beautiful patterns where there is no pattern at all. Turkey carpets and Indian shawls are often extremely rich in this singular principle. It may be described as a multifarious and almost infinite variety of indefiniteness." There are, doubtless, two distinct kinds of taste for the beautiful in ornament, not necessarily opposed, but often and generally existing in the same mind. The taste for the indefiniteness of the Indian shawl and Turkey carpet patterns is the same as that for the bank of summer wild-flowers and ferns, giving undefinable pleasure by their wild grouping of beautiful detail of form and colour. It is evidently a natural and correct taste, and, as gratified by the various aspects of nature, one from which mankind derives a great part of the enjoyment of life. None will dispute the good taste of that man who, surveying from a mound in the Mesopotamian wilderness, at the proper season, the rich carpet of many-coloured flowers which covers the country, is enchanted at the unusually magnificent decoration of the earth. This wilderness of flowers is an example of that "multifarious and almost infinite variey of indefiniteness" which your correspondent prefers to "order, precision, and definiteness." Although a wild beauty, it affords pleasure to the most cultivated minds. Its discords of contact of colours, wherever they happen, help to highten the richness of the more prevailing harmonies and contrasts, and the whole is delightful. But thus to prefer the flowery wilderness to the regulated garden is not in obedience to any canon of taste; it is the accidental bias of individual taste. Although admiring this style of indefinite beauty, man is not content with it alone. He does not leave the ornamentation of the earth altogether in the hands of nature. He regards her rich profusion of details as cast forth in unselected heaps for his arrangement. He has a taste, no less elevated than the other, which induces him to assort the flowers into harmonious masses, ribands, and borders, and with them and his walks to form a conventional design and to give the whole definiteness and order. Such gardens, viewed from the terraces and turrets of many an English hall and palace, are truly beautiful as well as the wilderness of flowers. As to the magnificence of the confusion of the stars, how truly magnificent also might be the effect of the illumination of the vast dome with a grand conventional arrangement of lights. Poets have found rapture in such a conception. We admire the piled-up glories and wild grandeur of a rich sunset; and also appreciate the conventional arrangement of the coloured panes of a stained-glass window. One can enjoy thoroughly the wild melody of the morning and evening songs of the woods and rural lanes, yet allow his attention to be diverted to the tones of the sylvan pipe, breathing the conventional and definite tune of "Coming through the rye," or "Highland Mary," with their simple repeats. So with the tempestuous harmony of an extravaganza, with "Songs Without Words," and the simple cathedral chant. In architecture, too, we have nature's grand grotto and cave temples, with their indefinite arches, domes, and columns; we admire them, in obedience to a true taste, and no less true is the taste which enjoys the conventional temples of art, with their definiteness, uniformity, and exact repetition of parts. These tastes, therefore, are not antagonistic or higher or lower, but only illustrate how varied and infinite are the expressions of beauty; and also, perhaps, how vain is the idea of endeavouring to trammel the fancy of the ornamentist by a code of laws of ornamentation.—I am, &c.,

William H. Goss.

Stoke-on-Trent.

DEAF AND DUMB INSTRUCTION.

Sir,—I trust you will allow me to call the attention of the readers of the *Journal* to a question which is, in my opinion, well deserving of investigation, and by the discussion of which the Society of Arts may assist in ameliorating the condition of an afflicted portion of mankind.

Public attention has recently been called to the method of teaching the deaf and dumb which has been for a considerable time successfully practised in Germany and Holland, and which has lately been introduced into this country. Like all new systems, it has met with considerable opposition from those who practise the generally established mode of instruction, and hence, up to the present time, none of the large institutions for training deaf mutes has adopted or attempted to adopt any means of communication with them, or between the pupils themselves, other than the finger language.

Now I do not suppose that any one would attempt to prove that the affliction of total deafness would not be greatly mitigated if, by observing the mouth of a speaker, the deaf mute could understand what he was saying, and in like manner could so imitate the actions made by the various organs as to produce similarly articulated sounds, and hence to speak intelligibly, in fact to converse with almost as much ease as the generality of mankind.

This system is the one which it is sought to introduce here, and which has been practised on some part of the Continent sufficiently long to produce several perfected pupils (people who mix in ordinary society without difficulty, who go to places of amusement and hear, or rather understand, what is being said by the preacher, the lecturer, or the actor, by the mere use of the eye), and yet its introduction is opposed, because such teaching has been found impracticable in schools where it has been attempted as an adjunct to the finger and sign system.

The teaching of the deaf child must be, under all circumstances, and under whatever method, a tedious and difficult operation; and I can well understand that the use of signs is always a more easily-acquired mode of communication than language of any sort, and hence that unless it be prevented by a strict discipline, the deaf child will use no other. In the same manner, when a deaf child has been taught to communicate by means of the finger-language, and has practised that mode of communication for some time, he is not likely to adopt any other in his intercourse with his fellow pupils; and therefore in institutions where the finger alphabet is taught and practised, lip-reading and speaking, when attempted as a more advanced form of education, have not been generally used by the scholars, nor found serviceable as an easier mode of communication with the outer world. But, surely, because such may have been the case, it is absurd to argue that it is better to continue the practice of teaching the finger alphabet as a safer and more certain mode of instruction. I will quite agree that the simultaneous use of both methods is impossible, but that is no argument why the more imperfect should be persevered in. I will agree that it may, and perhaps it does, take longer to produce the earlier elements of conversation by the speaking than by the finger system, but, lip-reading once acquired, the after-education will certainly be more rapid. I will agree that, were the speaking system untried, the change would be a dangerous experiment, but as it has been in use, and proved successful in some parts of the Continent, as it is being practised to a small extent here, and, considering the short time, has evinced all the elements of success, I can see no reason for the maintenance of the prejudice in favour of the finger language, and trust that it will be discarded from our large schools. I strongly urge your readers to visit the establishment in Euston-road, where the speaking system is being used, and feel little doubt but that each visitor will be a supporter of the cause which I have endeavoured to advance in this letter.—I am, &c.,

LIONEL VAN OVEN.

34, York-terrace, Regent's-park.

EXHIBITIONS.

The Milan Exhibition.—If an opinion can be formed from the number of packages that are daily arriving at Milan for the exhibition, from all parts of Italy, there seems to be no doubt of its success. The applications for the admission of objects have been so numerous that the executive committee have resolved upon increasing the space by the erection of additional annexes. The total space covered by the buildings will be 8,000 square metres (3,000 greater than that of the Naples Maritime Exhibition). The works are progressing most favourably, and the erection of the principal entrance, in the Swiss *chalet* style, was commenced last week. Arrangements are being made by the municipality for opening the fine theatre of La Scala during the exhibition, and for giving some entertainments at the arena. After the opera in the evening, Milan is to be illuminated, and a grand ball is to be given by the Società del Giardino.

GENERAL NOTES.

Carpets made from Wood.—The *Scientific American* thus describes this new kind of carpet, the use of which is stated to be rapidly on the increase in America: They are made of small squares of wood, or of more ornamental shape, which are glued on to a stout cloth. The pieces of wood are of different colours, and are placed together so as to produce all the effects of mosaic work, and as they are about a quarter of an inch thick, they last several years. They are put together with great nicety so that the joints are as perfect as a piece of cabinet work, and the whole is then varnished. The surface can then be polished, rubbed, washed, and even oiled like inlaid floors, which these carpets in fact exactly resemble.

Silvering of Lead Pipes.—Mr. H. E. Towle, of New York, has taken out a patent for silvering the interior of leaden pipes of any length, the object of which is to prevent the deleterious action of the lead on the liquids which pass through the tubes. The tube is filled with a solution of cyanide of silver, and connected with a sufficiently strong voltaic pile, of which one of the poles is a silver bar.

Gas Burners.—The Gas Referees, in their first report to the Board of Trade, lately issued, say:—"Every improvement in the construction of gas-burners is equivalent, in its economical effects, to the discovery of a method of cheapening the manufacture and supply of gas, for it enables the public to obtain more light from the gas which they consume and pay for. By using good burners, instead of bad ones, consumers may obtain from 30 to 50 per cent. more light, while their gas bill remains the same. The improvement of burners is also important as a measure of sanitary reform, for, as by this means the required amount of light is obtainable from a smaller quantity of gas, the atmosphere of rooms and workshops is less vitiated. Not only is an unnecessary amount of heat avoided, but, in consequence of less gas being burnt, the pernicious products of combustion discharged into the air (viz., carbonic acid gas, the sulphur impurities, &c.) are equally diminished, so that the condition of the occupants of private dwellings, and still more of the workpeople employed in factories and other large establishments, is rendered more comfortable and more healthy than it could otherwise be. In fact, the improvement of burners is of itself an important means of diminishing the pernicious effect of the impurities in gas—the gradual reduction of which impurities to a minimum is one of the duties devolved upon the gas referees." They go on to say, "they were led to inspect the gas-lighting arrangements in several large establishments in the City, especially those in which, owing to the prevalence of night-work, an unusually large quantity of gas is consumed. The inspection fully confirmed the apprehensions which the referees had formed from their examination of the burners procured from the gas-fitting establishments. For example, in the offices of two of the daily newspapers (establishments which consume more gas than any others), it was found that the burners chiefly in use were so defective that they gave out only one-half of the illuminating power of the gas actually consumed; and several of the burners tested by the referees gave only one-fourth of the proper light of the gas. These facts, and many others which came to their knowledge, proved to the referees that an enormous waste of gas prevails, with a corresponding pecuniary loss to the public; and they consider it a matter of urgent importance that such facts should be made generally known. The economy to the public arising from the use of good gas-burners instead of bad ones is so obvious as hardly to need remark. The gas-rental of London amounts annually to more than two millions sterling. Taking a very moderate estimate, upwards of one-fourth of this sum (£500,000) per annum might be saved by the use of good burners. This is the saving which might be made in London alone; how much vaster the sum thus economised, if good gas-burners were to come into general use throughout England. In truth, the economy arising to the public from the use of improved burners is as large as can be produced for many years to come from any improvements in the manufacture of gas, or from the amalgamation of companies, by which the cost of supply will be so materially reduced. The question of burners, indeed, although hitherto so little considered or investigated, meets one at every turn in matters connected with gaslight, whether these be regarded as problems of science, or in the more widely useful and practical form, as a means of economy for the gas-consuming public."

Thallium.—This metal was discovered by Mr. Crookes, in the residues from certain sulphurous minerals. It is also found in tolerable quantity in the mineral Crookesite, which is a selenide of copper found in Sweden. Herr von Kobell, in the *Journal Für Prakt Chemie*, 1871, No. 4, informs us that he has discovered this metal in the blendes of Geroldseck, in Baden, and of Herbesthal, in Westphalia.

The Railways in France and the War.—The report of M. Bastid to the National Assembly gives the following particulars respecting the state of the railways in France. The total length of lines opened to traffic is 17,546 kils., of which 7,122 kils. are in the hands of the Prussians, leaving 10,424 kils. in the hands of the French. Of the 7,122 kils. of lines under Prussian regulations, 1,037 kils. are worked by the companies to whom they belong, and this only under special restrictions, the traffic being entirely through, it not being permitted to carry either goods or passengers from intermediate stations. The lines under Prussian regulations are as follows:—Northern Railway Company, 951 kils.; Eastern Railway, 2,833 kils.; Western Railway, 1,193 kils.; Orleans Railway Company, 887 kils.; Paris, Lyons, and Mediterranean Company, 1,152 kils.; local lines, 106 kils.; in all 7,122 kils. The damage occasioned by the war to the various lines is estimated as follows:—The Eastern Railway Company, totally in the hands of the Prussians, 30,000,000 francs, 200 locomotives, and 900 waggons; the Paris, Lyons, and Mediterranean Railway, 4,000,000 francs and 300 waggons; Orleans Railway, 1,500,000 francs, 1 engine, and 30 waggons; the Western Railway, 15,000,000 francs, 6 engines, and 150 waggons; the Northern Railway Company, 6,000,000 francs, forming together a total of 56,500,000 francs. The damages occasioned by the war to the various lines was at first estimated by the Minister of Public Works at no less than 70,000,000 francs.

Rights of Invention.—Has a man "a right of property" in the inventions of his own brain? asks the *Morning Advertiser*. Is it expedient, and for the public good, that such a species of property should be recognised? To propound these questions is, it will be thought by most people, to answer in the affirmative. Nay, the average mind will be apt to wonder at such questions being raised at all, and more particularly, perhaps, at their being separated. Nevertheless, it has been denied, and by very influential authorities, that a man has any such right—nay, more, that there are such things as abstract rights apart from the legal rights conferred by positive laws. According to this theory, a man has no right to his life except in so far as the law gives him such right, and denounces the penalty of death or some other punishment against those who take it away. It has further been denied that a right of property in ideas or inventions is for the public good; just as if men would take the trouble to invent and discover if anybody and everybody were to be at liberty to gather where they have not sown, and reap the fruit of the inventor's labours. This question is a most important one, and ought to be discussed exhaustively. Some very suggestive resolutions on the subject were passed at a recent meeting of London patent agents, under the presidency of Mr. George Hazeltine, and the right of inventors to the sole use of their inventions was asserted in their fullest sense, as well as the doctrine that it is the duty of legislators to reconcile this right with the interests of the State. This, indeed, is the pivot on which the whole question turns. If there be such a thing as a right of property at all, it is self-evident that such right must attach to a man's ideas and inventions or discoveries. The right of property has been resolved by writers on the philosophy of legislation, into first occupancy or acquisition from the first occupant. This explanation has failed to satisfy many critics, who hold that property in external objects, such as land, is simply the creature of positive law. But a man's ideas spring from his own brain, and must, one would think, be as much his own property as his brain itself, whence they emanate. If that be so, the right of property in this case is plainer, stronger, more unquestionable than in any other. Upon this footing, property in ideas is identical with property in one's limbs or other physical organs. Assuming this view to be correct, it follows that the question of expediency is at least partially settled. It cannot be expedient, that is, for the good of the community, to deny to the individual members of which it is composed so sacred a right as this must be considered to be. An injustice that may attach to any member of the community whatever, and which, in this particular case, must attach, if it attaches at all, to the cleverest and most useful members—the inventors and discoverers—cannot but be regarded as injuries to society as a whole.

A Barometer without Mercury.—Professor A. Heller, of Orfen, gives, in Poggendorff's "Annalen," the description of an apparatus for determining the pressure of the atmosphere. The apparatus consists of a scale beam, to the ends of which are screwed two bodies nearly equal in weight, but greatly differing in volume—a hollow sphere and a solid cylinder. On one end of the beam is a mirror, which is approximately at right angles to the axis of the beam. At some distance from the apparatus is a telescope with a vertical scale, the image of which in the mirror is observed by a means of a telescope. It is clear that when there is any change in the expansion of the air in the vicinity of the apparatus, the beam will indicate varying angles with the horizon, which angles may easily be read off in the mirror by means of the telescope. The variations of the scale-beam, in consequence of alterations in the pressure, will not amount to much, if the dimensions of the apparatus are moderate; but the use of Poggendorff and Gauss's method of reading affords such a degree of accuracy that, as a brief calculation shows, under assumptions which are easily realised, the changes in the position of the beam can be measured with far greater certainty and accuracy than the height of the mercurial column in the ordinary barometer, provided the whole construction is light, and that its centre of gravity is at a short distance from the knife edge of the beam.

Commerce of Venice.—The Chamber of Commerce have lately published the following particulars respecting the trade of Venice, which show the increasing prosperity of that city since its annexation to the kingdom of Italy. From this it appears that the total value of the exports in 1870 amounted to 116,688,952 francs, and the imports to 143,942,872 francs, showing a difference in favour of 1870 of 10,847,848 francs over the preceding year in the imports, and 4,460,100 francs in favour of 1869 in the exports. The principal articles of trade were the following:—

	Imports. Frs.	Exports. Frs.
Woven and spun goods	23,779,960	17,155,680
Cotton	14,636,300	13,113,400
Hemp	13,014,120	12,527,235
Grain	12,928,318	7,398,629
Articles of colonial trade	9,810,575	6,900,980
Oils	8,279,430	8,171,900
Timber	4,599,904	4,662,454

The beads and glass ware, which form a *specialité* of Venice, figure in the list for the value of 5,612,060 francs. Compared with 1869, a considerable increase in the imports of woven goods, cottons, and timber, and in the exports of hemp, beads, and oils, is shown, and which explains the difference in the value of the exports and imports during last year. With respect to cotton, and in general the trade with the East, the statistics of 1870 give most satisfactory results, and the returns since the commencement of 1871 show a still greater increase.

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FRIDAY, AUGUST 25, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

EDUCATION OF GIRLS.

The Council has decided to appoint a Committee to promote the better education of girls in all classes. There will be little difference of opinion as to the fact that the wives and mothers of our labouring men, and the immense class of female servants, are very inadequately trained to their duties; but it is not so generally known that the women of the upper classes are even less well educated relatively to their means and positions. The reports of the Schools Inquiry Commission, and the evidence given before it, show that while the education of boys in the upper and lower middle class is far from satisfactory, that of girls is still more defective: that the instruction given to them is meagre and superficial; that the teachers are, as a rule, ill-taught themselves and very incompetent; that an exorbitant proportion of the school-life of girls is devoted to accomplishments; and that the aim of their education is rather to make them attractive than intelligent women—rather to bring them up to the conventional standard of their class than to fit them for any of the serious duties and callings of life. These results are confirmed by independent evidence, and there is reason to believe that the same defects exist in the education of girls of the higher class, who are generally educated at home by governesses.*

That such a state of things is fraught with evil to national character and national progress, must be apparent to all who reflect that it is the influence of women which acts upon the character and habits of the other sex, at the two most important and most impressionable epochs of life—childhood and early manhood. It is equally apparent that such an education—or rather non-education—must be fraught with evil to women themselves, leaving them unprepared to meet any of the emergencies of life, unfit to help others or to help themselves. Many efforts towards improvement have been made of late years, and various associations have been formed, both in London and the provinces, to promote measures for the better education of girls; but these associations, being confined to special points, and, with the exception of those forming the North of England Council for the Education of Women, working independently of each other, are comparatively little known, and have not the influence necessary to remove the most powerful obstacles to the improvement of girls' education, *i.e.*, the indifference of parents, and the ignorance and apathy of the general public regarding it.

Some larger movement, combining all these hitherto isolated efforts, and giving them the strength of union and organisation, seems required to bring their influence to bear on the country at large, and to create the sounder public opinion on the subject of female education which would create a demand for its reform, and enforce the measures necessary to secure it.

It is, therefore, proposed to form a National Union for the Improvement of the Education of Girls; and, in order to make it as wide as possible, that a subscription of 5s. should be sufficient to constitute membership. Into this Union all existing societies having the same objects in view will be invited to enter.

The Union will be represented in London by a Central Corresponding Committee, and by branches in every part of the country where one can be formed. It is hoped that the Committees of societies entering into the Union will act as its committees in their respective localities. Once a-year a General Meeting of representatives will take place, and a report of the operations of the year will be drawn up and published.

The objects of this Union will be:—

1. To enlighten the public mind, through meetings and lectures throughout the country, on the present low state of female education, on the national importance of improving it, and on the measures required for that end.

2. To collect and disseminate information respecting the best methods of education, the comparative advantages of home and school systems, and of large and small schools, the influence of endowments, and, generally, all questions connected with the training of girls.

3. To promote measures for the better training of female teachers, and especially means for their examination and registration by fixed standards, so as to secure a test of competency.

4. To assist the formation of councils similar to the North of England Council for the Education of Women in other divisions of the country, and, while endeavouring to multiply local centres of activity, to afford to all workers in the same cause a common bond of union and a means of intercommunication and combined action.

The Council of the Society of Arts earnestly invites the co-operation of all who have at heart not only the interests of women, but those of the country, in carrying this scheme into effect, and would remind them of the lesson taught by the late war, that an uneducated people cannot contend against an educated one, and that the surest way to educate a people is to educate its wives and mothers.

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* See paper read by Mrs. Grey before the Society of Arts, "On the Education of Women." Published by W. Ridgway, 169, Piccadilly.

The following have already agreed to be members of the Committee, and the Council proposes to add to their number:—

Rev. E. A. Abbott (Head Master of City of London School)
Viscount Amberley
Viscountess Amberley
Professor Sheldon Amos
Mrs. Sheldon Amos
Sir Robt. Anstruther, Bart., M.P.
Lady Anstruther
Mrs. Baden-Powell
William Barber, Esq.
Mrs. Barber
Thomas Horlock Bastard, Esq., Blandford
Mrs. T. H. Bastard
Mrs. Bateson, Cambridge
Miss Dorothea Beale (Principal of the Ladies' College, Cheltenham)
Lady Bell
Miss Bibby, Liverpool
Joseph Biggs, Esq.
Miss Caroline A. Biggs
Miss Elizabeth Blackwell, M.D.
Rev. Canon Blakesley
George H. Blakesley, Esq. (Fellow of King's College, Cambridge)
Rev. Gerald Blunt
Mrs. Blunt
Lady Bodkin
Miss Bolton
Miss C. V. Bolton
Miss E. Bonham-Carter
Miss Boucherett
Mrs. Brassey
Mrs. W. Briggs
Jacob Bright, Esq., M.P.
Mrs. Jacob Bright
Mrs. Brine, Teignmouth
Rev. Stopford A. Brooke
Mrs. Brookfield
Rev. W. Haig Brown, LL.D. (Head Master of Charterhouse)
Rev. G. F. Browne, St. Catherine's College, Cambridge
Sir John Bowring, Exeter
Lady Bowring
Rt. Hon. H. A. Bruce, M.P.
Dow. Countess of Buchan
Miss Frances Buss, Principal of North London Collegiate Schools for Girls
Hon. Mrs. Francis Byng
Rev. J. W. Caldicott, Grammar School, Bristol
Principal Chase, St. Mary's Hall, Oxford
Miss Anne Clough
Miss Frances Power Cobbe
Mrs. Arthur Cohen
Mrs. Cole
Miss Cordery
Miss Louisa B. Courtenay
Mrs. Crawshay
Mrs. Crudelius, Edinburgh
Chas. Darwin, Esq., F.R.S.
Mrs. Charles Darwin
Erasmus Darwin, Esq.
Miss Emily Davies
Mrs. De Morgan
Miss A. T. De Morgan
Countess of Derby
Mrs. Edward Dicey
Sir Charles W. Dilke, Bart., M.P.
Mrs. Duberly, Hunts.
Lord Dunglass
Lady Dunglass
Rev. J. M. Du Port
Miss Durant
Lady Emerson-Tennant
William Evans, Esq.
Mrs. J. G. Fitch
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Mrs. William Grey, 18, Cadogan-place, London, S.W., and Mrs. Henry Kingsley, 24, Bernard-street, Russell-square, London, W.C., have agreed to act as the special Honorary Secretaries, and all communications should be addressed to them at the Society of Arts, Adelphi, London, W.C.

ANNUAL INTERNATIONAL EXHIBITIONS.

EDUCATIONAL COLLECTION.

Toys and Games.

The official report on this section is by George C. T. Bartley, Esq., who says in his introduction:—"The idea of toys and games forming a section of the educational division of an International Exhibition may appear to some as strange. Many may be inclined to think that they are merely an addition to every nursery, and, beyond being useful in that capacity, are unworthy of consideration. Such, however, is not the case. To those who have considered the subject of the education of children, and who know the importance of infant teaching, it must be apparent that those objects, however trifling in themselves, which are so essential to the infant mind, and with which so many hours of its earliest years are passed, cannot, after all, be so very insignificant. That this is so, may be made evident by the idea of abolishing all toys from a nursery for a week; it would be as if the very food of the children had been cut off, and their whole existence would be made dull and miserable. Playing with toys, in some shape or other, is, in fact, a necessary part of the occupation of children, and as such has a very important influence on their education.

"Like many other branches of industry, the toy trade has been completely changed within the last generation. Together with the gradual development in general education, the importance of toys appears to have progressed in somewhat similar proportion. Our parents were almost content with the old Dutch doll, the brewer's dray-cart, boxes of bricks, the straight-legged wooden horse, and the Noah's ark, with the dove and olive branch depicted on the roof. The well-known character of Caleb, the toy-maker, in Dickens' 'Cricket on the Hearth,' was then the only supplier of the nursery valuables. No doubt some Calebs still exist; but a flourishing trade has grown up for supplying children with toys of a better description. It is now possible to obtain Noah's arks where the animals shall, at least, convey some idea of the originals—where the spiders shall not be quite leviathan in proportion to the elephants —puzzles of really artistic elegance, picture-books well executed, and dolls actually resembling in proportion and form the living model.

"Some argue that these changes are evidences of a luxurious age and the sign of extravagance; but, without for a moment advocating expensive toys as best adapted for children, there can be no question but that it is beneficial for them to have such things to play with as are good in themselves, and likely to make a true impression on the mind. In a picture-puzzle, for instance, the drawing should be correct, and the subject fitly chosen. The colouring, if in bad taste, will be detrimental. It will accustom the eye to that which it would be more desirable to avoid. Toys in good taste will imperceptibly train as early as the mind is capable of influence, by habituating the child to the form and shape of that which it is well he or she should imitate.

"That which is true as regards the most ordinary toys of the nursery, is equally applicable to those games and amusements which are intended to be educational. Some of these are so indifferent, that persons are apt at times to consider that all 'educational toys' are a mistake. The truth appears to be that toys and games must, from their very nature, be educational; but that their failing to be interesting arises from an attempt to give to play the formality and rigidness of a lesson.

"A good deal of skill is required in showing children how to play with their toys. The great art is the power of enabling them to interest themselves with their playthings, while as little as possible is done for them. Playing with children is, of course, often necessary; but the greatest good can be obtained from toys only if children are left to amuse themselves; and for this those playthings are of most avail which are useable, that is, such as a child can handle, take to pieces, drag along, and, in fact, really play with. Those which are merely fit to look at for a moment, but which do not admit of being handled, can hardly be classed as toys at all. In regarding this section in the Exhibition from an educational point of view, it may perhaps be remarked that beneficial results would follow if all girls, and particularly infant teachers in training, were taught systematically the proper purposes which toys have, and the way in which they may be most profitably put into the hands of children.

"The war in Europe, during the latter part of the year 1870, rendered it doubtful at one time whether it would have been possible to display an international collection of toys at the Exhibition this year, France and Germany having always been the chief countries for the toy trade. Had it not been for the exertions of Mr. Cremer, of Regent-street and New Bond-street, this section of the Exhibition would have been limited almost entirely to English goods. Mr. Cremer has the largest connection on the Continent among the toymakers, and in this way, even during the war, he was enabled to collect and, in many cases, to have made for him, special examples of the manufactures of many States which are not otherwise represented at the Exhibition. The result has been that the articles displayed form by far the most completely typical collection from the various toy-making countries which has ever been brought together.

"In this country the manufacture of toys is a great industry, and many thousands of hands are constantly employed upon it, though it differs much from other occupations, and from the trade abroad, inasmuch as, with the exception of the articles made by a few dollmakers on a fairly large scale, English toys are begun and finished in the homes of the poorer classes, and not collectively in extensive manufactories. In the East-end of London a great many of the cheaper articles are produced, such as tops, little carts, and nearly all the small wooden playthings, the better kind, such as horses and carts, selling for a shilling or more. Dolls, rocking-horses, etc., are made chiefly by families. One family will devote itself entirely to horses, another to boats, another to dolls, another to carts, and so on—and all they can make, that is the father, his wife, and children, sometimes assisted by one or two helpers, will be disposed of to some large toy warehouse. From this circumstance it is extremely difficult to get anything like an accurate idea of the number of persons employed in the trade. In the manufacture of dolls, rocking-horses, carts, horses, wheel-barrows, tool-chests, ships, and such-like toys, England has by far the lead of other countries. These are strong, serviceable articles, useable, and invariably popular with children.

"Gymnastic apparatus is also included in this section of the Exhibition. The articles exhibited are placed in the Western Arcade. The War-office sends a fine collection, being a complete set, such as is supplied by the government to a regiment. A training in gymnastics forms now an important part of the drill of each recruit, and the pieces of apparatus which have been sent, though not put up for use, are so arranged that it is easy to understand the whole course in training.

"From France an excellent typical collection has been brought together. Foremost, of course, are the French dolls, and next to them the French excel in all descriptions of musical and mechanical toys, though some of them are really not toys at all, but remarkable examples of clock-work ingenuity. Military toys are a speciality of the French trade. In these they are unsurpassed by any country. In spite of the results of the late war, the cry of the times has had its effect on the nursery requisites. What may be called almost working toy models of the chassepôt and the needle-gun are exhibited, as also the siege-guns and powder-carts used in Paris. Incidents in the siege have been made use of to produce variety in little articles of toy manufacture. One is an old woman, sitting and selling mice, rats, dogs, &c., all ticketed at famine prices, the labels on a fat cat and a very small piece of butter showing that they were worth almost their weight in gold. English liberality is also depicted in bundles of corn, &c., labelled 'English gift.' Special attention may be drawn to the French kitchen, which is an excellent toy. Nearly all the utensils are useable, and it is on a scale which would render it most attractive to a child.

"The chief feature in the trade of Prussia is the pewter manufactory; lamps, furniture of all descriptions, and such-like goods are largely produced in that metal.

Soldiers and sham fights are also made in considerable quantities for all countries, and the uniforms of the different armies are, of course, suited to the nationalities of each State. Among those now exhibited, it will be noticed that scenes in the French and German war already predominate.

"The characteristic feature of the toys from Sonnenberg is, that although they have no clockwork arrangement, yet some parts of them can be made to move either by turning a handle, or by motion being imparted from the wheels as they are pulled along the floor. In some the movement is accompanied by music. Rabbits, cats, and other animals, are made to move their ears, or drum on a tambourine, the movement in the wheel working on a number of levers, and producing this effect. Some of these are very ingenious. The collection of animals covered with real skin from this country is good. Several of them are sufficiently big for a child to ride upon. Great care is taken to preserve, as much as possible, the natural look of the animal, and although they are necessarily somewhat expensive, a large number is sent over to this country.

"A specially interesting feature in the collection which Mr. Cremer has got together, and which is introduced at an exhibition for the first time, is the arrangement showing the actual process of making wooden animals in Saxony. Strange as it may seem, they are turned. A ring of wood, varying in diameter with the size of the animal, is turned with cutting tools, having for their section the outline of the animal desired to be produced, either a horse, cart, elephant, &c. The turned wood is shown as finished by the lathe in Fig. 1, and in section in Fig 2. The ring of horses, or whatever animal it may chance to be, is then cut up into pieces, as in Fig. 3, and the finishing, Fig. 4, including the glueing on of tails, trunks, &c., is performed chiefly by children. Not only are animals made in this way, but the various parts of the different toys, such as the fastening of wheels, &c. The large wooden soldiers are also turned, though differently to the mode described above. Each one is made separately, and finished by hand.

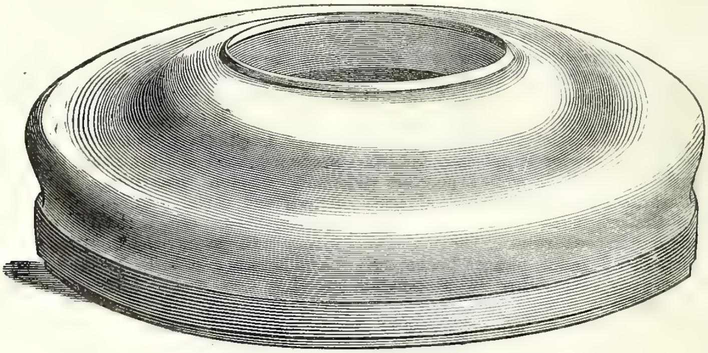

FIG. I.

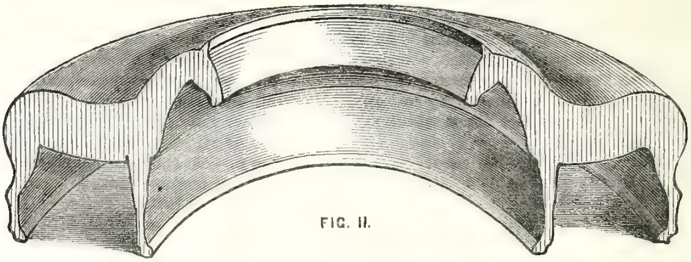

FIG. II.

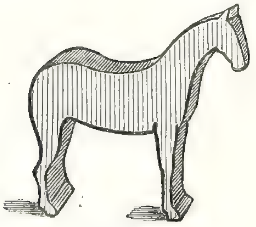

FIG. III.

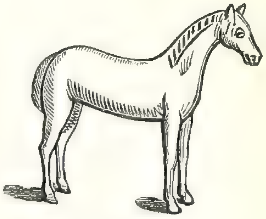

FIG. IV.

A. REID. DEL.

"It is difficult to obtain such a collection as the above, showing how toys are made abroad, owing to the jealousy generally felt among the foreign manufacturers, and the fear they have that England will start in opposition to them. It is not likely, however, that we shall ever be able to produce these articles at so low a cost as is done on the Continent. It is true that, by the ingenious arrangements above described, great saving is effected over the old-fashioned plan, when every little wooden animal was cut entirely by hand, but even now a large part of the finishing of these trifling objects must be left to personal manipulation. In this respect there is little chance of this country ever competing with the foreigner.

"Some excellent examples of building-bricks are exhibited from Saxony. This is a toy which must always remain popular with children, from the endless variety of form the blocks may be made to assume. The sets in the Exhibition are made to represent the chief orders of architecture, as the Roman, Greek, and Gothic. In this way the child's mind is associated with the differences which exists between the various styles.

"There is no mistaking the characteristic toys from Wurtemberg. The best ones are good specimens of metal work, and are painted so well, that the colour almost partakes of the nature of enamel. The horses and carriages, omnibuses, trains, &c., are modelled in metal, and not, as formerly, in paste, and are so well made as to be almost true to the originals. Especial notice should be taken of the model steam-boats; their paddles are moved by clock-work, and they cross a small, smooth pond before the spring is exhausted.

"The subject of teaching girls to cook has often been mooted, and although it is universally admitted that such a course would be desirable for a large section of the community, the difficulties to be overcome in order to carry it out in anything like a systematic manner have generally been considered as insuperable. The large number of toy-cooking stoves from all parts, however, suggests that these supposed difficulties may not, after all, really exist. Their chief feature is that they can really be practically used for small culinary purposes. It is, therefore, evident that cooking is a most popular game with children. As this is so, it would seem that really practical lessons might be given by means of these toys."

"Bavaria produces a miscellaneous collection of toys, and as a general rule they are of a cheap description. Printing presses, which make a favourite toy for children, must be considered one of the important branches of the trade. Those working with the Stanhope press action, like a real printing machine, have lately been introduced, and small electro blocks sold with the type. Perhaps the most attractive Bavarian toys in the collection at the Exhibition are those in metal, with some water-work arrangements. The castle manned with soldiers is the best example. The moat can be filled with water, and fountains and cascades spring from different parts as the fluid finds its level. The paper toys, which are sent chiefly from Bavaria, must also be mentioned. These consist of farmyards and other subjects, in which the animals, etc., are pictures cut out and mounted on card, with a small block of wood at the back to enable them to stand. They can be arranged in an infinite variety of ways, and are excellent toys for children."

Speaking of Holland, Mr. Bartley says, "there does not appear to be a single specimen of a Dutch doll in the collection. The trade in this article is very much reduced, and it has almost ceased to be part of the stock of a toy shop." It appears that no toys have been sent from Sweden, but an extensive collection of models of gymnasiums, suitable for schools and institutions, are displayed in the Swedish school-house.

On the whole, it may be said that this report and the collection it describes are specially worth the attention of all to whom the education of young children is a subject of interest and study.

THE TEACHING OF SCIENCE.

An interesting discussion on this subject took place in the Mathematical and Physical Section of the British Association during the last meeting. A paper "On Government Action in Scientific Questions" was read by Colonel Strange, who, after urging the importance of scientific education, said that at present the British Government was totally unfitted to direct such education, and he therefore suggested that two additions should be made to the Ministry, but neither unaccompanied by the other—first, a Minister of Science; and second, a permanent Consultative Council of Science, to advise the various departments through the Minister.

A paper "On Obstacles to Teaching Science in Schools," was then read by the Rev. W. Tuckwell. The author began by referring to the present position of science in the schools of this country, and to the difficulties of head masters in consequence of the absence of science teachers, whose cost, and the cost of appliances, were heavy matters for consideration. There was, further, the anxious question—How was scientific education to be inserted in the curriculum of an established school? In connection with this difficulty, he asked whether the day had not arrived when Greek and Latin verse-making might be allowed to disappear, and scientific teaching to be substituted? The author briefly stated the good results which might be expected to follow from scientific education, and he concluded by appealing to the association for help to establish such schools.

The Rev. T. G. Bonney (tutor of St. John's College, Cambridge) addressed himself to the part the Universities had taken in scientific instruction. He thought there was little fear that, for the future, science will receive its due reward. He thought he could speak not only in the name of Cambridge, but of Oxford. The Natural Science Tripos had been instituted for some years, and was growing in importance. He thought there would be no difficulty in getting a supply of masters. He wished we had a probation year, as in Germany, for the recommendation of a tutor was one of the most difficult tasks that falls to a college professor. Unless a man is seen at work in his class teaching, you cannot form a due idea of him; and he thought this probationary year would be one of the most important educational reforms that could be instituted.

Mr. G. J. Stoney supported the idea of the proposed committee. One of the most valuable works a right-thinking scientific man could do would be to point out the educational advantage of teaching scientific subjects, and what results would be attained by occupying a large portion of the time of boys at school in the study of science.

Mr. C. Huggins, as a teacher of science in one of our public schools, supported the views of the Rev. Mr. Tuckwell. The difficulties met with by such teachers as himself do not arise from the pupils, but from the opposition of the staff of masters to the teaching of science. In one school where he had taught, he was told the head master was induced to appoint a scientific teacher only from outside pressure by the parents of the pupils, and not from his own inclination; therefore the teaching of science was not looked upon with great favour in the school.

After some observations by other speakers,

Mr. Boyd Dawkins suggested that a scientific league should be formed of persons interested in teaching science, and that it should have for its object the enforcing the claims of science, and of bringing them before the Government in such a way as could not be resisted. He thought that scientific men—each man working in his own individual centre—wasted an immense deal of power, simply because they did not band themselves together for one common object. The teaching of science in schools was absolutely necessary if we were to maintain our position on the Continent of Europe. If our arts and manufactures were to be in the future what they had been in the past, scientific education must be improved. Hitherto it had been in the hands of a few earnest men, who had had to undergo every kind of obloquy, to endure all manner of sacrifice.

Therefore he thought it would now be desirable to inaugurate a kind of scientific league.

The Rev. H. H. Winwood enforced the observations of previous speakers with regard to the comparative inutility of classical teaching, and said head masters could not, as a rule, be made to depart from the old track. He urged the importance of scientific instruction.

GUN-COTTON.

The *Times* draws a marked distinction between the article lately adopted in our military service and the crude, treacherous, and comparatively expensive substance invented in 1846 by Schönbein, and subsequently introduced with improvements into the Austrian service, at the recommendation of Baron von Lenk, and goes on to say, "Give a dog a bad name, and hang him," is an adage peculiarly applicable to gun-cotton. The first attempts to practically utilise the philosophical researches of Professors Schönbein and Böttcher were attended with such disastrous consequences in this and other countries that gun-cotton was ultimately condemned as a thoroughly treacherous and highly dangerous compound, fit only for the chemist's laboratory or the specimen bottle of the lecturer. It is unnecessary to recapitulate the chapter of accidents which preceded the abandonment of all further manufacture of gun-cotton in this country. Further information may be gathered by referring to an able paper on the subject by Lieutenant-Colonel F. Miller, V.C., R.A., published at page 65 of the fourth volume of the *Proceedings of the Royal Artillery Institution* (1865).

In 1847-48, gun-cotton was given up and condemned in all countries but one. Austria still clung to the idea of the German chemists, and to Austria belongs the credit of pushing forward all practical inquiry with respect to gun-cotton up to 1862, when the subject was revived in this country by the Royal Society.

The subsequent history may be briefly told. A special committee was appointed to examine into the applicability of gun-cotton to military purposes, and to mining and other engineering operations. After a series of promising experiments, this committee was, rather suddenly, dissolved. It was rumoured at the time that its elements, being antagonistic, would not bind and the prosecution of the inquiry was handed over to the Ordnance Select and Royal Engineer Committees. Meanwhile, Mr. Abel, the Chemist of the War Department, had been actively engaged in investigating the properties of gun-cotton when prepared under varying conditions, and it is to him we owe the perfection of the present manufacture. Mr. Abel's preliminary researches were embodied in two elaborate contributions, published in 1866-67 in the *Transactions of the Royal Society*, to which a third, on the history of explosive agents, was added in 1869.

The main results arrived at by the special committee previous to its dissolution, may be stated as follows:—

First, it was proved that gun-cotton, as made by the Austrian or Von Lenk process, is, with proper precautions, decidedly superior to gunpowder in blasting operations, but is inferior to it as a propelling agent in either small-arms or artillery, both on the score of danger to the gun, and loss of accuracy in the shooting. Secondly, it was shown that the full explosive power of the Von Lenk material could not be developed, in either land or submarine mining, without confining the cotton in a strong vessel, previous to its ignition. In the Austrian process, the cotton is made into skeins, which, after the usual treatment with acid, &c., are made up into convenient forms. Artillery cartridges have been made by winding the cotton round hollow cones of wood, and for the bursting charges of shells, and for use in small-arms, the cotton has been woven into a continuous hollow cylinder; for mining purposes it has been twisted into a hollow rope. It is apparent that the fibre of the cotton is more or less long and loose in all these forms, and herein lies the principal defect of the Austrian method.

The most searching purification cannot altogether get rid of impurities, and finished gun-cotton is thus liable to change and to decomposition. Spontaneous explosions follow, and a coroner's jury brings in a verdict that "no evidence appeared how the explosion arose." The loose and porous condition of inferior cotton likewise tends to very rapid inflammation. If a loose mass of gun-cotton wool be inflamed in the open air by ordinary contact with heat, it will flash into a flame with a dull explosion. If the same cotton be in the form of a woven fabric, the rapidity of the inflammation will not be so instantaneous; but if the escape of the gases from burning gun-cotton rope or yarn be retarded by enclosing the material in a wooden box, it will explode violently if ignited by the ordinary application of heat. A store of this gun-cotton would thus, if accidentally fired, explode with possibly disastrous consequences. The principal object of Mr. Abel's investigations was to set aside this defect in the Austrian process, and we shall presently show how promising have been his labours in this direction. In 1865, Mr. Abel devised a new method of manufacturing gun-cotton. This consisted in reducing the gun-cotton to the form of very fine pulp, and subsequently pressing this pulp into solid cakes, or converting it into grains or pellets, and this is the process followed at Messrs. Prentice's works at Stowmarket, and about to be adopted in the government factory now in course of erection at Waltham Abbey.

The advantages gained by the Abel process, in comparison with that of Von Lenk, are very marked. With the latter, a long-staple expensive cotton must be employed, while ordinary cotton waste can be used in the Abel process. The operations incident to the Lenk process extended over a period of four weeks; Abel's gun-cotton can be manufactured in four days.

We have already referred to the practical impossibility of thorough purification by the Austrian method. During Abel's process the fibre is reduced to such minute particles that the retention of impurities is reduced to a minimum, and the finished gun-cotton should thus be perfectly stable even in tropical climates. The conversion of Austrian gun-cotton into woven fabrics or twisted rope is more or less dangerous, owing to the necessity of working with dry material. With the Abel process, absolute safety is secured during the whole manufacture, as the material is in the wet state throughout, and could thus be stored damp, if so required.

This necessity, however, did not appear to exist, as experiments had shown that the compressed gun-cotton if inflamed, even when packed in wooden cases, does not explode. It merely burns rapidly. This was looked upon as one of the most marked features in the differences which exist between the two processes. A store of Austrian gun-cotton, if accidentally ignited, would explode with violence, whereas, under similar circumstances, a storehouse of Abel's compressed gun-cotton, judging from the result of experiment, would merely burn like any other building.

Lastly, in order to develop the full force of the Austrian cotton as an explosive agent, it is necessary to confine it either in strong vessels or by secure tamping. The compressed gun-cotton may, on the other hand, be made to exert its full destructive force without any confinement whatever. When employed in the demolition of buildings, it is only necessary to lay it in a heap on the basement floor; when used in torpedoes the surrounding case need only be of a strength sufficient to resist the pressure of the water at whatever depth the torpedo lies. This is an immense advantage, and is due to a remarkable property possessed by gun-cotton pulp in the compressed state.

Experiments have shown that Abel's gun-cotton, when placed in the open air or packed in ordinary wooden cases, can only be exploded in one way—namely, by detonation; that is to say, by a fuze containing a certain quantity of fulminate. When ignited in this manner, the compressed cotton detonates violently, completely shattering the substances in which it is in contact. Austrian-gun cotton will not detonate. If a tube or fuze of mercuric fulminate be buried in gun-cotton which is in the form of wool or spun yarn, its explosion does not develop the same violent action as if the cotton were in the form of a compact homogeneous mass such as it presents in the compressed state. Gun-cotton wool does not even detonate when placed in contact with a compressed charge of gun-cotton which does detonate.

The difference in the behaviour of such explosive substances as nitro-glycerine and its compounds, and gun-cotton when exposed to the influence of a source of heat, has been made the subject of careful investigation by many distinguished chemists in this and other countries. M. Nobel has shown that crude nitro-glycerine can be detonated by contact with a small charge of confined gunpowder or by a large percussion cap.

It occurred to Mr. E. O. Brown, assistant-chemist of the War Department, that gun-cotton might also be ignited and exploded by detonation. Experiment proved this to be the case when the particles of the cotton were in a finely-divided state, and when its mass had been subjected to powerful pressure. Further trials, however, showed that gun-cotton is not nearly so sensitive or so susceptible to detonation as nitro-glycerine. The detonation of compressed gun-cotton cannot be accomplished by the explosion of ordinary fulminates. Nitro-glycerine can be detonated in contact with compressed gun-cotton without exploding the latter. An electric fuse, charged with 100 grains of a mixture of sulphide of antimony and chlorate of potash, has been been fired on a disc of compressed gun-cotton without causing any explosion. The gun-cotton merely ignited and burnt away. A bottle, containing three-quarters of an ounce of pure nitro-glycerine has been detonated on the top of a disc of compressed gun-cotton without exploding the latter. The gun-cotton in this case was scattered by the violence of the explosion, and fragments of it inflamed. A detonating fuze containing ten grains of mercuric fulminate failed to explode a hank of gun-cotton thread, while half that amount of fulminate was sufficient to cause compressed gun-cotton to detonate violently.

These experiments support the views held by Mr. Abel:—

1. That gun-cotton, freely exposed, cannot be detonated by any explosive agent less sudden and violent in its action than mercuric fulminate.

2. That nitro-glycerine, which is more readily exploded by a blow than gun-cotton, may be detonated through the agency of explosive mixtures far less violent and sudden in their action than fulminate of mercury.

3. That the mechanical condition of the gun-cotton most materially influences the result, and that a considerable compactness or density, and a consequently great resistance to motion of the particles, is essential for the detonation of gun-cotton.

To what, then, is this remarkable action due? How comes it that the same substance is susceptible of a totally different metamorphosis into its gaseous products according to the manner in which fire is applied? Is it that the violence of explosion is proportionate to the amount of heat evolved in the disturbance of the chemical equilibrium of the particular substance used as a detonator? Is it due to the facility offered for the passage of heat throughout the material acted on. Is it owing to the suddenness or sharpness with which the detonating substance acts? Experiment does not support any one of these views. There is far more heat evolved in the combustion of 100 grains of sulphide of antimony and chlorate of potash than in the explosion of ten grains of mercuric fulminate; the latter, however, invariably detonates compressed gun-cotton, while the former fails to do so. It is impossible to detonate loose porous gun-cotton, so that the action cannot be due to the facility with which heat can permeate the mass. Both iodide and chloride of nitrogen, even in comparatively large charges, fail to detonate gun-cotton; yet the explosion of these substances is certainly far more sudden than mercuric fulminate. We must accordingly look elsewhere for an explanation of this extraordinary phenomenon, and recent experiments appear to favour the theory advanced by Mr. Abel, that the relative power of different explosive agents to accomplish the detonation of gun-cotton appears to be in direct proportion to the mechanical effects of their explosion; in other words, to the blow they are capable of inflicting on whatever body they may be in contact with.

When iodide and chloride of nitrogen are fired on a thin sheet of copper, the indentation produced by the explosion is not nearly so marked as in the case of the mercury or silver fulminates. The indent produced by the former is not nearly so deep or sharply defined; indeed, a charge of two grains of chloride of nitrogen has been exploded on a watch-glass without fracturing it, whereas half that amount of silver fulminate was sufficient to shatter the glass to atoms. The mechanical effect of mercuric fulminate is much enhanced by confinement in a strong case, such as a tin tube, and under such conditions the violence of its action, as measured by work done, is in excess of either of the nitrogen compounds.

This may probably account for the fact that, although more instantaneous in its action, iodide of nitrogen fails to detonate gun-cotton, even in a charge twenty times greater than the usual charge of mercuric fulminate. Possibly, further investigation may throw more light on this remarkable explosive property. There may yet be some hidden peculiarity in the concussion or powerful vibration produced by some substances distinct from the mechanical force due to their explosion. There appears to be a species of *entente cordiale* between explosives of a certain class. They have a strange, undefined sympathy with one another. If one goes off, all the others in the immediate neighbourhood seem instantaneously to be *en rapport*. As the synchronous vibrations of a tuning-fork are taken up by other instruments, so the molecules of various explosives pulsate in unison. Thus, bodies in a state of high chemical tension may prove more susceptible to the operation of mechanical force chemically applied.

The value of this explosive for the hasty demolition of buildings was forcibly illustrated last summer in an experiment near Rye. A martello tower having been devoted to destruction, owing to the encroachment of the sea, 200lb. of compressed gun-cotton were laid in a heap on the basement floor. A detonating fuze having been buried in the pile, the explosion was effected by means of electric agency. As a work of demolition, this experiment was complete—the tower was utterly demolished. It has been calculated that over 1,000lb. of gunpowder must have been employed to produce a similar result. The experiment was repeated in the spring of this year with equally satisfactory results.

The demolition of the old fortifications at Portsmouth offered many opportunities of testing the value of compressed gun-cotton for military purposes. Portions of the counterscarps were blown out with comparatively small charges, and in one instance a very strong counterscarp gallery of brick and stone, about 250ft. long. and 7ft. wide, was destroyed by a charge of 60lb. of gun-cotton simply hung on nails to the roof at one extremity.

The power of hastily demolishing buildings is frequently of great importance, during the operations of both war and peace. Batteries may be constructed with secrecy and without annoyance when masked by buildings which at the proper moment may be demolished with great facility. During the fire at Quebec, many buildings had to be blown down to arrest the progress of the flames. Here, gun-cotton would have been of signal service. No tamping, no excavation would have been required. A few pounds placed in the cellar, a wire rapidly run out for a hundred yards or so, the turn of a handle, the pressure of a key, and the loftiest house would have toppled over and collapsed like a toy steeple.

The important experiments undertaken at Chatham by the Royal Engineer Committee proved conclusively the special value of compressed gun-cotton for military demolitions, such as stockades, bridges, piers, brick-walls, &c. A wooden beam 10 inches in diameter was completely shattered by two ounces of compressed gun-cotton inserted into a hole bored into the wood. A strong upright pile of foreign deal, over 17 inches in diameter, snapped off like a carrot under the influence of a necklace of gun-cotton discs. Eighty pounds of compressed gun-cotton were found sufficient to effect a complete breach through a double stockade formed of strong wooden piles, firmly bound together. The cotton was simply laid on the ground at the foot of one of the piles, and its explosion blew a passage sufficiently wide to drive a cart through. Brick walls of 18 inches thick can be destroyed in detail by a string of discs laid along the bottom of the wall.

In all these operations the lightness of the material, the absolute security with which it was handled, the fact of its requiring no tamping, and the ease and rapidity with which it may be applied, showed that compressed gun-cotton was admirably adapted for the service.

The Torpedo Committee have demonstrated that compressed gun-cotton is over four times as powerful as gunpowder when used in torpedoes.

To contain a charge of from 1,600 lb. to 2,000 lb. of gunpowder, it was necessary to provide a large and comparatively unmanageable receptacle. By the employment of a fourth of the weight of gun-cotton, or from 400 lb. to 500lb., the size of torpedoes has been reduced, and their service correspondingly facilitated. Such large charges will, however, rarely be used except in passive torpedoes. For those of an active class, such as Harvey's or Whitehead's, 100lb. of compressed gun-cotton will probably be found to be ample.

Compressed gun-cotton may, however, be the means of saving life as well as of destroying it. The submerged rock, which costs the sailor many an anxious thought and sleepless night, rapidly disappears under the Titanic hammering of successive gun-cotton charges, and the preliminary experiments at Dover and Cardiff have pointed to the feasibility of thus removing many harbour obstructions.

With a view of demonstrating the non-explosive property of compressed gun-cotton when fired by the ordinary application of heat, a number of wooden boxes, each containing 28lb. of gun-cotton discs, were stacked on one another, and surrounded with similar boxes full of clay, so as to represent the weight of the superincumbent mass when the boxes were stacked in tiers, as they would be in store. An ordinary electric tube, having previously been inserted into one of the boxes of gun-cotton, was then fired. Many of the spectators, knowing what would occur in the case of gunpowder, were prepared for a violent explosion. To their astonishment, however, the gun-cotton of the individual box merely inflamed without igniting that in the other boxes, and without disturbing the pile in any way. The experiment was then repeated by kindling a fire in the pile with shavings and tar. A considerable bonfire was the result. The outsides of the boxes burnt bravely for some 10 or 15 minutes, until at length the flame found access to the gun-cotton in one of the boxes; this was followed by a dull puff and a bright mass of flame, but there was no explosion. The materials of the bonfire were then scattered by the artillerymen in charge, in doing which a box of gun-cotton, partially charred on the outside, inflamed while being dragged by one of the men over the incandescent *debris*. Had this been a barrel of gunpowder several lives would, in all probability, have been sacrificed; as it was, the incident only caused a laugh at the agility with which the man jumped backward.

RAILWAYS IN INDIA.

The annual report of Mr. Juland Danvers, the Government Director of Indian Railway Companies, has just come out, and furnishes, among much statistical matter, the following information upon points of general interest:—

"The extent of railway communication now open in India is 5,050 miles, of which 556 miles were completed last year, and 211 since the beginning of the present year. The three Presidency towns and the capitals of the North-West Provinces and of the Punjaub are now united, and the system of trunk lines laid out by the late Lord Dalhousie may be regarded as completed. Commencing at Negapatam, the most southern terminus of the present Madras system, and proceeding by Bombay, Jubbulpore, Allahabad, and Lahore, to Moultan, on the Indus, a continuous length of about 2,800 miles of railway has been formed. All this has been effected at a cost of about £70,000,000, and profits at the rate of 3½ per cent. upon this sum were earned last year. A further sum of about £18,000,000 has been expended upon the other lines open for traffic and upon those which are in progress, making a total outlay of £88,000,000 upon railways up to the 31st of March last.

"Much progress has not at present been made on what are termed the State lines—viz., those which the Government in India has determined to construct under its own immediate supervision without the intervention of companies. A small branch from the Great Indian Peninsula Railway to the cotton mart of Oomrawuttee, of 7½ miles in length, has been opened, making the second line of this description which has been constructed by Government in the Central Provinces; but the line from Lahore towards Peshawur has not been advanced beyond laying it out as far as Jhelum, a distance of 102 miles. Delay in proceeding with the works in this undertaking has been occasioned by the proposal to alter the designs, which had been prepared for the standard gauge, and to adapt them to the narrow gauge. Now that this question has been settled in the affirmative, new plans are being made, and operations will commence in earnest. The following are the State lines in contemplation:—

		Length.	Estimated cost.
		miles.	£
The Punjaub Northern, from Lahore to Peshawur		270	3,000,000
The Indus Valley, from Moultan to Kotree		500	5,000,000
Lines in Rajpootana	from Agra to Ajmere	236	2,500,000
	from Delhi to join the above	125	
	branch to salt works	8	
From Indore to Khundwa on Great Indian Peninsula Railway		84	800,000
From Wurda, on Great Indian Peninsula Railway, to coalfields at Warora		45	300,000
From Carwar, a port south of Bombay, to Hooblee		60	700,000
		1,328	£12,300,000

The number of persons employed in the management and maintenance of 4,599 miles of railway on the 30th of September last was 69,233, or about 15 per mile; of these 5,048 were Europeans and East Indians, and 64,185 were natives. Efforts are being made by the companies and the government to bring the European staff to the lowest practicable limit. One of the hindrances to Indian railway enterprise is the necessarily expensive nature of that portion of the working staff which is filled by Europeans. To train and educate natives to perform the duties now allotted to Europeans is, Mr. Danvers remarks, an important object to keep in view in connection with the subject of economical reform. In Madras, considerable success has already attended the measures that have been taken for that purpose. The system of apprenticeship has answered very well there. As a rule, the youths have remained in the service of the companies after the expiration of their term of apprenticeship. The same plan has been adopted in Bombay, and the results are encouraging there also.

"Although there have been several accidents of a serious nature during the year 1870, the general results compare favourably with the year 1869 and most other previous years. The number of passengers killed and injured in 1870 were 13 and 63 respectively, as against 48 and 92 in 1869; the proportion of those who suffered from causes beyond their control being in 1870, 2·53 per million instead of 6·66, and of those who were killed by their own misconduct or incaution 1·65 in 1870, in place of 1·81 per million in 1869. As respects the servants employed on the railways, 113 lost their lives—13 from causes beyond and 100 from causes within their control; 134 were also injured, 114 from causes which might have been avoided. To complete the list of casualties, the number of trespassers has to be added. Of these, 78 were killed and 27 injured. A further class in the list of mortality has to be mentioned, and that is deaths in trains or at stations, of which 114 occurred in 1870. These cases, as described in the returns, show that the deaths occur under various circumstances and at all seasons, but that all may be attributed to natural causes, such as heat, apoplexy, exhaustion, cholera, which no arrangements on the railways could altogether prevent.

"Materials to the value of more than £28,000,000 have been sent out from this country for railways since their commencement; and 263,499 tons, purchased for £1,688,209, were despatched last year. There are now nine companies, representing 51,887 shareholders, 5,367 bond or debenture-holders, and 1,392 holders of debenture stock. Of this number, 51,519 are Europeans, and 368 natives of India.

"Up to the 1st of April last, a sum of about £88,000,000 had, as before stated, been expended by the companies on the railways undertaken by them. Of this, £5,500,000 was expended during the year just past, and about £614,000 represents the capital of the Calcutta and South-Eastern Railway Company, now in the possession of the government. The total amount of capital which it is estimated will be required for the lines which have been sanctioned, including those open and those incomplete, is estimated at about £100,000,000., of which £91,102,810 has been raised. But this does not include the cost of the land, interest, or loss by exchange.

"The £91,102,810 above-mentioned consists—1st, of share of capital, £78,487,585; 2nd, of debentures, £10,242,485 (of which £3,363,285 are convertible into shares at the option of the holder); and 3d, debenture stock, £2,372,740. The present financial year began with a balance of about £3,652,995 in favour of the companies towards the expenditure of the current year, which has been estimated at £4,600,000., of which £1,985,000 will be in England.

The revenue derived from the railways during the year ending 31st of December, 1870, amounted to £2,845,600, being about £340,000 in excess of the previous year. The gross receipts in 1870 were £6,213,865, compared with £5,709,382 in 1869, and the expenses £3,367,261, and £3,203,171 respectively. The amount paid by government for guaranteed interest during the corresponding period was in excess of the net receipts by £1,366,900, entailing to that extent a charge upon the revenues of the country. Of this, however, a sum of £500,000 may be taken as having been paid upon capital not yet representing open or productive lines. The gross receipts from passenger traffic in 1870 were £1,924,378, being £187,210 in excess of 1869, when they were £1,737,168. Those from goods traffic were £4,149,978 in 1870, and £3,808,767 in 1869. Miscellaneous receipts were £139,509 and £163,447 respectively. The general results with regard to passenger traffic show that the passenger tickets numbered 18,224,859, of which 135,829 were first-class, 603,486 second, 584,980 intermediate, 14,181,221 third, and 2,719,343 fourth or coolie. Thus, the third and fourth compose 92·72 per cent., the second and 'intermediate' 6·52 per cent., and the first only ·76 per cent. of the whole. Each first-class passenger paid 14s., and travelled 112 miles at 1½d. per mile; each second-class passenger paid 4s. 1¾d., and travelled 48 miles at 1·02d. per mile; each third-class passenger paid 1s. 8½d., and travelled 58 miles at 1·4 farthing per mile; each fourth-class passenger paid 1s., and travelled 40 miles at 1·2 farthing per mile. Taking the passenger trains alone (exclusive of mixed and special), the average length run by each train was 104 miles. The merchandise carried amounted to 2,633,687 tons, exclusive of coal, coke, and minerals, of which there were 801,582 tons. According to the returns furnished from India by the several companies, the average length run by each train with goods would be 144, with minerals 51 miles. The average amount paid for each ton of merchandise would be £1 5s., and of minerals 6s. 7d. Thus, the average amount paid for each ton of merchandise per mile would be 2·08d., and for each ton of minerals 1·5d.

"The important question of gauge has occupied much attention during the past year. The present width of 5ft. 6in. was fixed upon by the home authorities when Indian railways were first commenced, in the year 1869; Lord Dalhousie was in favour of 6ft.; but, after much consideration, 5ft. 6in. was decided upon as preferable. The suggestion that it would be expedient to adopt a narrower gauge for future lines of railway in India emanated from the present Viceroy. The chief ground upon which Lord Mayo and his Council came to this conclusion was economy. They considered that the railway system of India was really in its infancy; that its extension to any great length upon the existing mode of construction would be greatly retarded by the necessary outlay; that saving of cost in every direction was imperatively called for, and that such saving could be most satisfactorily secured by adopting a narrow gauge. The government of India regarded 3ft. 6in. as the maximum that should be used, but begged that this point should be determined in England. It has now been directed that the future narrow guage for Indian railways shall be 3ft. 3⅜in., this being, in the opinion of the home government, the most convenient as respects the width of vehicle which can be run on it, and one which, while equal to the present requirements of the traffic, with light rails and rolling stock, may be readily adapted, in case of an important increase of traffic, for larger vehicles and heavier engines.

WOOD PULP FOR PAPER.

This production is known to offer considerable advantages over the pulp of esparto grass, or other materials of the same nature used for paper-making. It is capable of producing any description of paper, from the coarsest kinds to the most finished writing-paper, and may now be made a very simple and comparatively inexpensive process. By Sinclair's patent wood pulp machinery, the cost of production to the unbleached stage is £8 per ton. About 42 cwt. of wood makes 1 ton of paper or dry pulp. Although the best white pine wood, at a cost of from £2 10s. to £3 per ton, is selected for the most perfect samples, coarser and even damaged wood, which can be obtained in almost any quantity at about £1 per ton, is largely used for the inferior qualities of paper. The wood is first chipped up into thin pieces of about 1 in. broad, 2 in. to 3 in. long, and ⅛ in. thick. It is then put into the boiler, and a solution of caustic soda poured over it, in the proportion of 600 gallons to 10 cwt. of dry wood. The boiler is then screwed down and fired, until it attains a pressure of 180 lbs. to 200 lbs. to the square inch, when the fire is drawn, and the boiler allowed to cool down. In about half-an-hour the lye is blown off, the top door is removed, and the contents scalded. The discharge-door is then screwed off, and the pulp drawn and washed with pure water in a poaching-engine. The fibre having been completely separated from the rosin and other matters, become easily pulped, whilst the latter are washed away. The boiler, which is tested by hydraulic power to 400 lbs. pressure to the square inch, is made of the strongest material and shape; the plates are of the very best quality, and the seams are all double rivetted. The furnace is in front at the bottom of the boiler, which is built upright on its seat, and there is a discharge branch in the rear. The flue goes round the boiler spirally to the top, and thus produces an equal heat at every part. A simple internal arrangement secures a rapid circulation of the lyes through the material, and effectually prevents the wood from being charred. The pulp produced is stated to be far superior in length and firmness of fibre to any wood pulp yet known, and the first cost and the expense of working are considerably less than those of any other apparatus in use. When the washing process is concluded, the wood is left in the condition of washed or unbleached pulp, of the value of £15 per ton, as per table given below. The whole plant required for producing about 10 tons of this pulp per week can be erected at a cost of £1,200, and worked by four men of very ordinary skill.

It is said that at some paper-mills in Scotland, where they purchase their pulp in a state of complete preparation for the mill, they have been paying £16 10s. per ton for the pulp of esparto grass, containing 50 per cent. of moisture, so that it must take two tons of this pulp to make one ton of paper, at a total cost of £33, and this therefore shows a profit of 100 per cent. to the manufacturers of wood pulp. It is further suggested that the erection of a recovery of waste furnace, to evaporate the soda from the lye, after the pulp has been boiled in it, will ensure a saving of 50 per cent. in the cost of the caustic soda. A considerable number of the Scotch papermakers are setting up the necessary apparatus for substituting wood for esparto grass, in view of the greater advantages the former is found to secure. Mr. John M'Nicol, of Glasgow, is the agent.

Materials and cost in the production of Wood Pulp, equal to one ton of Paper ready for passing through the Paper-mill:—

	£	s.	d.
43 cwt. of wood, at 30s. per ton	3	4	6
Caustic soda, for boiling the above, at 14s. per cwt., and 28lbs. per cwt. of wood	7	10	6
Bleaching liquor	3	0	0
Labour of cutting wood	0	4	0
Fuel, 15 cwt. coal, at 8s. per ton	0	6	0
Labour of boiling, washing, and bleaching	1	0	0
Total	15	5	0

Specimens of the pulp may be seen by members at the House of the Society.

EDUCATIONAL NOTES.

The Education of Girls.—At the last meeting of the British Association, in the section of Economic Science, Miss Lydia Becker read a paper "On some Maxims of Political Economy as applied to the Employment of Women and Education of Girls." In the course of her remarks she said that in various employments common to both sexes, there was one rule of almost universal application—namely, that when men and women are engaged in the same occupation, the remuneration of the women is fixed at a lower rate than that of the men. This remark had special reference to teachers, schoolmasters, and schoolmistresses in public elementary and endowed schools. Women were said to be paid less because of the action of the law of supply and demand; but there would not be such a superabundant supply of schoolmistresses compared to schoolmasters if women were not arbitrarily shut out from many remunerative intellectual employments in which they are fully competent to engage. There was another matter connected with the public educational provision for girls in which there seemed to be a violation of the principles of economic science, and of equality in regard to the two sexes—the introduction of needlework as a compulsory subject for girls in public elementary and endowed schools. Without disparaging the importance of needlework in the present condition of domestic economy, the writer maintained that it is a branch of industry, and not of learning; and that, while it might properly form part of the course of an industrial or technical school, it was out of place in an ordinary elementary school. She thought that if sewing were removed from the list of subjects taught in elementary schools, its place might be supplied by a subject which, while coming properly within the range of general education, would perhaps be even of more immediate importance to the well-being of families than even needlework—namely, physiology and the laws of health. So long as dense ignorance prevails among the mothers of the race, we must expect a stunted and ill-developed generation to grow up. After some remarks by Lord Houghton, Mr. J. G. Fitch said he gathered from Miss Becker's statements that she attributed the smaller pay of the female teachers to the deliberate arrangements of the Privy Council. But the Privy Council did nothing in the way of regulating salaries. This was done by the local committees, who made their bargains with the teachers, and whose bargains were regulated by the ordinary law of supply and demand, and by the simple fact that the salaries of well instructed women in any position were considerably less than those of the men in the same position. Miss Becker had alluded to the very large portion of time spent in needlework in the elementary schools, which she also attributed to the Privy Council, and the instructions given to the inspectors. No doubt the Privy Council insisted upon needlework as part of the course of instruction in all girls' schools, but the truth was, it was to the ladies' committees that we must attribute the fact that little girls sat dawdling over needlework during the whole forenoon of every day they attended the school.

CORRESPONDENCE.

RESOURCES OF INDIA.—COAL—THE MAYO COLLIERY.

Sir,—This colliery is situated in what is called the Googoose coal-field, at the village of Googoose, which is distant about ten miles west from Chanda. The Wurdah River, a tributary of the Godavery, passes within a mile of it, and from Chanda the southern road leads direct to the Great Indian Peninsula Railway. Googoose is about 73 miles distant from that railway by road, but I believe government is now constructing a railway to connect this coal-field with the above railway, and such new line will probably pass through Hinghunghat, the great cotton mart of the central provinces. This colliery was formally opened by the Viceroy, in February, 1870, prior to which a pit of ten feet diameter had been sunk, which intersected, at 80 feet depth, a seam of coal four feet thick, and, at 15 feet lower, or 95 feet from the surface, a bed of coal 33 feet thick was arrived at. The coal in these two beds was of variable quality, but was estimated to contain at least 20 feet thickness of good coal.

The four-foot seam is considered the best coal, and galleries have been run into it, and as it dips from the outcrop it thickens out to nine feet. The pit has been revetted with masonry and fitted with guiding-rods and two cages. There is a continuity of thick coal-beds over the Googoose area, which contains $3\frac{1}{4}$ square miles of coal-bearing rocks, which area should contain about forty millions of tons of coal, provided we take the thickness of the beds at 20 feet, and calculate on the basis that an acre of one foot in thickness will yield 1,000 tons, which will allow for wastage, &c.

At the village of Teylwassa, about ten miles from Googoose, higher up the River Wurdah, a boring struck a seam of coal 44 feet thick, at a depth of 60 feet from the surface; and at Majree, a place only 54 miles from the Great Indian Peninsula Railway, a bore-hole, on descending 75 feet, struck on a still thicker seam of $50\frac{1}{2}$ feet.

At Wurrora, a place within 47 miles distance from the Great Indian Peninsula Railway, a boring struck coal at 102 feet depth.

A fault occurs at Mundoree, between Majree and Wurrora, occasioned by the intervention of a trap-dyke, running up north from the River Wurdah.

After the opening of the colliery at Googoose, the train which conveyed the Viceroy from Nagpore to Sindhee (30 miles) was fed with coal from this pit, and it ran the distance in ten minutes under the usual time.

Chanda coal was used for a stationary engine at the Kamptee-bridge works, and 36 lbs. of it raised steam in one hour and twenty-five minutes, while the application of 28 lbs. of English coal to the same engine did not raise steam under one hour and thirty-five minutes. The coal burnt clear, freely, and without dirt, leaving very little clinker, the residuum being a light, white ash.

The State line, of 45 miles, starting from the Wurdah station of the Great Indian Peninsula Railway to Wurrora, is estimated to cost £300,000, and will be of great assistance in carrying cotton from the Hinghunghat market.

The Googoose coal gives $44\frac{1}{2}$ per cent. of fixed carbon, while Bengal coal yields 52 per cent. of the same.

There is no doubt that this colliery will be the means of greatly reducing the working expenses of the Great Indian Peninsula Railway, as will also the Wurrora pit, as they will both provide a much cheaper locomotive fuel than English coal, which costs about £4 per ton at Sindhee, while the native coal can be delivered at the same place for about £2 8s. per ton by the present carting arrangements, which latter are very heavy; and when the new lines to these collieries are opened, the coal from Wurrora will probably be delivered at Sindhee for about £1 a ton.—I am, &c.,

A. Romaine Wragge, Lt.-Colonel.

Old Charlton, 19th Aug., 1871.

EXHIBITIONS.

Moscow Industrial Exhibition.—There is to be an exhibition in Moscow, and one in a town in Siberia. The *Levant Herald*, July 19, says:—"It would seem that the example of the Industrial Exhibition held in St. Petersburg during the spring of 1870, has proved contagious, for a Polytechnic Exhibition is announced to take place at Moscow in the spring of next year, on the same plan, but upon a scale more extensive. According to the programme, as at present arranged, the proposed exhibition is to consist of two divisions, the one, which is intended to occupy the space lying between the river Moskva and the angle of the Kremlin wall, near the Taiminske Tower, will contain the mechanical and manufacturing allotments, while the other, lying within the walls, upon the open square in front of the smaller palace, will be reserved for articles of historical interest. It is expected that full particulars of the minor arrangements will be published in the course of a few days. But it would seem that the exhibition mania has spread even further than this, for it seems, by the last number of the *Russian News*, that a similar show is about to be held at Tiumen (a Siberian slope of the Ural), to which contributions are expected from the whole of Western Siberia."

GENERAL NOTES.

Social Science Congress.—The first preliminary prospectus of the forthcoming Annual Meeting of the Social Science Association, to be held at Leeds, from the 4th to the 11th of October next, has just been issued. The Congress will be presided over by the Right Hon. Sir J. Pakington, Bart., M.P. The Vice-Presidents of the Congress number among them the Bishop of the Diocese, the Earl of Harewood, Lord Houghton, Ven. Archdeacon Musgrave, the M.P.'s of the borough and some of the neighbouring constituencies, and the Mayors of Leeds, Barnsley, Bradford, Dewsbury, and Halifax. The Executive Committee and the Committees of Departments are made up of the leading gentlemen of the town interested in the various subjects coming under the departmental heads. The Departments are four in number, viz., 1. Jurisprudence; 2. Education; 3. Health; and 4. Economy and Trade; and the officers appointed to preside over them, and the special questions for discussion, are as follows:—*Jurisprudence.*—President, W. Vernon Harcourt, Q.C., M.P. Vice-Presidents, William Bruce (Stipendiary Magistrate of Leeds); Mr. Serjeant Cox (Deputy-Assistant Judge of Middlesex, Recorder of Portsmouth); W. T. S. Daniel, Q.C. (County Court Judge); Andrew Edgar, LL.D.; Arthur Hobhouse, Q.C.; Professor Leone Levi; J. B. Maule, Q.C. (Recorder of Leeds). Municipal Law Section: 1. What steps ought to be taken to establish a better system of Legal Education?—2. What is the best Constitution of Local Courts, and what should be their Jurisdiction?—3. What alterations are expedient in the Laws relating to the Devolution and Transfer of Land? Repression of Crime Section: Chairman, The Right Hon. Lord Teignmouth. Vice-Chairmen, Right Hon. Sir Walter Crofton, C.B.; Rev. Edward Jackson; J. H. Kennaway, M.P.; E. C. Wines, LL.D. (United States Commissioner on Prison Discipline).—1. How far ought the Cellular System of Imprisonment to be adopted? and how far does it necessarily interfere with Productive Labour?—2. By what Principles ought the amount of Punishment, other than Capital, to be regulated?—3. By what Measures may the Trading in Stolen Property, whether by purchasing it or receiving it in pledge, be most effectually prevented? *Education.* — President, Edward Baines, M.P.; Vice-Presidents, Sir Andrew Fairbairn; James M'Clelland; Rev. J. H. Rigg, D.D.; Rev. Canon Woodford, D.D. 1. What are the Special Requirements for the Improvement of the Education of Girls?—2. How may the Education of Neglected Children be best provided for? The question to be considered under the divisions:—(*a*) Industrial Schools and their relation to the School Boards. (*b*) In what form, if any, may Compulsion be best applied?—3. What are the Advantages and Disadvantages of Large as compared with Small Schools? *Health.*—President, George Godwin, F.R.S. Vice-Presidents, Charles Chadwick, M.D., D.C.L.; Edward Filliter, C.E.; J. D. Heaton, M.D.; Frederick J. Mouat, M.D.; F. S. Powell. 1. What are the best and most Economical Methods of Removing and Utilising the Sewage of large Towns?—2. What are the best Means of Securing the Sanitary Improvement of Human Habitations?—3. What are the best Means of Promoting the Health of Operatives in Factories and Workshops? *Economy and Trade.*—President, William Newmarch, F.R.S. Vice Presidents, Sir Antonio Brady; Samuel Brown, F.S.S, ; Edwin Chadwick, C.B.; John Jowitt; J. Garth Marshall; Walter Morrison, M.P.; A. J. Mundella, M.P., Samuel Waterhouse, M.P. 1. What Amendments are needed in the existing laws for the Licensing of Houses for the Sale of Intoxicating Liquors?—2. What principles ought to regulate the Assessment and Administration of Local Taxation?—3. Is it desirable that the State or Municipality should assist in providing Improved Dwellings for the Lower Classes; and, if so, to what extent, and in what way? The reading and discussion of papers on the above questions will occupy three days of the Congress, and two days will be taken up with the consideration of voluntary papers on subjects other than the above, coming within the scope of the Departments. The inaugural address will be delivered on the evening of the first day, and the addresses from the President of the Council and the Presidents of the Departments, one on each successive morning. The arrangements for the Congress are progressing satisfactorily, and it is hoped that the meeting will be a highly successful one.

Iron and Steel Institute.—The following is the programme of the meeting to be held at the end of the present month, at Dudley:—*Reception-room*—The Museum, Mechanics' Institute, Wolverhampton-street, Dudley, will (by permission of the Dudley Mechanics' Institute and of the Dudley Geological Society) be available for members from Monday, August 28th, until Friday, September 1st, as a general reception and writing room, post-office, telegraph-office, &c. The Committee of the Mechanics' Institute have also placed their reading-room and library at the service of visitors, and have offered the free use of the Public Hall and other rooms. *Hotels*—Visitors can be accommodated at the "Dudley Arms" and at the "Bush" hotels, Dudley; the "Talbot" hotel, Stourbridge (five miles); the "Swan" and "Star and Garter" hotels, Wolverhampton (six miles; the "Queen's," "Great Western," "Hen-and-Chickens," and other hotels in Birmingham (eight miles). *General Meetings* — On Tuesday and Wednesday mornings, August 29th and 30th, general meetings will be held in the Public Hall, Mechanics' Institute, Dudley, commencing at half-past ten o'clock, and lasting about two and a-half hours. The papers mentioned hereafter will be read and discussed. Facilities will be afforded at these meetings for the exhibition of models or other objects of interest to the iron or steel trades, on due notice being given to the secretary at least three days previously. *Visitors' Tickets*—Each member can obtain a visitor's ticket on application to the secretary. These tickets admit to the general meetings, but do not entitle the holder to visit the works or to join in the excursions. *Works to be visited*—In addition to the formal visits arranged for Tuesday, Wednesday, and Friday, the iron and other works belonging to members of the South Staffordshire Ironmasters' Association will be open to members. The situation of these will be indicated on a sketch-map of the district, which will be given out at the opening meeting. On Tuesday, immediately after the conclusion of the general meeting, a special train will be provided to convey the members to Tipton, where luncheon will be provided by the Tipton ironmasters, and the remainder of the day will be devoted to an inspection of the iron-works of that locality. On Wednesday, after the termination of the general meeting, members will proceed to Dudley Castle limestone caverns, which will be illuminated for the occasion. A special train will convey the party from Tipton Station to Round Oak Iron-works. After inspecting the works, luncheon will be provided by the Earl of Dudley. Thursday, August 31st, will be devoted to Birmingham. The Birmingham Exchange will (by permission of the directors) be available for members on showing their tickets. The following works will be open for inspection on presenting members' tickets:—Gammon and Co., Great Brook-street, glass; Fettlefold and Chamberlain, Broad-street, screws; Playton and Son, Northampton-street, jewellery; Taylor and Co., George-street, pins; Watts and Manton, Regent-place, buttons; Baker and Co., Chester-street, Aston-road, wire-mills; Thomas Richard Icknield, Port-road, edge tools; Tonks and Sons, Moseley-street, brass-foundry; May and Mountain, Berkeley-street, engineers; Hardman and Co., Newhall-hill, church furniture works; Gillot and Sons, Graham-street, pens; Bragg, T. and J., Victoria-street, jewellery; Hadley Brothers, Eyre-street, cut nails.

Population of New South Wales.—An estimated return of the population of the colnoy of New South Wales, as taken on the 2nd April, 1871, under the census of 1871, has been prepared, and has been laid on the table of the Assembly. From this it appears that the population of West Sydney is 34,755; and the population of East Sydney, 39,461. The sexes are nearly equal in West Sydney, and there are nearly 2,000 more females than males in East Sydney. The total population of the city is 75,945—38,142 males, and 37,803 females. The population of the suburbs is, males, 28,555; females, 30,255; total, 58,810; Sydney, 75,945; suburbs, 58,810; country districts, 366,825; total, 501,580. This 501,580, exclusive of aborigines, is estimated as the total population of the colony on the 2nd of April last. The increase of population in the 10 years is—in Sydney, 19,105, or over 33½ per cent.; and in the suburban districts, 21,967, or over 59½ per cent. As the returns have not yet been received from Bourke and Walgett, a similar calculation is not made in regard to the country districts. It is estimated that the population of Walgett is about 1,200, and of Bourke 2,000, which makes the grand total (exclusive of aborigines) of 501,580. It is presumed that in those sparsely-populated portions of the colony there must have been more persons omitted than usual on the occasion of taking a census, seeing that this census was taken during a time of floods.

Pianoforte Action.—A "self-acting escapement and perfect check-repeater action" was patented in 1862, by Mr. Thomas Molineux, of Manchester, and Park-village East, London. Mr. Molineux claims that it is a simple, effective, and durable action, and that it is the only check-action that has but one centre of friction; and that, consequently, the most powerful blow can be produced without increasing the weight of the touch. The following is a description of the action:—The lower end of the sticker, or hopper, rests on the key, and there is a regulating screw in the end of the key, whereon the sticker rests. The hammer is propelled by the upper end of the sticker, which is bevelled, so as to allow it to escape more freely; and there is an adjusting screw in the sticker, against which the tail of the hammer-butt comes when the hammer reaches the string. The position of the checks—one part being fixed to and working with the sticker, and the other fixed to the hammer-butt, both of which, when in motion, form the segments of a circle—greatly assist the repetition of the blow of the hammer. Towards the upper end of the sticker is affixed the lower end of a spring, the upper end of which is attached to a loop, or cord, which is affixed to the hammer-butt. By these means, when the hammer strikes the string, the tail of the hammer-butt comes against the adjusting screw on the sticker, which presses out the sticker, and thus releases the hammer from the string. The spring also draws the hammer into check. In repeating the blow of the hammer, the spring presses the sticker against the hammer-butt, and produces a very rapid repeat. To show more fully the capabilities of this action, a full-sized model has been placed in the Society's House, for the inspection of members and their friends; a working model may also be seen at the Royal Polytechnic Institute, the hammer of which strikes the strings more than a million times per annum without the action deteriorating.

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FRIDAY, SEPTEMBER 1, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

COUNCIL MEETING.

A Special Meeting of the Council, Edwin Chadwick, Esq., C.B., in the chair, was held on Friday, the 25th August, to receive a deputation from Russia in reference to the Exhibition intended to be held in Moscow next year. The deputation consisted of Monsieur Philip Koroleff, Conseiller d'Etat Actuel, Director of the Moscow Agricultural Academy, and President of the Educational Department of the Exhibition, MM. Lvoff, Nicholas Saenger, Secretary of the Society of Friends of Natural Science, and the Rev. Basil E. Popove. The deputation were introduced by Major-General Scott, C.B.

M. Koroleff made an address to the Council in Russian, which has been translated as follows:—

On the 11th of June, 1872, the Society of Friends of Natural Science, Anthropology, and Ethnography, attached to the Imperial University at Moscow, propose, with the permission of his Imperial Majesty, to celebrate the 200th anniversary of the birth of Peter the Great, falling on that day, by the opening of a Polytechnic Exhibition in Moscow.

This exhibition, which is intended to form the foundation of a Central Polytechnic Museum in the old capital of Russia, and to present, as far as possible, a complete view of the present relations of natural science and technicology to arts and commerce in Russia, as well as of the progress made by the Russian nation in applied sciences throughout a period of two centuries, since the time of Peter the Great, will, in the opinion of the society, form a most suitable tribute to the genius of this great historical character, and communicate a more elevated and especially interesting feature to the festival in his honour.

The Society of Friends of Natural Science are, however, fully conscious that their countrymen have yet much to learn from those nations who have been working in the field of applied sciences many centuries earlier, and that there are many results of their long labours which may be, with international, so to say, advantages received and applied in Russia.

It is with this conviction that the Moscow Society of Friends of Natural Science have empowered the committee, of which I have the honour to be president, to enter into relations with the representatives of science and art in various countries, with a request for their kind advice and co-operation in the furtherance of our object, that of giving our countrymen the means of knowing what they can and must derive from other nations, with benefit and material advantage to themselves.

Our first visit has been to England, and we deem ourselves fortunate in having been given the opportunity of addressing ourselves, on the above-mentioned subject, to your esteemed and influential Society. And we feel sure, gentlemen, that on acquainting yourselves with the object and character of our undertaking, you will not refuse, in the interest of arts and commerce, to give us your kind support and the help of your influence in England.

Permit me, then, gentlemen, to represent to you some of the features of the proposed Polytechnic Exhibition in Moscow. This exhibition is not, strictly speaking, an international one, for, in accordance with its immediate object, it is proposed to limit the number of nations represented in it. We hope to receive the co-operation of German, French, Belgian, and Dutch exhibitors, but we particularly hope to find the desired sympathy and aid in England, which has attained, in comparison with other nations, such vast and unsurpassed results in that particular sphere, comprising the applications of science to art and commerce, within the limits of which it is proposed to keep our exhibition.

The Applied Natural Sciences and Technicology will form the two great divisions in our exhibition. It is in these two branches of social life that England has given so great an impulse to its own people, and is able to do the same in the case of other nations.

Our exhibition is not a commercial undertaking. Its idea has been started, and is being carried out by men devoted to science and art, who have accordingly based it, not on the principle of competition, but on that of previous invitation, and selection by competent judges.

It is not yet in our means to determine what immediate results and material advantages will accrue from the exhibition to our various foreign exhibitors, but we know full well that undertakings carried out with a purely scientific aim have often led to greater results than could be expected. When men like Volta, Galvani, Oersted, Davy, and Faraday gave themselves up to the study of electricity, they certainly could not foresee that this subtle power was destined to become one of the greatest agents in the history of the whole world.

True, our undertaking is on a limited scale, and cannot boast of such extensive means as those which have ministered to the commercial success of similar undertakings abroad. We feel sure, nevertheless, that it will not be without international interest and advantage. The participation in it of, for instance, English exhibitors will open the way to the vast empire of Russia for many useful appliances and products. Russian manufacturers will be shown a source from which they may derive many improvements and advantageous facilities in the manufacture of home produce, and at the same time they will be enabled to judge what cannot be, with advantage, produced in their own country, and must necessarily be obtained from foreign producers.

Foreign exhibitors will, on the other hand, have the way opened for a greater demand and an increased sale of their various products.

The Imperial Government has taken care to guarantee the protection of inventions placed in the exhibition, which, on application being made in proper quarters, may be provided with exclusive patents, even during the time of their exhibition.

Articles sent to the exhibition will be admitted into Russia free from duty.

The committee, on its part, allows the free sale of every article exhibited or made at the exhibition.

In view of the proposed formation of a Polytechnic Museum in Moscow the Committee will also take the necessary measures that articles considered essential to form parts of a systematical collection in it, should be, if possible, secured for the museum.

Such, gentlemen, are some of the features of the proposed Polytechnic Exhibition in Moscow. For all further details with regard to the rules of the exhibition, the facilities offered for the transit of goods, &c., I beg to refer you to the exhibition programme, of which I shall have the pleasure of forwarding to your honourable Society an adequate number of copies.

I will conclude by expressing our sincere hope that you, gentlemen, will not refuse to give our society your kind assistance and support by promoting the object of our exhibition and will use your powerful influence to induce your countrymen to take an active share in it.

On behalf of the Moscow Society of Friends of Natural Science, permit me to offer you our earnest thanks for the kind way in which you have been pleased to receive our deputation, and to assure you a most cordial welcome should you be pleased to pay a visit, next year, to our white-walled city.

Mr. Chadwick said—On behalf of the Council, I am to assure you of their most hearty response to your request. They will make it known to the Chambers of Commerce and other institutions in Great Britain in union with the Society, and to their members, between three and four thousand, engaged in Arts, Manufactures, and Commerce, amongst whom, we doubt not, there are many who will be enabled to take an active practical interest in furthering your objects. All men of art and science in this country will, I am sure, sympathise with your exertions, and desire their success in Russia. We do not forget that the great sovereign—your earliest leading promoter of the useful arts—whose birth you desire to celebrate, sojourned for a time for their study in this metropolis, and returned to Russia with Englishmen to aid in their advancement. We shall be most happy if we can stimulate further progress, by showing the great advances that have been made, under peculiarly favourable circumstances, since he came to reside here.

A committee was then formed for the purpose of promoting the undertaking, consisting of—

Lord Henry G. Lennox, Chairman of the Council
G. C. T. Bartley
Frank Buckland, Inspector of Fisheries
Andrew Cassels
E. Chadwick, C.B.
Hyde Clarke
H. Cole, C.B.
E. Lawrence
W. P. Marshall
A. Murray
P. C. Owen
Major-General Scott, C.B.
S. Teulon, Vice-chairman of the Council
Major de Winton

With power to add to their number.

Rev. B. Popove, P. Le Neve Foster, M.A., } *Secretaries.*

It is further resolved that the Lord Mayor and Professor Owen, F.R.S., be requested to join the committee.

EXAMINATIONS, 1872.

The Programme of Examinations for 1872 is now in the press, and will be ready for issue in a few days, when it may be had, gratis, on application to the Secretary. It differs but slightly from that for the present year.

It will be remembered that, in the Programme for 1870, the Council decided to omit those subjects in which the Science and Art Department holds examinations, and this arrangement still continues.

Two new subjects were added last year, viz., "French Commercial Correspondence" and 'German Commercial Correspondence." The papers set are intended to test the capacity of candidates to fill the office of foreign correspondent in a house of business, and the certificates will be first-class only. No prizes are offered in these subjects, nor will the certificates be counted for the Prince Consort's Prize.

The Final Examinations, in 1872, will be held on the evenings of the 16th, 17th, 18th, and 19th April. The Time Table has been arranged as follows:—

Tuesday, 16th April, From 7 to 10 p.m.	Wednesday, 17th April, From 7 to 10 p.m.	Thursday, 18th April, From 7 to 10 p.m.	Friday, 19th April, From 7 to 10 p.m.
Arithmetic. Logic. German. Floriculture. Musical Composition.	Book-keeping. Theory of Music. Domestic Economy. English History. Italian. *Commercial German.*	Metrical System. Political Economy. French. English Language. Fruit and Vegetable Culture.	Mensuration. Geography. Latin. Spanish. *Commercial French.*

Friday, 19th April, 6 to 7 p.m.—Dictation.

Attention may be drawn to the Prizes offered with the view to encourage an improved style of writing and manuscript printing. The writing is to consist of Roman and Italic letters, from one-eighth to three-fourths of an inch in height, done entirely by the hand, without the use of instruments.

Special attention may also be drawn to the scheme for holding *vivâ-voce* examinations in Modern Languages, explained in a memorandum kindly furnished by Mr. Hyde Clarke, a member of the Council. It is earnestly hoped that this will be more extensively carried into operation next year.

The Elementary Examinations, held by the District Unions and Local Boards, for which papers are furnished by the Society, are fixed for the 12th, 13th, and 14th March.

Full details in reference to the Examinations are given in the Programme, copies of which should be applied for to the Secretary of the Society of Arts, by all intending to come forward as candidates, or otherwise interested in the Examinations.

ANNUAL INTERNATIONAL EXHIBITIONS.

EDUCATIONAL COLLECTION.

Materials and Appliances for Science Teaching.

The report on this section is by J. F. Iselin, Esq., M.A. After some introductory remarks, the reporter describes the various preparations exhibited, which are intended for teaching comparative anatomy, such as stuffed animals and disarticulated skeletons. He specially mentions a cod's head articulated so as to show every bone, with each bone numbered and named, thus giving the student great facility for acquiring a knowledge of its name and position; also a skeleton of a ferret, intended as an illustration of a method of mounting skeletons, so that they may be available either for exhibition in a museum or for use on the lecture table, or for minute study; and to this end the bones, although placed as nearly as possible in their natural relation to each other, may yet be removed separately for examination. A lobster has been prepared specially for the purposes of the lecturer, and serves as a type of the crustacea. It is so disarticulated and arranged that all the hard parts of the animal are shown, and the position of certain organs is indicated by arrows. Mr. Edwin Ward exhibits "School Museums of the Natural History of the Earth," which have been prepared with the view of facilitating the study of the products of the earth in schools, the primary object being to present as many as possible of the typical examples of the different classes of the animal, vegetable, and mineral kingdom.

After referring to the preparations for use with the microscope, the writer proceeds to describe the models in wax and other substances of portions of the body for the use of students of medicine and anatomy. They are magnified representations, and, where possible, special portions, such as muscles, are made moveable, so as to show the place of attachment, and when removed, to discover the organs beneath. Messrs. Zeiller, of Munich, manufacture a most extended series of models to illustrate the study of anatomy, physiology, and ethnology, the materials which they employ being canvas or paper, covered with wax, papier maché, or plaster of Paris, according to the nature of the subject to be represented. It is stated that they have been used with great advantage in the schools of anatomy in Saxony and Bavaria. In the Austrian collection there is also a series of anatomical preparations.

Collections and apparatus for illustrating instruction in mineralogy and geology are fairly represented in the Exhibition, and special mention is made in the report of the models for teaching crystallography; but raised maps for teaching physical geography, a science more especially adapted to the acquirements of younger students, are not numerous.

"Among the appliances for illustrating instruction in science must not be forgotten contrivances for displaying objects in museums, and diagrams to assist the lecturer in bringing portions of his subject home to his hearers through the medium of the eye. Mr. Twining—the loss of whose Museum of Domestic Economy by fire, a few days before the opening of the Exhibition, all interested in education cannot cease to deplore—has, notwithstanding the misfortune, sent to the Exhibition several specimens of the arrangements by which he has contrived to effect simplicity and economy in the furnishing of museums." Diagrams for the use of lecturers on various sciences are shown, many of them, especially those relating to geology, being, in the reporter's opinion, of considerable merit.

"Turning, now, from the appliances and models employed by the teacher of natural history to apparatus and instruments to illustrate instruction in experimental science, it will be found that the Exhibition includes some of the most noted of the makers of philosophical apparatus in this country, although it is to be regretted that most of the provincial manufacturers do not exhibit. Nothing has been shown from France or Germany, although the good and cheap apparatus (more especially from the latter country) are in request in England, and are largely imported by our own dealers. Austria, alone, of foreign countries, takes a prominent place in this branch of the Exhibition. The Minister of Public Instruction in Hungary has sent a large and excellent collection of apparatus for teaching natural physics, manufactured in Vienna and used in the Hungarian polytechnic and trade schools."

Of the philosophical instruments exhibited, electrical and magnetical apparatus is, perhaps, the most fully represented. Some electrical, galvanic, and magnetic apparatus, made expressly for the use of teachers of physics in artisan and elementary science classes, is especially referred to. "One of the great drawbacks to the successful introduction of experimental science, as a subject of instruction at Mechanics' Institutes and other educational institutions for the working classes, has been the very high price at which the instruments necessary for the proper illustration of the teaching are generally offered for sale. This difficulty the exhibitor (Mr. Peters, of Clerkenwell, himself a working man), has endeavoured to obviate, and without sacrificing accuracy of workmanship, to produce apparatus which shall be within the reach of poor students, and he appears to have produced really useful apparatus at remarkably low prices.

"Optical instruments are represented in the Exhibition by some of the most renowned makers in London. The beauty, precision, and high finish of their manufactures, however, almost take them out of the class of educational objects, as their naturally consequent high price puts them above the means of most ordinary students, and confines the use of them to those engaged in scientific research of an advanced order."

Apparatus for use in the laboratory is shown by one exhibitor only, Messrs. Griffin and Son, and in mechanical science there are only one or two exhibitors. Other branches of science are represented by single exhibitors. Messrs. Pastorelli show a set of meteorological instruments specially constructed to advance and popularise the study of meteorology, by offering to schoolmasters, students, and others, a set of instruments combining cheapness with accuracy. Mr. S. Highley shows a model of a magic lantern and screen, which he has devised for the use of lecturers, and which has been introduced with very satisfactory results into the Russian military college.

In conclusion, the writer expresses regret at the absence from this portion of the Exhibition of any display on the part of foreign countries. He says:—"This regret cannot fail of being heightened when it is considered that this section of the Exhibition is the one which bears most directly on technical instruction, and therefore a great deal might have been expected from Germany and Switzerland, countries to which we look up as models in this branch of education. From the former country we have scarcely anything worthy of notice; from the latter absolutely nothing. No doubt the unfortunate course of events on the Continent during the past year has had the effect of turning men's attention to subjects of more direct importance, and it may be that it is on this account that the portion of the Exhibition of which this report treats has not assumed a more international character. Would it be too much to ask that her Majesty's Commissioners should return again to this subject? The national importance of technical and industrial education cannot be overrated, and a great step gained is it for us to have a personal knowledge of what other countries are doing, and the aim they have in view. If it might be allowed to the writer, he would venture to suggest technical instruction, its means, appliances, and results, as a branch of one of the future annual international exhibitions. It may be that, in a year or two, when the Continent again knows the blessings of peace, a more extended display of this character could be got together. Then such institutions as the Polytechnic Schools at Berlin, Dresden, Hanover, Vienna, Prague, Zürich, Munich, Nüremberg, Stuttgart, and Carlsruhe, the Mining School at Freiberg, the Building Schools at Nienburg, Holzminden, and Chemnitz, the Central School at Paris, the Schools of Arts and Trades at Châlons, Aix, and Angers, may consent to send us apparatus and appliances showing fully their methods of instruction. Such an international collection would make a display which could not fail to excite the attention of educationists in this country, and bring vividly before them the great efforts which continental nations, notwithstanding their natural drawbacks, are making to contest with England the palm of industrial supremacy. Every now and again the note of alarm at the deficiency of our working population in the scientific knowledge bearing on their trades is raised, but only to die away again, leaving little or nothing done in the way of improvement."

THE TEACHING OF ART AND SCIENCE.

At a meeting recently held for the purpose of promoting the establishment of a National Technical University, Sir Antonio Brady presiding, Captain Mercier, in the course of an address, related his own views and experience as an artist, in the teaching and application of industrial art:—

"In addition to teaching our children to read, write, and cipher, let us teach them practically whatever calling in life it may be their lot to follow. Let us so educate them that they shall be able to compete on equal terms, and therefore successfully, with the workers of other nations. Give them fair play, and, as Britons, they will hold their own. Fair play to our sons and daughters means, that as the children of other nations are technically taught, ours must be technically taught. To the three popular 'R's' we must tack on 'art and science.' If the system which is pursued in Bavaria is any criterion, my feeling with regard to art is in unison with that which is entertained there, for little children from six years old are taught drawing in all the Bavarian schools, and have been for years past. The late King Louis, of Bavaria, gave the subject of technical education his careful consideration, and established a complete system in Munich, the capital of the kingdom. This included special schools, which, by law, every child has to attend from the age of six to twelve or thirteen. In these special schools drawing forms by no means an insignificant part of the instruction given. As an evidence of what this system of technical education is capable of doing, let me mention the change it effected in Munich. In twenty years, the population more than trebled itself, and the city, from being dull and uninteresting, has become a place of resort for artists of all nations. It is now a repository and school of arts, and is visited by the lovers of the beautiful from all parts of the world. The King of Bavaria, in providing for the technical education of his people, created a city which will remain a lasting monument of his goodness, energy, and taste. Let us follow the example set by the King and people of Bavaria, and, in twenty years hence, we shall be in a position to tell a different tale from that which we can now relate of the twenty years that have passed since 1851. In 1851, Englishmen had a right to be proud of their country. The genius of Paxton had given them a building which the whole world regarded with wonder and admiration, and English manufacturers stored it with productions which, as the productions of nations then stood, more than bore comparison with any. In one branch only were Englishmen inferior to foreigners, where the application of art was necessary. Since that glorious epoch in the history of our country, there have been three other international exhibitions. The Emperor of the French, ever ready to co-operate with England in any great work, promoted that of Paris in 1855. In 1862, England had its second exhibition, to be followed again by that of 1867 in Paris, when we learnt, in the language of Mr. Scott Russell, "not that we were equalled, but that we were beaten, not on some points, but by some nation or other, at nearly all those points on which we had prided ourselves." It brought home to us the startling truth that, as producers of those industries in which we thought ourselves superior to other nations, we were inferior, and inferior, too, to younger nations, who lacked the natural advantages possessed by our country in abundance. Directly we realised the facts we took practical measures to ascertain the "Why's and wherefores." Special commissioners were dispatched by government to report on the results of the exhibition, and the Society of Arts sent over a number of working men, that the subject might also be considered from the artisans' point of view. The testimony given by the commissioners and by the body of eighty-six working men, showed conclusively that the superiority of foreign workmen was due to the superior education which they received generally, that that education was especially adapted to the occupation which the artisan followed, and included the general instruction of drawing. The voluminous reports which these gentlemen furnished in every way confirmed the testimony already obtained, that the Continental system of education is a practical one of applied art and applied science; that not only is every child taught to read and cypher, but it is taught to draw; that when a child's primary education is supposed to be complete, it is removed to higher schools, where principles of elementary art and science form a portion of the instruction imparted, and where special instruction is given in the application of the principles of science and of art to the vocation the child is intended to pursue; that, in fact, the system of education on the Continent is a technical one; that whilst we have been going on in the old-fashioned jog-trot manner of letting those learn who cared to learn, letting those who did not to leave it alone, France and the nations of Germany have established a grand system of science, art, and trade schools, in which their artisans acquire that technical knowledge which enables them to excel ours when work of rare skill has to be executed; that whilst education is with us desultory, thousands and thousands not being educated at all, on the Continent it is general, and it is extended to all, without exception. I have mentioned that the children of Munich, from the age of six to twelve or thirteen, are instructed to draw. Let me now mention that the drawing in the primary schools is followed by more practical drawing and teaching in the advanced schools, and also in the holiday and Sunday schools, more hours in each week being devoted to the teaching of drawing than to any one subject. Thus, in the enlightened countries of the Continent, the machinist, the cabinet-maker, the carpenter, the stonemason, in fact, the artisan generally, whatever his occupation, is taught drawing—and that special drawing which will be most serviceable to his trade. What a different story must we tell of ourselves. How many, or rather how few, can draw? Any taste which, as children, they may have had for drawing, as already pointed out, was nipped in the bud, and very little effort has been made to revive it. None in school —perhaps he has never been to school—none as apprentice, and none as a journeyman, for few working-men care to enter themselves as students in schools of art. Some few good fellows there are who do make the attempt; their experience is, however, unsatisfactory, and they give it up disappointed and disheartened. They find that they have no power with their hand or eye, and have not the patience to drag through the drudgery of the pot-hooks and hangers of drawing which some of our school of art masters insist is necessary. Consequently, the advantages which our schools of art offer (and they are really important) are, to a large extent, only enjoyed by the middle class. This is not what our Science and Art Department intended. To show that it would not be difficult to teach the artisan drawing, and to interest him in learning to draw, let me relate my own experience as a teacher. Some years ago I volunteered my services to the Council of the Salford Working Men's College, with the view of establishing a drawing and painting class, to which I undertook to act as honorary master. My offer was accepted. The Council provided liberally the usual requisites, consisting of plaster casts, lithographs, examples, easels, drawing boards, &c. The class opened with some thirteen or fourteen pupils, one a house-painter, one a railway goods porter, and another a packer. Having no experience in teaching I commenced with the stereotyped method of setting the pupils to draw straight lines, and several evenings were spent—or rather wasted—over them. The pupils were evidently getting discouraged, and no wonder, for the copying of straight lines, night after night, would weary the most patient. It being evident that a successful result could not be achieved with such a system, I determined to try another. I discarded the lithographic example, and substituted a square office stool. This was drawn first in the most simple position, presenting to the pupil's eye really only a series of straight lines. When a sufficiently good drawing was made in that position it was placed in a more difficult one, and so on from stage to stage, practical lessons in perspective being acquired at the same time. The result was beyond measure gratifying to the pupils, the college, and myself. From the office-stool we got to a Windsor chair, from the Windsor chair to still more complicated forms, a cabbage, a bunch of turnips, whatever, in fact, was suited to the ability of the pupil. The class prospered. The house-painter and railway goods porter, both of whom had unmistakable genius, gave up their trades. I took charge of them for a time, and they only left me to earn their livings as artists. The packer became a pattern designer. The cause of my success with this class, the only one which I have ever attempted to teach, was that the system which I adopted was a practical one—in other words, it was technical. It was suited to the capacity of the pupils; it was interesting; it was comparatively simple; and the result of an hour's lesson was tangible. It created a feeling of confidence of himself in the pupil, and that feeling of confidence gave his eye a ready command over his hand. In contrast to the method just described, imagine some of our schools of art pupils "working for weeks over an outline which is only a bad imitation of another outline." This is no exaggeration, for it is a description given by a school of art master in his own words.* Can the unfortunate students who have to work "for weeks over an outline" have any other feeling than that of disgust for drawing. An important step is the education of our masses, especially our skilled artizans, in the knowledge of what is good and what bad in taste. Doubtless many will feel, especially those who reside within easy reach of South Kensington Museum, that all that is necessary for the inculcation of correct principles of taste is now being done, and that consequently there is no occasion for us to bother ourselves. Though I never visit the Museum without mentally thanking its promoters for the benefits which it confers, I cannot admit that it supplies all that is necessary. In the first place, it is doubtful whether the majority of its visitors are those who most need the education which it was established to give. The machinery for registering the number of visitors does not indicate their social rank, and I must confess on all occasions when I have been there, the majority of my companions appeared to be of the better class. If we are to have an educated people, and if the people are to be educated by museums, those institutions must be established in various parts of the metropolis, and in every town of any importance in the United Kingdom. On this subject there cannot be two opinions. Indeed, thanks to the untiring energy and public spirit of Sir Antonio Brady and the gentlemen who worked with him, the justice of this principle has been admitted, and I presume a splendid museum will shortly be opened in the east end of the City. With reference to museums, permit me to avail myself of the present opportunity to suggest a course which, in my humble opinion, would not be difficult of adoption, by which their usefulness would be very considerably increased, and which would remove the reproach which some persons cast upon South Kensington, that it is "simply a magnificent show." A publisher who undertakes to engrave a picture, in exhibiting it takes care that its beauties shall not be overlooked. Having some knowledge of human nature, as our ancient friend "Sam Slick" would say, he knows very well that if left to speak for themselves, the good points of the picture would not be appreciated, if they were even noticed by one man out of every thousand who looked at it. If it had got a "name," possibly the public, prompted by a feeling of curiosity, would be tempted to look at it, and might pronounce it "very pretty," and if they could do so unperceived, would pass their fingers over it to feel if it was smoothly painted or otherwise, as a wealthy, but not over educated, lady did in my own studio on one occasion. Rubbing her hand over the picture (which fortunately was dry), and looking me straight in the face the while, she exclaimed, "How beautifully painted; so exquisitely smooth!" Had the picture been roughly painted, she would doubtless have thought it a daub, and said nothing. But to return to the publisher. He engages an able lecturer, who perhaps every half-hour gives an address on the picture, descriptive of the story it is meant to tell, this or that special quality of artistic excellence, its wonderful texture, its richness of colour, its depth of tone, &c., until the sympathies of his audience are entirely with the picture, and they see in it all the attributes so eloquently expatiated on by the lecturer. The natural result is that they subscribe for the engraving. What the publisher does with his picture, I would suggest the authorities of South Kensington Museum should do with the wonders of art and industry of which they are the custodians. To each section or department of the Museum it would be well to attach a lecturer, who at stated hours should give practical addresses on the treasures in his department. The value of such addresses would be immense. Thousands and thousands who go through the Museum see without understanding. In fact, the majority who do visit it do so from the love of sight-seeing, just as they go to Madame Tussaud's, the Tower, the Monument, or any other of the wonders of London. As some may meet this suggestion by saying that lectures are already given at South Kensington Museum, let me point out that these lectures are in courses of six or twelve, that they are addressed to the scientific and learned, not to the people who most want instruction, that they are given in the lecture theatre attached to the museum, not in the museum, and that the cost of admission to the lectures places them beyond the reach of the working man. As it is not the educated but the ignorant that we wish to provide for, the courses of lectures which are given from time to time do not in any way do away with the necessity for the plan I have carried out. The addresses I desire in the museum should be specially addressed to the working man, and should be purely descriptive of the history, style, excellence, and manufacture of the objects in the museum. Some may further combat my suggestion by saying that the artist-workman can educate himself in the museum without the aid of any lectures. Of course I know that he has to do so at present, and therefore there can be no question of his ability. Still, however great the ability of the artist-workman, it appears to me that the hints of an able lecturer, with the objects to refer to, would be of great value even to him, whilst to the thousands and thousands who now leave the museum as ignorant as when they entered it, the boon would be beyond value and above price, as the book of art (which South Kensington to my mind is) is to them a closed volume. We do not content ourselves with placing the Bible within the reach of all and in the hands of all. Simple as are its truths, we provide and specially educate men of the highest intelligence to teach it to all. Having spared no expense in making South Kensington Museum an institution of which England may well and justly be proud, having stored it with treasures so costly, surely we might expend a few additional pounds to provide lecturers to describe to us those beauties which to the uninstructed are unseen, or at most are curiosities, as which they are regarded by the majority of the poor who do enter the museum. Should my humble suggestion commend itself to the authorities at South Kensington, the museum will become a national university of taste, and it will do more in educating the masses in correct principles of taste, and in the application of art to industry, in one month of thirty days than it can do now in one year of three hundred and sixty-five. I have said that educating our skilled artisan in correct principles of taste would be the second step towards the application of art to industry. Taste, as you know, is a doctrine on which authorities differ. Rules dogmatically laid down by one, are as dogmatically contradicted by another.

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* Prize Report on the Art Educational Section of the Paris Exhibition of 1867, by Walter Smith, Esq., Head Master of the Schools of Art in Leeds, Bradford, and Wakefield, page 12.

We, however, cannot do better than accept Carlyle's definition, as I will venture to interpret it. Taste means a reverence for all that is orderly, good, and beautiful. An object of art industry must have the following qualities:—Orderly, it must be modest and subdued; good, it must be calculated to serve some purpose of utility; beautiful, it must be symmetrical in form, and if ornamented, its embellishments must be appropriate. Objects of industrial art, from the saucepan in the kitchen to the vase in the drawing-room, from the flower dredges to my lady's rouge pot, may be classed in two divisions, the useful and the ornamental. There is, therefore, no difficulty in applying my interpretation of Carlyle's principles of taste. An object of simple utility must by its shape be fitted for the purpose it is intended to serve. In construction and material it must be durable. In form it must be symmetrical and shapely. An ornamental object must be appropriate in form and harmonious in colour and ornamentation. It must be calculated to serve some useful purpose; it must be designed from nature. Identical principles of taste, it will thus be seen, are applicable to the works of the simplest utility as to those of the highest ornament. With regard to ornamentation, let me here say that the ancients in introducing it were not influenced by the mere love for idle display. Ornaments for either the temple, the private residence, or for the person were all intended to serve and did serve some useful purpose. In those days, as there are in our own degenerate time, there were ignorant and vulgar persons, the only means of educating whom was through the eye. Ornamentation was introduced into the Temple to instil into them a feeling of reverence, to remind them that when they stood within its precints they were on holy ground, and therefore must be decorous in their behaviour. Ornamentation of objects of utility was introduced to induce the same class to use them, and in like manner with ornaments for the person, as they were disposed to pay less attention to attire than was consonant with our ideas of propriety, hence the introduction of anklets, armlets, and necklets. Though for convenience I have divided objects of art industry into separate classes, they really appear to me to belong to but one. The same principles of taste, as I have shown, apply to both, and prove that to be valuable the ornamental article as well as the article of mere utility must be orderly, good, and beautiful. A useful article will therefore be an ornamental one, whilst an ornamental article must be useful. The more this view of the subject is considered, the more it will commend itself, contrary though it is to the popular belief that a useful article must be ugly, and an ornamental one useless. When we receive that general education in technical taste which must come with the general teaching of drawing, our poorest artisan will be infinitely happier than he is now. The appliances of his household, however simple the material in which they are made, will be found to gratify his intellectual faculties, as well as to contribute to his bodily comfort. No matter how commonplace the material of which an article is made, if its form is symmetrical, it will be a source of gratification to the possessor, and will exercise a refining influence on his nature; and though he may be unable to explain why he is gratified, he will be conscious of the fact. Man is endowed by nature with very many gifts or instincts. An appreciation for, and a love of, the beautiful is one of them. Thus we often hear the art uneducated say, in expressing an opinion on a picture, "Though I know nothing about painting, I know what pleases me." In further illustration let me tell you, as a portrait painter, that the best judge of a likeness is a child, and that I would be guided more by the child's opinion than that of the most accomplished critic. In further consideration of the application of art to industry, we must to drawing and taste add design. Design, though greater than drawing or taste, is the offspring of both, for unless a man can draw he cannot design, and unless he can apply the principles of taste, he cannot design correctly. Having, however, learnt to draw, and to apply the principles of taste, which I have laid down, the art workman will readily learn to design, design being understood to mean the power to invent new forms for useful objects, new embellishments for ornamental ones, and new patterns for materials. The art-workman wishful to do this, and to do it well, must remember our three guiding principles, order, goodness, beauty, and with these principles well engrafted on his memory, he must study the productions of others, with the view of finding to what extent they possess or are deficient in those qualities. With this aim he cannot study a fine object too attentively. Let him imprint its beauties on his mind, let him make notes of it, but if he wishes to produce an original work to excel as a designer, he must design not from any man's work, I care not how grand it is, but from nature. As speaking my own sentiments, and as having given the subject much careful consideration, permit me here to say that a grave national indiscretion is committed in sanctioning and encouraging the system of copying which is commenced in our schools of art, and is continued in our national galleries. The energy of our art students is wasted by the system; their genius is blunted by it; their powers of imagination are lost by it; their time is wasted by it. We cannot, therefore, too strongly protest against its continuance. We Englishmen, though we can invent machinery the most complex and powerful, and than whom, if we will only take the trouble to exercise the faculty, there is not a more imaginative race, cannot invent an educational system of our own. Whatever we do as teachers, whether it be of physic, science, or art, or the simplest conversatory knowledge, must be after methods invented and in use by other nations. Hence, because copying works of the great masters is thought a good thing on the Continent, we encourage it here; and yet whoever heard of a great painter being made by the system. Sir Joshua Reynolds, when he went to study in the galleries of Rome and Florence, did not waste his time in copying; no, not even those works which he most admired. He did as I have recommended our students of design to do, he made notes. Studying the works of the great masters in art and industry is one thing, copying those works is another. The student cannot study them too attentively or too minutely. Let him learn their beauties by heart, as he would a charming verse of poetry or a striking passage of prose, but no copying. Having impressed his mind with all it will receive of the qualities of this picture or of that vase, let him work from nature, and endeavour to embody some of those excellent qualities which commended themselves to him. Such a system will give his genius some chance, and if persevered in will produce successful results. These remarks are as applicable to the industrial art-student as to the fine-art student. For, as in drawing and painting, so in designing, the student must learn from some natural object. By all means let him be surrounded with the best examples of design. To each, however, should be appended an analysis, showing by what objects in nature its form was probably suggested; the reason of its fitness or otherwise for the purpose intended; what natural object had probably suggested its ornamentation, and why the ornamentation was appropriate or inappropriate. Were this done in our museums, their value as educational institutions would be increased a hundred-fold. The student would be able to refer from the objects to nature; he would learn to discriminate between the most excellent and the inferior designs, for the reason why one was good and the other bad would be made apparent to him. The student would also be led to discover some of those endless, ever-varying forms which nature is constantly presenting, but which, owing to deficient culture, are unobserved by the majority. Wherein lies the difference between the great and the inferior painter; the great and inferior designer? The one copies from God's works, the other from man's.

The great painter having determined on the subject for his picture goes to nature for each part in it; he will have his model for everything; if it only be a blade of grass, he will paint it from nature. Not so with the inferior painter. His picture is made up from the works of others. An appropriate bit is copied from one picture, and other appropriate bits from another, and photography is largely requisitioned. The great painter and the great designer are ever on the alert for fresh effects or forms, storing them up in their memory, and calling them forth as they are required. If we only knew the history of all art treasures, we would find that each was due to some accidental circumstance, which suggested to the mind, sensitised by study, its applicability to it. An untrained eye might see the same effect or object a thousand times without its suggesting any application. If our designers of the future will take the hint, original works will become as plentiful as blackberries in September, and instead of following the occupation as a "to get bread and cheese" business, they will do so from pure love, finding greater pleasure the deeper they dive in the mysteries of the art, and finding, what is more, that it is not a mystery at all. That it is far easier to be original than to copy, far easier to produce original designs from nature than from the designs of another. The blossoms of spring, the flowers of summer, the fruits of autumn, the frosts of winter, present their ever-varying beauties as suggestive of designs for textile fabrics and wall-papers, whilst the whole animal and vegetable world offer their treasures to the designer of the useful and the ornamental. From what I have said, it will be seen that the application of art to industry by us as a nation means three things:—A general and thorough knowledge of drawing; the acceptance and application of the interpretation which I have given of taste, and a universally spread veneration for the sublime and ever-varying beauties of nature.

THE POSTMASTER-GENERAL'S ANNUAL REPORT.

The report of the Postmaster-General on the work of 1870 is of special interest, the year having been remarkable for several events which must have put the powers and capacity of the department to a severe test. There was the transfer of the telegraphs to the Post-office; there were important postal changes, which came into operation in October; and there was interruption in our foreign communication by the war between Germany and France. The changes which came into operation in October were three. One was the introduction of the halfpenny card post; and so convenient has this been found that about 1,668,000 of these cards circulate through the post-offices in the United Kingdom in a week—1,374,000 in England, 167,002 in Scotland, and 127,000 in Ireland. At the same time the postage on newspapers was reduced to one halfpenny, without restriction as to weight or superficial area; and this will prove one of the most acceptable of modern improvements. The newspapers circulating through the post in the United Kingdom in the last quarter of the year 1870 are estimated to have been about 22,500,000, as against 20,000,000 in the corresponding quarter of 1869. Lastly, there was the reduction of postage upon book-packets, patterns, and samples, from one penny for four ounces to one halfpenny for two ounces—a fair and useful change in the arrangement of the charge. In the last quarter of the year 1870, the book-packets, circulars, and pattern and sample packets passing through the post are estimated to have amounted to about 21,630,000. The Post-office, however, considered it necessary to insist strictly on the limitation to *boná-fide* patterns and samples. The public had not been strict in the observance of that limit, and much discontent arose. On this account, and from the difficulty of defining samples, it was determined to reduce letter postage to such an extent that not only samples, but all light articles, may be sent through the post in closed covers for a moderate charge, thus abolishing the distinction between letters and samples, and providing a cheap post for small parcels. This change to a charge of 1d. for one ounce, 1½d. for two ounces, and an additional halfpenny for every additional two ounces up to 12 ounces, which will be carried for 4d., and will form the final limit (no letter or parcel to exceed 12 ounces), is yet a pleasure to come, but we believe it will not have to be long deferred. The book-packet rate will remain as at present.

With regard to the interruption in our foreign communications caused by the war, the report says, very early in the campaign it became necessary to make fresh arrangements for forwarding mails which had previously gone through France. The North German Lloyd vessels ceased running to New York. The risk of interruption to our Indian mails became serious. It was found necessary to abandon the Marseilles route altogether, and to send through Belgium and Germany by the Brenner Pass to Brindisi, and thence by Italian packet to Alexandria, and this route has not since been departed from. On the whole, this change has been decidedly advantagous to the public—the postage is lower and the route is more expeditious. But it was in respect of the mails for France itself that the greatest perplexity prevailed. Amiens, the very keystone of communication, was threatened, and eventually closed. The mails were diverted from Calais to Cherbourg, Dieppe, and finally St. Malo. In the communication with Paris the pigeon post has become matter of history. Letters intended for this novel mode of transmission had to be sent to the head-quarters of the French Post-office at Tours, where, it is understood, they were all copied in consecutive order, and, by a process of photography, transferred in a wonderfully reduced form to a diminutive piece of very thin paper, such as a pigeon could carry, the photographic process being repeated on their arrival in Paris for the purpose of obtaining a larger impression. The letters were required to be posted open without cover or envelope, registered, and restricted to 20 words; they had to be written in French, in a clear and intelligible manner, and relate solely to private affairs and contain no allusion either to the war or to politics. The charge was fixed at 5d. each word (the name and address counting as one word), and 6d. for registration. Between the early part of November, 1870, and the end of January, 1871, 1,234 letters were sent from London to Tours for despatch by pigeon post to Paris, then invested. With regard to other foreign postage arrangements, the report chronicles a reduction in the rate of postage between this country and Germany, and upon British mails passing through Germany; further steps towards the abandonment of the inconveniently small quarter-ounce scale, a reduction of the postage between this country and Norway, and several new contracts for the conveyance of mails by sea. The establishment of a colonial service between San Francisco and New South Wales and New Zealand makes the latter colony, the last point on the route *viâ* Suez, the first point on the new one, receiving its mails from England 10 or 11 days sooner than before. It may be also mentioned here that the total estimated number of international letters sent to and received from the United States in 1863 was 2,241,440; in 1868 the postage was reduced from 1s. to 6d.; and in 1869 the number was 5,265,000; on the 1st January, 1870, the rate was reduced to 3d., and in that year the number of letters was 6,675,000, an increase of 171 per cent. over 1863.

The home service shows in 1870 an increase in the number of head post-offices in the United Kingdom from 839 to 844. Seventeen towns were provided with additional mails to London. One town has now nine mails every day from London, and eight with additional mails to London. The system of midnight despatches from London has been extended to additional towns, admitting of letters posted too late for the ordinary night mails being included in the first instead of the second delivery in the morning. The provinces have been very generally provided with a late day mail despatch to London, so that letters passing through the metropolis may there be disposed of overnight instead of in the morning. Greater use is made of the night railway trains. The number of contracts for the use of all trains has been increased; and in all three kingdoms the conveyance and delivery of letters has been accelerated. In England, there was, at the end of the year 1870, 357 towns with both a night and day mail from, and 258 with a night and day mail to London; 76 towns with three mails daily from, and 94 with three to London; 63 towns with four mails daily from, and 82 with four to London; 27 towns with five mails daily from, and 43 with five to London; 2 towns with six mails daily from, and 7 with six to London; 3 towns with seven mails daily from, and 2 with seven to London; and one town with eight, and one with nine mails daily from London. The number of letters delivered in the United Kingdom increased from 831,914,000 in 1869, to 862,722,000 in 1870—viz., 714,278,000 in England, 83,265,000 in Scotland, 65,179,000 in Ireland, being 31 to each person in England, 25 in Scotland, 12 in Ireland. The increase was 3·8 per cent. in England, 2·8 per cent. in Scotland, 3·4 per cent. in Ireland. The number of book packets, newspapers, and pattern packets delivered advanced from 108,668,000 in 1869 to 130,169,000 in 1870—viz., 101,710,000 in England, 13,766,000 in Scotland, 14,693,000 in Ireland; in England the increase was 21·9 per cent., in Scotland 17·7 per cent., in Ireland 8·3 per cent. The number of money orders issued increased from 9,811,432, for £19,395,635, in 1869, to 10,231,525, for £19,993,987, in 1870, viz., 8,717,972, for £17,062,015, in England; 838,942, for £1,607,964, in Scotland; 674,611, for £1,324,008, in Ireland; the average amount of an order being a fraction over 39s., and the average commission 4·19d. The increase in money orders issued in 1870 over 1869 was 2·9 per cent. in England, 4·8 in Scotland, and 3·2 in Ireland. In 1870, 24,674 money orders were also issued in the United Kingdom for payment of £97,765 abroad; and 125,575 orders were issued abroad for payment of £548,624, in the United Kingdom. The number of letters returned in the year declined to 3,792,894; no less than 11,505 bore no address at all, and 289 of these were found to contain money, to the amount of £3,376. Nearly all the returned letters were restored to the writers, but 212,224 were either destroyed or remained in hand when the return was made up. There were also returned, in 1870, 864,210 book packets, 21,683 pattern and sample packets, and 613,007 newspapers. Of the whole 936,000,000 letters and book packets passing through the post in 1870 unregistered, 27,913 were alleged to be lost; the number seems large, but it was ascertained that many of these letters had either never been posted, or had been delivered. The number of inland registered letters and packets passing through the post in 1870 was 3,005,094, and only 12 were lost, or not quite one in a quarter of a million. The gross revenue of the Post-office in 1870 was £4,929,475, of which £184,093 was for commission on money orders; the cost of the service was £3,435,865 (£1,737,768 for conveyance of mails at home and abroad, and £1,698,097 for collection, delivery, and management); the net revenue was £1,495,610. In the five years 1861-65 the net revenue averaged £1,001,763 a-year; in the years 1866-70, £1,407,046. At the end of 1870, the staff of officers, omitting those exclusively employed on telegraph duties, was 28,429, of whom 70 were stationed abroad. The number was above 1,000 more than at the end of 1869. The increase was caused by the October changes, and the growth of Post-office business generally. The number includes 14,318 sorters, letter-carriers, messengers, &c., and 13,893 postmasters and clerks. There was an addition of 750 to the London establishment, and a great part consisting of boys employed mostly in the sorting of newspapers.

The Post-office is now used for other purposes besides the conveyance of letters. It issues dog licenses and what are now known as "establishment licenses." In 1870, the Post-office issued 524,077 dog licenses, at 5s. each; and some persons would be very thankful if there were no more than this number of dogs in England. In the same year the Post-office issued 72,053 licenses, at 15s. each, for male servants; 30,716 licenses, at 42s., for carriages, and 72,817 at 15s.; ten licenses to horse-dealers, at £12 10s.; 199,330 licenses at 10s. 6d., for horses and mules; 5,774, at two guineas, for armorial bearings, and 9,991 at one guinea; and 40,742 gun licenses. The Post-office savings banks had, at the close of the year 1870, 1,183,153 depositors, with £15,099,104 due to them. In the Post-office savings banks and old savings banks there were at the end of 1870, 2,567,909 depositors—2,235,238 in England, 234,228 in Scotland, and 98,443 in Ireland. There were also 2,480 government policies of insurance, insuring sums amounting to £190,072; 1,532 immediate annuities, amounting to £30,632, purchased by the public for £349,553; and 238 deferred annuities, amounting to £4,677.

THE IRON AND STEEL INSTITUTE.

The members of the Iron and Steel Institute met on August 29th, in the hall of the Mechanics' Institute, Dudley. Mr. Henry Bessemer, president of the institute, occupied the chair.

Mr. Henry Johnson, hon. secretary to the Dudley Mining Institute, read a paper on "The Geological Features of the South Staffordshire Coalfield, with special reference to the future development of its Mineral Resources." In the course of the paper, Mr. Johnson said—In its virgin state, the South Staffordshire coalfield was remarkably rich both in coal, ironstone, and limestone, and as, owing to the geological structure of the country, the principal seams of each cropped out in various places, the mineral riches of the district could not well escape attention. In point of concentration of wealth, no part of Great Britain has presented more striking characteristics than South Staffordshire. Within a comparatively short distance from the surface, a great number of rich seams of coal and ironstone exist, and in several instances the ironstone is so closely associated with coals that both are worked by one operation. The most valuable seam is the famous thick or ten-yard coal, which represents a deposit of carbonaceous matter not found in a single stratum in any other coalfield of Great Britain. This enormous bed of coal may be said to consist of numerous minor beds, in some cases a very little foreign matter intervening, but in the south end of this coalfield much clayey deposit separates the beds. Notwithstanding, however, the extent of the minerals originally existing in this coalfield, the requirements of the local iron manufactures, and of other manufactures that spring up in the neighbourhood, together with the demand for domestic consumption, have led to a large continuous exhaustion of coal; and I think it is generally admitted that the older portion at least of the Black Country is nearly worked out and exhausted. Under these circumstances, it has become a matter of vital importance to South Staffordshire to ascertain how long the known deposits of coal will last, and also what prospects there are of following the coal measures underneath the red rocks which surround the coalfield on all sides. Having described the great geological features of the district, Mr. Johnson proceeded as follows:—The area of the coalfield, as at present known and worked, is about 110 to 120 square miles, and measures from Messrs. King's, Cradley-park Colliery, on the north, to the Brereton Colliery, near Rugeley, in the south, 21 miles; and the extreme width is from Bullock's Farm Colliery, West Bromwich, to Earl Dudley's

Himley Colliery, six miles. The various seams of coal and ironstone are by no means persistent over the whole field. Very frequently, important changes take place within a comparatively short space, and thus it is not easy to correlate the beds either with those existing in other coalfields or with distant parts of the same field. In considering how far evidence of this kind may be made available in tracing the connection between the South Staffordshire and adjoining coalfields, it is desirable that the foregoing fact should be borne in mind. The general character of the measures in the central and south, and in the northern portions of the field, are best illustrated by the sections given in the memoirs of the Geographical Survey. These show, in the most forcible manner, the yet richness of the district, the seams of coal alone representing a total thickness of about 80 feet. In the Silurian portion of the field there is a gradual thinning of all the beds composing the thick coal, and at the same time as gradual a thickening of shales and sandstones between such beds of coal, until, at the extreme limits of the coalfield, it is lost in what is little better than a bed of mud, 30 to 40 feet thick, dipping under the Permians at Hagley and to the south of Hales Owen. It is extremely difficult to account for this gradual decrease in thickness of coal, and increase in foreign matter, so as to reduce this wonderful seam from probably the finest bed of coal in the world to one that is entirely valueless—and all this in the short distance of about three miles. The South Staffordshire coalfield may be divided into four districts, each having very singular and apparently fortuitous geological conditions. 1. The one south central, where the thick coal is free from pantings, and the coal of fine quality and great thickness; the lower measures are, as a rule, thin and poor in quality. 2. The north central portion, where the thick coal is wanting altogether, the undermeasures of both coal and ironstone are of fine quality and nearly double the thickness as where the thick coal exists. 3. The extreme north portion, where the thick coal is absent, as one bed, and the ironstones are absent too, there are numerous seams of coal of fine quality and great thickness. 4. And in the extreme south portion, where the thick coal is split up into numerous and separate beds of nearly a worthless character, and in which ironstones are entirely wanting too, there exists two beds of remarkably pure, fine clay which, in many estates, more than counterbalances the loss of the thick coal, even in its best condition. To attempt to account for this apparent incongruity of geological conditions cannot be made in so short a time as is at our disposal; but it may hereafter form a subject of deep interest to the inquiring geologist. The coal measures are cut off from the new red rocks on the eastern and western sides by well-defined boundary faults, which have thrown down the strata, and have brought the newer formations on a level with the coal. The east and west boundary faults are not supposed to cut off the coal measures, but simply to lower them a greater distance from the surface. On this assumption there is reason to believe that coal will eventually be found on these if not all sides of the existing field, by penetrating the surrounding rocks, though it is impossible to say at what depth it may be discovered or whether at such a depth as to be successfully worked. Probably one of the earliest successful attempts to discover coal underneath the permian and new red sandstone in England was made by the late Earl of Dartmouth, at the Heath Colliery, West Bromwich, in 1832. After many years of difficult sinking through those water-bearing rocks, the thick coal was discovered, and was afterwards worked over a large area until a recent date. The thick coal having been worked up to what was considered to be a down-throw west, and the belief gaining ground that thick coal would still be found near Birmingham, a company was formed twelve months ago, called the Sandwall-park Colliery Company, for the purpose of testing the ground, and the trial shaft is now being sunk at a point about a mile and a quarter west of the former Heath Collieries. If coal should be discovered here, then the existing coalfield will receive a very great accession to its mineral wealth, and go far to place it in its former position, for in that case it would not be at all unreasonable to predict a connection of the Warwickshire coalfield with that of North Staffordshire. Besides this sinking in the permian, there have recently been several lateral headings driven from the coal measure into the permians on the down-throw side of the western boundary fault, by the Earl of Dudley and others, but without being able to determine the amount of the down-throw. the only true test for this side of the coal-field would be to sink a shaft in some favourable spot between the Shropshire coal-field and that of South Staffordshire, and it is to be much regretted that the vast unexplored region lying between the two coal-fields does not possess sufficient landed and mining interest to put the oft-told suggestion to a practical test. Some few years ago, two very important trial sinkings were commenced in the south end of the coal field at Wassel-grove, near Hagley; but on the pit being sunk to a depth of 262½ yards, the upper silurian beds, on which the coal measures of South Staffordshire repose, were pierced, and of course all hope of obtaining coal was ended. Probably the most signal piece of good fortune which has befallen explorers of the confines of this coal-field is near Aldridge, where the Coppice Colliery, after making a series of upper coal and ironstones (not very successfully), was about to be abandoned. But the old proverb of "Nothing venture, nothing win" being very forcibly impressed upon the mind of Mr. James Lindop, the mining engineer of the colliery, it was arranged that he should form the managing director of a small company to let the ground below. He then commenced sinking, and it is gratifying to be able to say, at a depth of about 450 yards, they discovered both the shallow and deep coals of Cannock Chase brought sufficiently near to work them together, 14 feet thick. It is difficult to overrate the importance of this discovery, as it will go far to connect the Aldridge district with not only Cannock Chase, but because it is strong evidence in support of a connection existing between the Staffordshire and Warwickshire coalfields.

No discussion followed the reading of the paper, and on the motion of the Chairman a vote of thanks was accorded to Mr. Johnson.

ASSOCIATION OF CHAMBERS OF COMMERCE OF THE UNITED KINGDOM.

The circular convening the autumnal meeting of this body, to be held at Plymouth on the 26th and 27th September next, has just been issued.

It states that the objects which the Council have in view are chiefly, by a preliminary discussion of the more important subjects of interest in commercial legislation, to prepare for more efficient action when the Parliamentary Session commences. Tuesday and Wednesday, 26th and 27th, will be devoted entirely to the business of the meeting. On Wednesday evening, there will be a dinner at the "Royal Hotel," given by the Plymouth Chamber to the delegates, honorary members, and special guests. Subsequently, arrangements have been made for the inspection of her Majesty's Dockyard at Devonport, the Steam Yard at Keyham, and the various ships of war in the Sound and Hamoaze. Excursions will be made to the principal places of interest in the "Three Towns," and opportunities afforded for visiting the beautiful grounds of Mount Edgcumbe, Saltram, &c. A copy of the official programme of questions to be discussed accompanies the circular, which is signed by the president, S. S. Lloyd, Esq.

The following resolutions are among those to be discussed:—

"That the tax on trades and professions being impolitic in principle, incapable of realisation even approximately with equity, and being most vexatious and offensive in its operation, is a tax which should only be resorted to in cases of great urgency, and ought now to be repealed and the Associated Chambers having arrived at the above conclusion as the result of their experience and investigation, determine to represent their views by deputation to the Chancellor of the Exchequer."

"That a memorial be addressed to her Majesty's government, praying them not to assent to any curtailment of the stipulated twelve months' notice for the abrogation of the Commercial Treaty with France, and further praying them not to negotiate any treaty with France of a more restrictive character than the present one."

"That this Association urge upon government the great importance of the trade with Spain and Portugal, and that, for the purpose of promoting in these countries the consumption of the products of our manufactures, the duties on wines be equalised."

"That a memorial be presented to her Majesty's government, calling their attention to the vast increase in our trade with China which would result from the opening up of the Yangtze river to steamers, and to the necessity of stipulations for this purpose being inserted in any future treaty or convention with China."

"That in order to give greater facilities to the public for remitting moneys by post, the Postmaster-General be memorialised to adopt a system supplementary to the present, whereby notes payable on demand at any post-office in the kingdom, in sums not exceeding £1, and subject to certain restrictions, be issuable at post-offices."

"That this Association, after having duly considered the answer given to their deputation by the Right Hon. W. E. Gladstone, M.P., still maintain their opinion that the existing organisation of the departments of government is inconvenient and unsatisfactory to the public; that the extent and importance of the Commerce of this country demands the appointment of a Minister of Commerce, for the purpose of dealing with all questions affecting trade and manufacturers, and that the attainment of this measure be sought by such means as the meeting may deem efficient."

THE LIVE STOCK OF NEW SOUTH WALES.

The *Sydney Morning Herald* says:—

In our summary of 19th April we published that portion of the report of the Chief Inspector of stock relating to horses and cattle. We now give the report relating to the sheep of the colony.

The number of sheep in the colony during each of the last ten years stands as follows:—

1861	6,119,169
1862	6,550,896
1863	7,169,126
1864	9,089,463
1865	9,650,106
1866	11,644,593
1867	15,066,377
1868	16,000,000
1869	16,848,217
1870	16,218,825

The returns for 1870, inclusive of sheep possessed by owners of less than 500, show an annual decrease of 791,434, compared with those for 1869, which is, of course, to be principally accounted for by the losses sustained during the drought in the latter part of 1868 and the beginning of 1869, and to some extent by the consumption of sheep by the Victorian meat-preserving companies. The losses through the drought were estimated in the end of 1869 at 1,000,000 by the inspectors; but they must have been greater, even allowing for the sheep which were taken by these companies, to make the present decrease, and swamp the increase that ought to have been on more than 15,000,000 sheep. It was at one time expected that the season of 1870 would prove very favourable, and that the returns for 1871 would show a considerable increase in the number of our sheep, notwithstanding that a great many must find their way to the meat-preserving factories, but the rainfall of the last five or six months having been a most excessive one, has brought on foot-rot in almost every district throughout the colony, and fluke bottle and worm in the sheep in most of the upland country; and the direct and indirect losses from these causes will be very considerable. The moistness of the season has, of course, with the rankness of feed, produced grass in superabundance, and the losses of lambs from grass-seed also have, in many instances, been very severe. For these reasons, therefore, it is feared that the returns of sheep for 1871 will show but a very moderate increase.

Sheep from the best German, French, and American flocks have from time to time been introduced and interbred with our Australian merino, producing some remarkably fine sheep; but, upon the whole, none can excel the Australian merino, descended from the original Camden stock, either in the quality of the fleece, or the certainty with which pure rams from this family mark their progeny.

Although the losses sustained in the vain attempt to grow fine wool upon large-framed sheep, the crossing the merino ewe with the Leicester and Southdown ram, taught those who made the attempt that their theories were unsound, and their plans impracticable, it was not until the last three or four years that really sound ideas on the subject of sheep-breeding began to be general throughout the colony, and they have still plenty of room to spread. Now, however, that the march of improvement has once begun, it is moving on with certainty.

What, therefore, with more correct ideas on the proper system of breeding, the purchase of a better class of stud rams (which has now been going on for several years), and the close culling and correct classing of the ewes, great improvement is already noticeable in the wool on most of the larger stations, and the example thus set has been followed on the smaller holdings. The fencing-in of the runs is also tending in a large degree in the same direction, not only through the immediate improvement in the quality and weight of the fleece, which always follows the turning out of sheep, but also in relieving the owner from the care and trouble of managing the hosts of shepherds and hut-keepers employed on the station while the sheep were shepherded, and allowing him to turn his attention to raising the character of his sheep and clip.

The abstracts show an average per sheep for the whole colony of greasy wool of very nearly 5lbs.; of cold-water washed, of 2lb. 11¾oz.; of scoured, of 2lbs. 10oz.; and of hot-water washed, of 2lbs. 7⅓oz.

In the preparation of the wool for market, sheep owners have within the last few years made very great advancement. On many of the principal stations the hot-water system has been adopted, and very large sums have been expended in pumps, spouts, and other machinery and appliances, while most of those who still stick to the cold-water wash have dropped the rough and ready careless customs, which the scarcity of labour during the diggings induced, and have fallen back upon the more careful systems followed some twenty years ago.

From the continued wet, the scourge of foot-rot was last year very severe, and from the returns it would appear that it was more or less prevalent in all the districts but three. The average of the returns for the several districts would appear to be as follows:—"In eleven districts "very bad;" in eleven "bad;" in eight "slight;" in two no returns, while three districts only are reported as entirely free from it.

The sorts of treatment tried for this ailment have been very varied. The returns are somewhat meagre, but they furnish the following information:—The greatest number of cures reported are with butter of antimony. It was found the best remedy in nine districts; in five districts arsenic solution, in troughs was preferred; in four, bluestone, in different shapes, was used; in three, a hot solution of vitriol. In five other districts the following preparations were approved of, respectively:—1st, a solution of aquafortis, spirits of salts and copper; 2nd, a mixture of Stockholm tar and corrosive sublimate; 3rd, tar and turpentine; 4th, carbolic acid; 5th, an ointment of gunpowder, bluestone, verdigris, and sweet oil. There are no particulars as to dressings from eight districts. From the great variety of dressings used, it is evident that a more thorough inquiry is required to obtain a better knowledge of the disease and its proper treatment.

The subject of combing and clothing wool has been introduced here with a view to its being thoroughly ventilated and settled. It is essential to know (1st) what class of wool is most likely, on an average of years, to bring the best price in the European markets; and (2) what wool can be most profitably grown in several districts of the colony. Samples of the different wools to which prizes were awarded at the late show go home to the London International Exhibition of this year, and the first question can, to a great extent, be settled by our Commissioners obtaining the opinions of the leading buyers for England and the Continent on these samples.

The wool clip of 16,000,000 sheep, at 2½lbs. washed wool per week = 400,000,000lbs. at 1s. 2d. per lb. in Sydney	£2,333,333
Cast of fat sheep, being, say, one fifth of 16,000,000 = 3,200,000, at 7s. 6d. each	1,200,000
Total value of annual return from sheep	£3,533,333

With regard to the annual report of produce from sheep, an estimate may be arrived at as follows:—

Annual cast of fat sheep as above		3,200,000
Less:—		
Consumed in Sydney and suburbs, as partly estimated and partly ascertained from slaughter-house returns	520,000	
Consumed in Maitland and neighbourhood, as partly estimated and partly ascertained from slaughter-house returns	182,000	
Consumed in the rest of the colony (estimated)	704,666	
		1,386,666
Leaving to be sent into Victoria and South Australia, and to be boiled down and preserved in this colony and in Victoria, say,		1,813,334
Then taking these sheep, 1,813,334, at the same price as above, 7s. 6d., they would amount to		£ 679,998
Amount for wool as above		2,333,333
Add tallow and skins from sheep slaughtered for food		130,000
Total value to be exported		£3,143,331

N.B.—The number of sheep that went from this colony, in 1869, into Victoria was 780,026, and into South Australia 86,749, making together 866,775.

The coarse-woolled sheep are principally confined to the coast districts, where they are kept for breeding lambs for the Sydney market. They chiefly consist of Leicester and Southdown, with a few Cotswold and Cheviots—the latter being principally in the New Zealand district. The Leicester appear to be the favourite breed for fattening lambs, the ewes being excellent mothers, but still a good many put their faith in the Downs. There is no doubt that coarse-woolled sheep, if properly managed, will pay much better than the merinos in the coast districts for lamb-breeding, more especially if they are allowed to be at large in paddocks. They do not thrive if knocked about by shepherds and their dogs. A flock of full-grown pure-bred Leicesters will shear from 5 to 7 lbs. of washed wool per head, which will generally sell at, say, from 10d. to 12d. per lb.; and lambs from three to four months old will cut from 3 to 4 lbs. of washed wool. The wethers, again, of this breed, when three years old, will kill from 160 lb. to 200 lbs. each.

Great mistakes are made by many breeders of coarse-woolled sheep in breeding from mongrels, *i.e.*, putting a half-bred Leicester-merino ram to a ewe of the same stamp, under the idea that the progeny will be as good as the sire or dam. They will find their mistake, for these half-breeds deteriorate both in carcase and wool, and become useless rubbish.

CORRESPONDENCE.

EDUCATION OF GIRLS.

Sir,—Although I have been a member of the Society of Arts some ten years, and although I am not unacquainted with the liberal use of ink, I have not hitherto seen fit cause to trouble our *Journal* with any of my poor comments. But now I cannot remain silent after reading the announcement of the Council, printed in your last Friday's issue.

I wish to say that, since my entrance into the Society, I have, notwithstanding that I am a close observer and reader, not seen a more intrinsic announcement than the one just made, with a view to the improved education of girls, and especially that of those in the higher middle and highest grades of life. To every line of the announcement, until we arrive at the words "secure it," I beg most heartily to subscribe.

It is not, however, my intention to occupy unnecessarily your limited space, neither am I disposed to air myself or my opinions before the many illustrious workers whose names appear on the committee. The object undertaken by them chiefly approves itself to my judgment, because it can be adequately carried into operation by women themselves, with the prudent aid, perhaps, of a few practically-minded and upright men. It will also, in my opinion, open up ground for the surplus energy of many excellent women, whose numerical preponderance over the other sex is one of the most serious facts of the age that we have to contemplate. Moreover, a sphere of usefulness such as is sketched by our Council will, I cordially and anxiously anticipate, in good time withdraw some of our over-zealous sisters from those dangerous political and social shoals upon which they seem now to sail blindly under full sail, but upon which eventually they will most inevitably founder.—I am, &c., A Life Member.

DEAF AND DUMB INSTRUCTION.

Sir,—May I be allowed to make a few observations on Mr. Van Oven's letter, on the education of the deaf and dumb, in your paper of the 18th inst. Having been a teacher of the class in question for a considerable part of my life, I may claim to have some knowledge of the subject upon which he writes. I trust I may be able to show that, if the system now brought under notice has not been introduced into the institutions for training deaf mutes in this country, there are very strong reasons why it should not be so introduced. The particular effort which has initiated the present discussion can be looked upon only, at present, in the light of an experiment, and it would be manifestly unfair to require it to furnish, at this early stage of its career, a complete corroboration of the views held by the advocates of the system of teaching under which it is conducted. But when the system has been carried on for years, under the circumstances most favourable to success, we may fairly look for the results which are said to be so much in advance of those that can be shown by other systems. Fortunately, this test can be applied in the present case.

It will be well here to say a word or two on the rival methods of teaching. There may be said to be three systems, which have been named by Dr. Gallandet, respectively, the natural system, the artificial, and the combined. In the first, language, expressed in writing and dactylology, is taught mainly by the agency of natural and other signs; in the second, speech is the main feature of instruction, and it, and its recognition by the eye, as expressed by the organs concerned in giving it utterance, are relied upon mainly as the agent in instruction; and in the third, language is taught as in the first method, and speech and lip-reading take their place among the other subjects of instruction. The natural system was exclusively followed in the United States till lately, and prevails, with few exceptions, in this country; the artificial system has been always that upon which most of the schools in Germany has been taught; and the combined is that under which the London institution was founded, and which prevails in France, Belgium, Italy, Russia, Sweden, and Denmark, and is rapidly gaining ground in the United States, the country where, probably, more is done for the deaf mute than in any other. It will be seen, from what is here stated, that the attempt to teach the deaf and dumb to speak and read the lips is by no means a new thing. There are, even now, persons in this country who are able to speak quite intelligibly, and who use speech in all the ordinary concerns of life. Unfortunately, the apathy which at present attaches to all that concerns the education of the deaf and dumb in this country is most of all apparent in the neglect which has fallen upon this important branch of their instruction. We should, however, add that this particular subject is a very bone of contention among teachers of the deaf and dumb, and upon it fierce disputes have raged between those who favour and those who discountenance its teaching. The parties in the disputes to which we here refer have been the advocates respectively of the natural and combined methods of instruction. We cannot dwell on this matter now. Our more immediate task is the consideration of the usual systems of teaching *by* speech (not the teaching *of* speech) and by signs. It is claimed for the former of these systems that the progress of the children taught under it is more rapid, and that, at the end of their term of education, they are left in a far better position as human beings to move in the concerns of everyday life than pupils taught under the latter system. The controversy between the advocates of the two systems is as old as the time in which it was first attempted to teach the deaf and dumb by regular fixed methods. They found their first exponents in the Abbé de l'Epée, in France, and Samuel Heinicke, in Germany. Between these two eminent men, each arguing in defence of his own ideas, commenced that dispute which has come down to our own times. Their respective countries have each, generally, adopted their views. The system of teaching Mr. Van Oven advocates in his letter, it will be seen, has been, in its main features, carried on considerably longer than the time he indicates.

The subject has lately been revived in the United States. There, all that has to do with the education of the deaf and dumb meets with attention, and the claims of this class of persons educationally are acknowledged by the legislature in a way that puts to shame the efforts made among ourselves. It is not, therefore, surprising that the relative merits of the systems of teaching have been frequently discussed, and the fact of an institution having been lately established on the so-called German principle again brought the subject forward. The Americans are a practical people, and, as much public money is expended on the education of the deaf and dumb, it became a matter of some importance to them to prove the truth or falsity of the assertion which was loudly and confidently made, that the system of instruction had hitherto been carried on on an entirely erroneous basis. With this end in view, a special commissioner was, in 1867, appointed to examine into methods and results, and to report on the state of education in Europe, with the view of adopting what might be found to be beneficial. Dr. Gallandet, the gentleman appointed for this office, was well qualified for the task, having been associated with the deaf and dumb from earliest infancy, and holding the office, directly under the Congress, of President of the Deaf Mute College at Washington. In the course of a most exhaustive inquiry, he visited fourteen of the countries of Europe, and forty-four of the principal institutions. From the report of this inquiry, which I think may be fairly considered as decisive of the subject in question, I shall make a few extracts. Speaking, after a careful review of the opinions of the advocates of the artificial system he had met with, and of the results they had to show, Dr. Gallandet sums up the whole case as follows:—"It is plainly evident, from what is seen in the articulating schools of Europe, and from the candid opinions of the best instructors, that oral language cannot, in the fullest sense of the term, be mastered by a majority of deaf mutes. Its proper position, therefore, in the system of instruction, is not as a base or foundation, nor yet as the principal material in the superstructure, but rather as an adornment to certain portions of the building. Or, leaving this figure, it should be regarded as an accomplishment, attainable by a minority only. . . . Every one will understand that not all persons are endowed with a talent for music; that not every human being can succeed in art essays; that few men are capable of oratory; and fewer still of poetry. . . . Thus I conclude it to be with articulation among the deaf and dumb. To the mass it is unattainable, save in degrees that render it comparable to those sculptures and paintings that never find a purchaser, to books and poems that are never read, to music that is never sung, . . . exhibiting only that limited degree of success which honest criticism is compelled to stamp as no better than failure."—(p. 53 of Report).

Of the proportion of those who attempt and are successful he says (p. 51):—"Nowhere have my own examinations exhibited results sustaining the idea that 50 per cent of the deaf and dumb can acquire a sufficient fluency in articulation to converse readily with strangers. That from 10 to 20 per cent. can do this, I have no manner of doubt. . . . . An additional 40 to 60 per cent. may aspire to converse on commonplace subjects with their teachers, family, and intimate friends."

Speaking of signs, he says:—"But a single instructor, Mr. Hirsch, of Rotterdam, of the scores whose opinions I have sought, assumes to be able, in the instruction of deaf mutes, to dispense with the language of signs."

With one more extract I will finish:—"From this discussion it appears that prominent and able teachers, who have their systems of instruction of articulation, admit that a sufficient number of their pupils to warrant the formation of classes, and even of schools, are found incapable of being taught on this plan. I deem this calm and deliberate judgment of an intelligent body of practical instructors . . . taken in connection with the results of my own observation, of sufficient weight to lead me to reject the ideas on which the artificial system is based, as unsound in conception and impossible of execution. . . I would not, however, be understood as denying to the teachers respecting this class of schools the merit of considerable success in the instruction of the pupils. A large minority do certainly acquire a degree of speech and power of lip-reading that is of great value to them."

I may say that the result of this inquiry has been that the institutions in America have, many of them, introduced articulation as a subject of instruction.

Much more ought to be said, were space at my disposal;

but enough has been, I hope, written to throw some light upon the matter. The combined system, which seems to me the wisest method of instruction, is gaining ground in every country but our own. Here, at present, all is stagnation in this, and, indeed, in all that concerns the education of the deaf and dumb. The establishment of an institution among us, in which the possibility of teaching some to speak is shown, will, I trust, do much towards directing attention to this branch of instruction, and to the educational requirements of the deaf and dumb generally. We can never get our pupils to the point of Mr. Van Oven's "perfected pupils," but we may hope to give them what now from various untoward circumstances they cannot get, viz., a good education, and where the capacity exists in any degree sufficient to repay the trouble of cultivation, the use of that voice which nature has seemingly denied to them.—I am, &c.,

Richard Elliott.

THE PATENT LAWS AND THE RIGHTS OF INVENTORS.

Sir,—It is a singular fact that the papers and communications relative to these laws, which appear from time time in the public prints, all emanate from parties who derive a large portion of their income from that source, and therefore it happens that they bear the appearance of being entirely one-sided.

The assertions put forward by the *Morning Advertiser*, the organ of the licensed victualler, that a man possesses a lawful right to his ideas, is a simple truism, so long as he keeps those ideas in his own head; but as soon as he promulgates those ideas, then comes the difficulty of how, or by what means he is to be rewarded for bringing out his invention, if any benefit should be conferred upon the general public by his so doing.

In 99 cases out of 100, the patentee derives nothing from his patent excepting as an advertisement, or as he may be thereby enabled to defeat some rival in trade or business; but the public can receive no benefit from such transactions, especially as the majority are taken out for utterly trivial and futile ideas.

A scrutiny is often recommended, in order to prevent any except useful patents being obtained; but the undertaking is totally impracticable, in the first place on account of the expense, and secondly, because no man or body of men can forestall the judgment of the public in regard to a future patent when brought out.

I need not occupy your space with the details of the multifarious nuisances created by the laws as they now stand, for they are well known, but will merely assert that any alteration will only make them very much worse. Also, that if the total cost of these laws, including riders, Chancery suits for alleged piracy, and a long list of etceteras, were to be summed up, ample funds would be realised for generously rewarding successful inventors, without damaging the general public with the monstrous, unnatural system of exclusive privileges.

The first patents granted in bygone, semi-barbarous times were merely intended to enable certain merchant adventurers to carry on an exclusive trade or business, for their own proper benefit and advantage—certainly not for the public; and it is a question with me whether our successful patentees, such as James Watt, Henry Bessemer, and others, would not in the end have found themselves in the same position if they had never meddled with patents at all, owing to the enormous expenses they were put to in obtaining their exclusive patent rights, as in contending against piracy, costs only partially repaid by fleecing the consumers with exorbitant charges.

Watt was compelled for many years to adopt the sun and planet in his engines, because Hornblower obtained, by a fiction in law, a previous patent for the crank, a simple implement, as old as the pagan mythology.—I am, &c.,

Henry W. Reveley.

GENERAL NOTES.

New Rates of Postage.—On the 5th of October next, the following reduced rates of postage for inland letters will come into operation:—

For a letter not exceeding 1oz.				1d.
,, exceeding	1oz.	but not exceeding	2oz.	1½d.
,, ,,	2oz.	,, ,,	4oz.	2d.
,, ,,	4oz.	,, ,,	6oz.	2½d.
,, ,,	6oz.	,, ,,	8oz.	3d.
,, ,,	8oz.	,, ,,	10oz.	3½d.
,, ,,	10oz.	,, ,,	12oz.	4d.

Any letter exceeding the weight of 12oz., will be liable to a postage of 1d. for every ounce, beginning with the first ounce.

Ice-making Machine.—Messrs. Nasmyth, Wilson, and Co., Patricroft Foundry, near Manchester, have lately made for Mr. F. Label, of 21, St. Nicholas-lane, London, an ice-making machine on the principle of the patent of M. Mignot, of Paris, and the fact of the low temperature of compressed air when allowed to dilate. The machine forces this compressed atmosphere under and all round metal moulds, filled with water, which are placed in a cylindrical compartment, which communicates with an air-tight box. The difficulties which have formerly prevented the adoption of this method are, it is said, overcome by means of injecting cold water with the air while it is being compressed. The machine, working at a pressure of 60 lbs. to the square inch, produces 50 lbs. of ice in an hour. There is no expense for materials by this process, as atmospheric air and cold water are the only essential requirements of this ice-making machine.

The Approaching Solar Eclipse.—Preparations are already being made to observe, in a manner becoming the occasion, the eclipse of the sun in December next, which will be visible, as a total one, in India, Ceylon, and Australia. The Astronomer Royal is superintending the adaptation of instruments already in his possession for use in India, while the President of the Royal Society has arranged to have instruments of the newest and most approved kind sent to Australia. The Royal Society of New South Wales is organising an expedition to Cape Sidmouth, and it is expected that Ceylon will, for a time, be taken possession of by a staff of observers from England. From the experience so recently acquired in connection with the solar eclipse of last winter, it is not too much to expect that the result of the observations of the forthcoming one will be a great addition to our knowledge of solar physics.

Monument to Captain Cook.—A memorial monument has been erected in New South Wales to the memory of Captain Cook, at the supposed place at which he landed from the *Endeavour* in April, 1770. On the monument are two brass plates, one bearing the following inscription:—"Captain Cook landed here 28th April, 1770. This monument was erected by the Honourable Thomas Holt, M.L.C., A.D. 1870. Victoria Regina. The Earl of Belmore, Governor." The other contains the following words from Captain Cook's journal:—"We discovered a bay, and anchored under the south shore, about two miles within the entrance, in 6 fathom water, the south point bearing S.E. and the north point east. Latitude, 34° S., longitude, 208·37°." The entrance to the bay where Cook landed has other memorials. On the north side is the column erected, on behalf of the French nation, to the French navigator, La Perouse. The enclosure around the column is planted with trees and flowers. The monument erected by Mr. Holt is on a place less elevated, but it can, nevertheless, be seen from several parts of distant suburbs. Public subscriptions are being made for a monument of a more costly kind, to be erected in one of the parks of the city of Sydney.

Scientific Instruction.—The Royal Commissioners have considered the memorial of the professors of the School of Mines, and of the Keeper of Mining Records, in reference to the recommendation of the Commission that the Royal School of Mines and the Royal College of Chemistry should be consolidated, and that the consolidated institution should be accommodated in the new building at South Kensington. With reference to the objection that the plans of the Commission involve great expense to the nation, and that the additional accommodation required can be obtained in Jermyn-street at a moderate cost, the committee state that it is in evidence that the cost of extension in Jermyn-street would be very great; whereas the government possesses a building at South Kensington affording all necessary accommodation. They adhere to their original determination.

Oysters.—The high price of oysters in England, arising from the utter inadequacy of the supply to meet the ever-increasing demand, is very well known. For several years past oysters, even of a very inferior quality, have realised as much as £2 a bushel in London, while the price of native oysters have ruled as high as from 2s. 6d. to 3s. per dozen; a price which has necessarily had the effect of restricting their consumption to a comparatively limited circle. Oysters, it is said, can be purchased in Canada and the United States for less than a dollar a barrel (equal to about 4s.) for 1,000. A sample barrel, from Chesapeake Bay, was brought to England some short time since, which, when tasted, were found to be exceedingly good, although they had been in the barrel for about twenty-four days; the remainder were afterwards laid down in the Faversham Oyster Company's beds, where they remained for several weeks; at the end of that time they were taken up and returned for examination, when it was found they had improved both in flavour and appearance. Lobsters, it is said, can be purchased in Canada at about 4s. to 5s. per hundred, and there can be no doubt that they will be readily saleable in the London market at a price which will leave a very large margin for profit. A company has been formed for the importation of oysters and lobsters from those places.

New Application of Collodion.—At a recent meeting of the Berlin Society, some details were given of a curious quality possessed by collodion, which has been recently discovered by M. Kleffel, and which may, it is thought, possibly lead to some useful application. He has found, remarks the *Photographic News*, that if a glass plate is coated with collodion in the ordinary manner, and, after the liquid has set, a printed sheet of paper is pressed upon the surface lightly with the ball of the hand, a very exact reproduction of the printed matter will be found impressed upon the collodion after the removal of the paper, the design or type remaining perfectly visible after the complete desiccation of the film. Particularly distinct is the printed matter when the plate is held up as a transparency, or when seen by reflected light, after the surface has been breathed upon, the type or design being somewhat sunken and bright, while the remaining portion of the film appears dull and matt. M. Kleffel is not yet prepared to offer an explanation of this singular phenomenon, but, in all probability, the greasy nature of the printer's ink prevents its being attacked by the alcohol and ether of the half-set collodion, while the remainder of the paper is completely impregnated and softened by these volatile liquids. For this reason it is that the printing has the appearance of a bas-relief. To obtain the result in a perfect manner it is necessary to employ a somewhat thick, structureless collodion, and not to allow the action of setting to go too far. Moreover, a light, even pressure is requisite to yield sharp and distinct reproductions. As a ready method of copying valuable originals, it is suggested the process might be available; then the necessary manipulations require no more time than the process of copying a written document in the ordinary copying-press.

Bismuth.—For some time past we have been dependent on Bolivia for our supply of metallic bismuth; and as it furnished but little, the price was very high. It is now found in large quantities in Australia. The *South Australian Register* states that, in the Balhanisa mine, this metal exists in considerable quantity, and that reduction works for the extraction of the metal have been constructed at the mine.

Trade and Population.—It is interesting, says the *Echo*, to observe what relation the increase of trade bears to the population. As we have said, our imports for 1870 were £303,296,082, and the exports are placed at £244,134,738, or in all £547,430,820. This is equal to £17 15s. 2d. per head of the population of the United Kingdom, and except in 1866, when we experienced the climax of the over-trading of the one or two previous years, it is the highest rate ever reached. Ten years ago, our aggregate foreign and colonial trade was £13 0s. 7d. Since the panic year, 1866, when it was £17 16s. 10d., declining in 1867 to £16 12s. 3d., there has been a steady growth. In 1868, it was £17 3s. 11d per head, and in 1869, £17 6s. 3d. Of the consumption per head of the different imported articles there are also some useful statistics. Of wine, we, as a nation, in 1856, consumed $\frac{1}{4}$ gallon, and in 1869 about $\frac{1}{2}$ gallon. The consumption of imported spirits has also increased. It is now ·27 gallon, or upwards of $\frac{1}{4}$ gallon, as compared with ·18 gallon, or nearly $\frac{3}{16}$ of a gallon. Of tea, in 1856, we drank rather more than $2\frac{1}{4}$ lbs., and in 1869 more than $3\frac{3}{4}$ lbs. The increase in the consumption of tobacco per head is not so considerable, the rate now being 1·34 lb. as compared with 1·16 lb. in 1856. Of the more substantial articles, we consume, of foreign wheat, $124\frac{3}{8}$ lbs., as compared with $84\frac{1}{2}$ lbs. in 1856. Of all imported dairy produce we consume more now than we did; and, as an increasingly manufacturing country, this tendency will increase.

Post-office Savings Banks.—A Parliamentary return, moved for by Mr. Baines, gives an account of the business transacted in the year 1870 at every post-office savings bank in the United Kingdom. The return shows that there are several post-office banks in England, with deposits exceeding £50,000; and the bank at the head post-office at Birmingham has deposits exceeding half a million sterling, although there are several other post-office banks in that town. The deposits in the post-office banks in Middlesex, including the City of London, amounted at the close of 1870 to no less than £2,728,634; in Surrey, to £1,084,860; in Kent, £1,011,893; in Warwickshire, £925,791; in Lancashire only £899,345; and in all Yorkshire only £613,566. The post-office banks appear to be, to a considerable extent, used for other purposes than that of permanent investment of savings, for about a third of the entire deposits held was withdrawn in the year, and at many post-offices one-half. Some country districts, or centres of country districts, show a great contrast to this; the deposits in the post-office bank at Blandford exceed £50,000, and in that of Canterbury they exceed £138,000; and in both instances the year's withdrawals did not amount to a fifth of the total deposits held. In the whole United Kingdom £6,333,082 was added to the deposits in 1870, and £4,758,187 was withdrawn. The net increase of deposits in the year (the excess of deposits over withdrawals) was £1,399,728 in England, £46,007 in Wales, £37,488 in Scotland, £88,716 in Ireland, £2,911 in the Channel Islands—making a total increase of £1,574,895 in the amount of deposits. At the close of the year 1870, there were 1,072,953 depositors' accounts open in the English post-office banks, and sums amounting to £13,727,450 were due to the depositors; in Wales, 30,646 depositors, and £403,398 due to them; in Scotland, 39,033 depositors, and £304,235 due to them; in Ireland, 38,279 depositors, and £633,060 due to them; in the Channel Islands, 2,242 depositors, and £31,051 due to them—making a total of 1,183,153 depositors, and £15,099,104 due to them.

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FRIDAY, SEPTEMBER 8, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

EXHIBITION AT MOSCOW.

A Special Meeting of the Council, Edwin Chadwick, Esq., C.B., in the chair, was held on Friday, the 25th August, to receive a deputation from Russia in reference to the Exhibition intended to be held in Moscow next year. The deputation consisted of Monsieur Philip Koroleff, Conseiller d'Etat Actuel, Director of the Moscow Agricultural Academy, and President of the Educational Department of the Exhibition, MM. Lvoff, Nicholas Saenger, Secretary of the Society of Friends of Natural Science, and the Rev. Basil E. Popove.

M. Koroleff stated :—

That on the 11th of June, 1872, the Society of Friends of Natural Science, Anthropology, and Ethnography, attached to the Imperial University at Moscow, propose, with the permission of his Imperial Majesty, to celebrate the 200th anniversary of the birth of Peter the Great, falling on that day, by the opening of a Polytechnic Exhibition in Moscow.

This exhibition, which is intended to form the foundation of a Central Polytechnic Museum in the old capital of Russia, and to present, as far as possible, a complete view of the present relations of natural science and technicology to arts and commerce in Russia, as well as of the progress made by the Russian nation in applied sciences throughout a period of two centuries, since the time of Peter the Great, will, in the opinion of the society, form a most suitable tribute to the genius of this great historical character, and communicate a more elevated and especially interesting feature to the festival in his honour.

This exhibition is not, strictly speaking, an international one, for, in accordance with its immediate object, it is proposed to limit the number of nations represented in it. The co-operation of German, French, Belgian, and Dutch exhibitors, is hoped for, but we particularly hope to find the desired sympathy and aid in England, which has attained, in comparison with other nations, such vast and unsurpassed results in that particular sphere, comprising the applications of science to art and commerce, within the limits of which it is proposed to keep our exhibition.

The Applied Natural Sciences and Technicology will form the two great divisions in our exhibition. It is in these two branches of social life that England has given so great an impulse to its own people, and is able to do the same in the case of other nations.

The exhibition is not a commercial undertaking. Its idea has been started, and is being carried out by men devoted to science and art, who have accordingly based it, not on the principle of competition, but on that of previous invitation, and selection by competent judges.

Foreign exhibitors will, on the other hand, have the way opened for a greater demand and an increased sale of their various products.

The Imperial Government has taken care to guarantee the protection of inventions placed in the exhibition, which, on application being made in proper quarters, may be provided with exclusive patents, even during the time of their exhibition.

Articles sent to the exhibition will be admitted into Russia free from duty.

The committee, on its part, allows the free sale of every article exhibited or made at the exhibition.

In view of the proposed formation of a Polytechnic Museum in Moscow the Committee will also take the necessary measures that articles considered essential to form parts of a systematical collection in it, should be, if possible, secured for the museum.

A committee was then formed for the purpose of promoting the undertaking, consisting of—

Lord Henry G. Lennox, Chairman of the Council
The Lord Mayor
G. C. T. Bartley
Frank Buckland, Inspector of Fisheries
Andrew Cassels
E. Chadwick, C.B.
Hyde Clarke
H. Cole, C.B.
E. Lawrence
W. P. Marshall
A. Murray
Professor Owen, F.R.S.
P. C. Owen
Major-General Scott, C.B.
S. Teulon, Vice-chairman of the Council
Major de Winton

With power to add to their number.

Rev. B. Popove,
P. Le Neve Foster, M.A., } *Secretaries.*

EXAMINATIONS, 1872.

The Programme of Examinations for 1872 is now ready for issue, and may be had, gratis, on application to the Secretary. It differs but slightly from that for the present year.

It will be remembered that, in the Programme for 1870, the Council decided to omit those subjects in which the Science and Art Department holds examinations, and this arrangement still continues.

Two new subjects were added last year, viz., "French Commercial Correspondence" and "German Commercial Correspondence." The papers set are intended to test the capacity of candidates to fill the office of foreign correspondent in a house of business, and the certificates will be first-class only. No prizes are offered in these subjects, nor will the certificates be counted for the Prince Consort's Prize.

The Final Examinations, in 1872, will be held on the evenings of the 16th, 17th, 18th, and 19th April. The Time Table has been arranged as follows :—

TUESDAY, 16th April, From 7 to 10 p.m.	WEDNESDAY 17th April, From 7 to 10 p.m.	THURSDAY, 18th April, From 7 to 10 p.m.	FRIDAY, 19th April, From 7 to 10 p.m.
Arithmetic. Logic. German. Floriculture. Musical Composition.	Book-keeping. Theory of Music. Domestic Economy. English History. Italian. *Commercial German.*	Metrical System. Political Economy. French. English Language. Fruit and Vegetable Culture.	Mensuration. Geography. Latin. Spanish. *Commercial French.*

FRIDAY, 19th April, 6 to 7 p.m.—Dictation.

Attention may be drawn to the Prizes offered with the view to encourage an improved style of writing and manuscript printing. The writing is to consist of Roman and Italic letters, from one-eighth to three-fourths of an inch in height, done entirely by the hand, without the use of instruments.

Special attention may also be drawn to the scheme for holding *vivâ-voce* examinations in Modern Languages, explained in a memorandum kindly furnished by Mr. Hyde Clarke, a member of the Council. It is earnestly hoped that this will be more extensively carried into operation next year.

The Elementary Examinations, held by the District Unions and Local Boards, for which papers are furnished by the Society, are fixed for the 12th, 13th, and 14th March.

Full details in reference to the Examinations are given in the Programme, copies of which should be applied for to the Secretary of the Society of Arts, by all intending to come forward as candidates, or otherwise interested in the Examinations.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

EDUCATIONAL COLLECTION.

MATERIALS AND APPLIANCES FOR ART-TEACHING.

The report on this section is by George A. Stewart, Esq. In his introductory remarks, he says:—"In order to fairly estimate the value of the materials provided for our educational purposes, it is necessary to consider briefly the changes they have undergone from their first to their present condition.

"The most ancient art works are found in the temples and tombs of Egypt, on walls, ceilings, and pillars, and on the coffins and wrappings of the embalmed bodies of the dead. The paintings on the walls are on prepared grounds of cement or plaster. The outline was drawn in red, and afterwards corrected in black. The figures were painted in conventional colours—as brown or black for men, red for women, and yellow for prisoners or slaves—animals and other accessories in approximation to their true colours. The Egyptians used red, yellow, blue, and green, in two tints of each, and black and white; these were mixed with weak glue, and in some cases covered with a varnish made of glue or rosin, dissolved in oil of turpentine. They sometimes painted on tablets of cedar and sycamore, and the materials they used were of so perfect a character that their original purity and brilliance are still preserved after a lapse of three thousand years.

"The Greeks painted decoratively on the walls of their temples and houses, and on their vases, and also pictorially on moveable tablets of wood. The paintings on their vases date from a very early period, and at first consisted of various ornaments and rude drawings of animals, in a brown or black colour, on the clay ground. To this succeeded, about 400 B.C., vases in coloured grounds of black, crimson, cream-colour, and white, with various coloured figures and ornamental decorations of the most beautiful character, enabling us, from the purity of their outline and simplicity of composition and colouring, to form some idea of the pictorial art of this period. The earliest Greek picture on record was by Bularchus, 718 B.C. From this time, they advanced in the practice of painting with such rapidity, that, about 300 B.C., Greek painting became renowned throughout the world for its excellence, and the masterpieces of its most famous painters were secured by cities and princes as the greatest treasures they could possess. The Greeks painted on tablets of fir, larch, boxwood, and marble. On these materials, a ground of white was carefully laid, and often a second of a dark reddish colour, on which the picture was painted in colours mixed with glue, the lights being produced by erasure down to the white ground by means of a cestrum, or short metal rod, broad at one end and sharp at the other. The picture was then covered with a varnish, as a defence against damp and dirt, which was either a liquid bitumen or made of some resin dissolved in oil. The favourite mode of painting was, however, with encaustic, or colours mixed with melted wax. They were prepared in cakes similar to our water-colours, and were called waxes. When required for use, they were softened by fire or by a resin-oil, and laid on with a brush. When the picture was completed, heat was applied, which partly liquified the wax, and spread it like an enamel over the surface, rendering it so durable that pictures of this kind discovered during the last century were quite perfect, although about 1,800 years old. The early Greek painters made use of only two or four colours, cultivating the utmost simplicity of treatment in their work; but in the highest period of art almost all the colours now known appear to have been used by them, with the Vestorian azure and the Tyrian or marine purple in addition.

"The earliest recorded work of Roman art is that by Fabius, surnamed Pictor, who decorated the Temple of the Goddess of Health (about 300 B.C.). In the reign of Augustus, a painter, named Ludius, invented the Arabesque style of decoration, which became the model of all succeeding works, and is finely illustrated on the walls of Herculaneum and Pompeii. Most of these paintings are excuted in tempera, in which the colours are mixed with glue, gums, or milk. In these paintings we have the first representations of ancient studios, and of the materials used by painters. In one of them a female artist is represented painting a copy of a statue. In one hand she holds a palette, on which the tints are mixed; in the other is a brush, which she is dipping into a box of colours by her side. The picture she is painting is shown at her feet, enclosed in a wooden frame, and a similar one hangs on a wall behind. In another decoration an artist is represented working at an easel similar to our own. By his side stand his colours on a little table, and close by a pot to wash the brushes in; he is, therefore, working with gum or water-colour. In another part of the room a person is grinding colours on a slab placed over hot coals; these are evidently encaustic, or colours mixed with wax.

"Artists of every period have always preferred such methods as seemed to ensure the permanency of their work, with sufficient pliability of means of representation to enable them fairly to express their conceptions. This desire led to the adoption, towards the decline of the Roman Empire, of the mosaic method of decoration, or the production of pictures by means of pieces of coloured stone, marble, or glass. The Greek artists of Byzantium obtained a great reputation in this art, and between the 4th and 12th centuries were almost exclusively employed in all great works. In Italy, the native artists preferred and practised '*buon*,' or pure fresco, and '*fresco-secco*,' for church decoration. The earliest example of the former kind is by Pietro d'Orvieto, in the Campo Santo, Pisa, painted in 1390. In fresco, all colours are mixed with water and lime, and laid on a surface of new wet plaster. In fresco-secco, the same colours are used, but on a dry ground of plaster saturated for painting on. In 1230, the use of oil mixed with colours as a medium is first recorded. In the accounts connected with the decoration of the Queen's Chamber, at Westminster, there is an item of 117 shillings and tenpence, for oil, varnish, and colours bought, and for pictures executed. Similar records exist in Germany, France, and Italy of the employment of oil-painting as a method of executing inferior kinds of mural decorations. At length the Van Eycks of Bruges, after numerous experiments in the mixture of oils and varnishes with colours, brought this process to perfection, and exhibited its superiority over all other methods in an altar-piece painted for the Church of St. Bavon, Ghent, in 1432. The renown of the new method soon spread over France and Italy. The facility with which it was worked, and the brilliancy of its results led to its universal adoption.

"In the development of these various methods of painting, the artist was himself the principal experimentalist, and the knowledge of all materials used was deemed so important that an artist's apprenticeship was lengthened beyond that of other occupations, to give time for this special study. Thus, in Italy, painters had to go through an apprenticeship of thirteen years, six of which were given to the manufacture of colours and the preparation of various grounds, the remaining seven to the practice of painting. This careful training, and the great encouragement given to genius, led to a development of art which rivalled that of the best period of the ancients. The colour used by mediæval painters were kept in cups, pots, or shells, ready ground for either tempera, fresco, or oil, the medium being added in course of the work. The vessels of colour were sometimes arranged round the painter's girdle, to be ready at hand. The palette, in its modern form, was invented about the 15th century, and was at first very small. The earliest account of oil colours tied in little bladders occurs in English treatises in 1661. They are mentioned as conveniences for 'travelling picture drawers.' They remained in use until 1842, when Brown and Reed, artists' colourmen, of Holborn, invented and patented the convenient metal tubes now universally adopted.

"Our country has also the honour of having contributed very largely to the development of the modern beautiful art of transparent water-colour painting. Up to the latter end of the 18th century, water-colours were kept in china or glass vessels, or in horse-mussel shells. In 1781, Mr. Thomas Reeves invented and introduced the cake of water-colour, for which improvement he received the thanks and awards of the Society of Arts of that date. About 1844, water-colours, kept in a moist state by being mixed with honey, appeared, and were sold in small pans. In 1846, Messrs. Reeves introduced the moist colour in tubes; and in 1848, still further improved the colour in this convenient form by mixing it with glycerine. Camel hair pencils, and brushes made of the hair from the tails of animals, were used by the Romans in the time of the emperors. Charcoal was also used by the Romans. Crayons were known to the French early in the 15th century. Holbein used them for first sketches, from which he painted his oil-pictures. The Italian black and red chalk was in common use among mediæval painters. Artificial *conté* (black chalk) was introduced by a firm of that name in Paris, at the commencement of the present century. Lead pencils were in use in 1565. The material is properly plumbago, a form of carbon found in various parts of the world, but in the greatest purity in Borrodale, Cumberland. It occurs in lumps of from one to four pounds weight, and is worth from 30s. to 40s. the pound. The mine is worked for six weeks annually, the produce brought to London and sold by auction realising an average of £20,000. The pencils were formerly made with small rods cut from the native substance. Its scarcity, and the waste in manufacture made them expensive. Of late years the best plumbago is ground up with inferior kinds from other countries, mixed with other substances, compressed, cut into small rods, and inserted in the wood of the pencil. This method, entailing no waste, has enabled manufacturers to reduce the cost to one-third of the original price. India-rubber comes from Brazil, Guiana, Assam, and Central America, and was first made known to Europe by M. de la Condamine in 1735. Up to 1820 it was only used for erasing pencil marks; since that time, however, its many valuable properties have been discovered, and it is now extensively employed in arts and manufactures."

Passing to the present Exhibition, Mr. Stewart first speaks of the various drawing models shown. A large model of a house with its appurtenances, modelled and coloured admirably, and intended for a preparatory exercise to sketching from nature, a similar model of a water-mill, are the principal "rustic" models exhibited. There are some excellent wire models for teaching solid geometry and crystallography. The original form of a geometric solid is made in iron wire, and sectional forms of the same figure are shown by brass wire. There are excellent wood models of all mechanical forms, and cardboard forms for school lectures, which are useful and inexpensive. Various other models, drawing copies, boxes of colours, and of drawing instruments are described, as well as easels and lay-figures, but they do not appear to possess any remarkable or novel features.

THE FRENCH POST-OFFICE TARIFF.

M. Michel Chevalier has addressed the following letter, on the recent alterations in the French Post-office tariff, to the editor of the *Journal des Débats*:—

"Sir,—You are aware that the National Assembly has just given its sanction to the proposal of the government for an increase in the rates of postage, and that the former rates—of 20 centimes for an ordinary letter to be carried from one postal district to another, and of 10 centimes for a letter intended for delivery within the bounds of the district in which it is posted, and more particularly for a Paris letter—are now to be raised to 25 centimes and 15 centimes respectively.

"And yet the increase in the revenue expected from the operation of this measure is highly problematical; for it is to be feared that it will materially affect the number of letters posted, and, if a diminution does take place, we shall simply, either without any profit to the treasury, or for the sake of a very trifling one indeed, have thrown obstacles in the way of wealth-producing business intercourse, and thus supply a cause for the impoverishment of the country, and necessarily of the treasury also, for there is no gainsaying the truth of Du Quesnay's words to Louis XIV., viz., 'A poor country and a needy treasury go together.'

"The art of a skilful administration, and the aim that it must ever keep in view, should be to encourage the production of wealth, to stimulate trade by removing impediments from its path, and to favour commercial operations, be they great or small. Now, the most elementary conditions to be fulfilled with that view are the simplification of means of transport and communication, and the establishment of a rapid and inexpensive postal service; for, after all, nine-tenths of the letters passing through the Post-office are business letters. Human nature is very affectionate, doubtless; yet letters between friends constitute a mere fraction of the grand total, when compared with the number of business letters.

"The government of all civilised nations regard the postal department from this point of view. About 30 years ago—it was in 1837—England led the van by lowering to a uniform penny rate her former tariff, which varied according to distance, and was on an average six or seven times more expensive. We, in France, followed the example set us after our Revolution of 1848, and nearly the whole of Europe, as well as the United States, have now adopted the same system.

"At this present time, however, it is the French tariff of 20 centimes per letter which is the highest. In Germany, the charge is one silbergroschen, or 12½ centimes for the whole country; in the United States 3 cents, or 15 of our centimes. Both the English and Americans are of opinion, nevertheless, that these rates are still too high; and, in fact, so far as England is concerned, I may mention that, since October last, a stamped card, costing one half-penny, has been introduced, of which people make use, either to send orders to their tradesmen or to convey a scrap of news to friends. It is a kind of unsealed letter. With regard to America, the time is not far distant either when two cents, or ten centimes, will be the cost of transmitting a letter from one end of the Union to the other, that is to say over a territory sixteen times as large as the whole of France.

"It is a mistake to view the postal department as one of the sources of the revenue, properly so called, for it is a branch of the public service whose special function it should be to promote commercial activity, and consequently the increase of national wealth, by means of the low charges at which it does its work. It is by this indirect though abundantly productive process, rather than by the high figure of its net profits, that it should supply resources to its national exchequer. Moreover, let me just point out that it is by no means a matter of certainty that a rise in the rates of postage will show an increase in the net revenue. For in a democratic country—I mean thereby a country where all, both high and low, are engaged in some kind of work—it is an advantage, economically speaking, to tax the people moderately, inasmuch as the demand for a lightly-taxed article has a tendency to grow; and, in point of fact, it always does so rapidly when a high duty is taken off or lessened; whereas, if tariffs be altered in a contrary direction, the opposite effect is not slow to manifest itself. We should bear in mind that in matters of taxation the rule that two and two are four does not hold good; just as the half of four is greater than two—nay, many a time equal to or even more than four.

"In 1839, Mr. Rowland Hill brought before the House of Commons his measure of Post-office reform, and predicted that, no matter at how low a figure the rate might be fixed, his plan would be sure to effect speedily a perfect balance between Post-office expenditure and revenue, and that, very shortly after, revenue would exceed expenditure. And he was quite right, for whereas the letters carried in 1838 numbered 76 millions, in 1868 they attained to 808 millions; the net income of the Post-office being 42 million francs at the former, and 55 million francs at the latter date. As to the gross income, it had advanced in a higher proportion—in fact, it had doubled.

"In France, when the postal reform was introduced, the number of letters stood at 126 millions, and in 1868 it had reached to 449 millions. This rate of progression is less considerable than that on the other side of the Channel; however, the interval between the periods compared is ten years less. Still, a careful examination of French official statistics shows that the estimated probable increase in the number of letters is under 100 millions for a period of ten years in France; so that in one country we have 76 against 808 millions, or an increase of 1 to 11; whereas in the other the corresponding figures are 126 against 449 millons, or 1 to 3½.

"The English Parliament thought that this Post-office reform had been so beneficial, had imparted so great an impetus to business of all kinds, and afforded such wonderful facilities of trade intercourse, that it awarded £20,000 as a national recompense to Mr. Rowland Hill, on whom the government had by this time, moreover, conferred a title. Not to be behindhand, his native town of Birmingham erected a statue in his honour.

"The Post-office in France has had most excellent directors-general, who have held their offices for long periods, and have introduced many considerable ameliorations. I may mention M. Coute, under the dynasty of July, and M. Vandal under the second Empire. But these able administrators have been hindered and interfered with in regard to their views on rates of postage, which represent the gross revenue of this branch of the public service, by the economical arrangements of the Minister of Finance, and that is one reason why it would, perhaps, be better that the Post-office department should, taking on itself a few additional duties which might be easily determined, form a perfectly distinct administration; in fact, a separate ministerial department, as is the case in England and the United States.

"Whereas the Minister of Finance is chiefly concerned to raise a revenue, without sufficiently weighing the feasibility of procuring, by indirect means, funds more considerable in amount than the immediate yield of a high tariff, an enlightened Postmaster-General cannot help looking at the question from a totally diferent point of view. It was inevitable, and it did actually happen, that the Minister of Finance and the Postmaster-General were at variance with one another now and again. But the latter, being a subordinate, was constrained, *nolens volens*, to submit, and that to the injury of the public interest. And of this a deplorable proof is afforded by our postal relations with the United States.

"In 1857, France had negociated with the United States a postal convention, the provisions of which were in perfect conformity with the ideas then current on the subject of international post-office regulations. The rates of postage under that treaty were excessive; so that, when its expiration was drawing nigh, the American Postmaster-General, availing himself of the rights of his independent position, sent to France Mr. Masson, a member of Congress, and a most intelligent negociator, whose duty it was to make arrangements for a fresh and more liberal convention. His mission extended to other European States, where he met with the fullest success. But in Paris, although he had the advantage of the good-will and support of the French Postmaster-General, and notwithstanding his own perseverance and energy, he failed completely at the Ministry of Finance. Some time after this the Postmaster-General at Washington renewed his attempt in respect to France, sending over for that purpose two commissioners instead of one only, and one of whom, a United States senator, held a very high position in America. The French Postmaster-General supported these gentlemen to the best of his ability, but nothing availed, for, to their supreme astonishment, when they went to the Ministry of Finance, they were met with a dignified refusal. As though there were principles worthy of adoption in matters of this kind other than an enlightened regard for the interests of the public and of the trading community, the Ministry of Finance at this juncture had laid down as a ruling principle for conduct a certain idea, the effect of which necessarily would be, if carried out, to raise the tariff.

"If we turn to England, we shall find that there the question, being treated with far greater enlightenment, was solved in a manner which gave the highest satisfaction to the commercial world. Between that country and America the rate of postage for an ordinary letter weighing 14½ grammes was fixed at 30 centimes. In the case of other European States the rate was 40 centimes.

"Hurt by the reception extended to her commissioners, America, which had been very patient, and had consented to two successive prorogations of the convention of 1857, made up her mind to put an end to this same convention, so that at present we are deprived of the advantage of a postal convention with the United States. The rates of postage on letters from one country to the other are very high indeed, and, as far as printed matter goes, quite prohibitory. The same remark applies to samples. But, to make matters worse, by a simple decree of the executive—which is of doubtful legality—a tariff has been established, whereby letters passing through England, which is most frequently the case, are subjected to a rate of 1 franc 20 centimes for each 10 grammes; which is equal to four times the cost of the English letter weighing 14½ grammes.

"This is an undeniable drawback for French commerce. Under the government of the 4th of September, the Post-office had its share of the widespread disorganisation in the public service. But we have now lived six months under a regularly constituted government, and I may not unfairly put the question whether our rulers have taken measures to put an end to our very prejudicial position touching the transmission of letters, printed matter, or samples to the United States. Some explanation on the part of the government on this subject is highly desirable. The public would be grateful to learn that serious efforts are being made to arrange this disagreeable business.

"There is another matter in the postal service which has created surprise and dissatisfaction in the public mind. Some weeks before the fatal declaration of war, a bill had been passed by the Chambers which had for its object the introduction of the Post-office order system, for the remittance of small sums of money (£10 and under) from France to England, and *vice versa.* This would be a great convenience, and would cost the State nothing. The bill was duly promulgated, but the Post-office orders are not to be had, and why? The public is inclined to attribute this unconscionable delay to neglect on the part of the administration.

"In one word, I may say that the whole of the facts before us with reference to Post-office management unfortunately testify that misapprehension still prevails as to the nature of this particular service, as to its conditions of prosperity, its proper connection with the exchequer, and the extent of its influence on the budget and on the wealth of individual citizens.

"Michel Chevalier."

THE INDUSTRIAL CLASSES ABROAD.

It will be remembered that last year a series of carefully compiled tables, relative to the condition of the industrial classes in foreign countries, were published in the *Journal.* During the time which has elapsed since the publication of the report upon which those tables were based, an inquiry of a more general and extended character has been made, in accordance with instructions given by the late Lord Clarendon to her Majesty's diplomatic and consular agents. The chief object of the circular letter, addressed in June last year, was to elicit particulars in regard to the purchase-power of money in foreign countries as compared with England, in regard to matters connected with the preservation of health, and in regard to the quality of work executed in the several departments of labour. Whilst acknowledging the great ability and care displayed in the preparation of the former reports, it is observed that certain important information was still deficient and in some places altogether wanting. Upon this occasion the inquiry has, therefore, been extended to her Majesty's consuls at places where a diplomatic representative of her Majesty is not resident. The result has appeared in what is termed "Further Reports respecting the Condition of the Industrial Classes, and the Purchase-power of Money in Foreign Countries."

BELGIUM.

The first of the series which claims attention concerns the working classes in Belgium. Our representative, Mr. Pakenham, observes, it must not be forgotten that Belgium is the most densely populated country in Europe; that emigration from it beyond the sea is next to nothing; and that, in contradistinction to the Walloons, who remain, generally speaking, in the manufacturing districts, there are scarcely any but Flemings who, without work at their own homes, or not finding it in the province of Hainault or in the province of Liege, go into France, where they number about 80,000, a number of trifling importance considering the masses of the unemployed, which means that there is always a superabundance of hands, even when the industrial manufactures happen to be in their normal state. There is, therefore, in ordinary times, and still more so in periods of commercial crisis, great misery amongst a portion of the lower classes. More than one-fifth of the population are inscribed on the lists of poor relief, and were it not for private aid the sufferings and privations undergone in this country, so rich in industrial and manufacturing wealth, would be much greater even than at present. It will be understood, also, that in the lower class of working men, the superabundant demand for work maintains pretty nearly constantly at their level the smallness of wages, that is to say, the wages of the inferior class of workmen are not sufficient, and one only receives from them, in quality and quantity, in proportion to the value of the money given to them. But, generally speaking, the wages not being in proportion to the dearness of alimentary and other wants of life, it is only too true that the condition of the inferior working man is deplorable, and that too much haste can hardly be made in finding a remedy for evils which, in the future, may become very serious as regards the tenure of property and the maintenance of public order.

The workmen's dwellings are described as being better in the villages than in the towns, mainly on account of the difference in rent. It is in the narrow and unhealthy quarters in towns, where there is but little circulation of air, that entire families live, and this is observable generally in large towns. The workmen's homes in the country are healthy and well-kept; the furniture is often defective and leaves much to be desired, but what there is, is neatly kept, and when the wife does not leave the house to work out of doors, an air of cleanliness prevails which is often found wanting in other countries. Dirty and ill-kept dwellings are rarely found in Belgium, except among spendthrift workmen, and scarcely anywhere but in the large towns, the manufacturing districts, and the coal region. The generality wear the blouse, week-days and holidays alike; it is the costume of the masses, as the cap is their usual head covering. Clothing, in spite of its extreme simplicity and its *soi-disant* cheapness, does not the less form a heavy charge on a workman, perhaps already encumbered with a large family. Those who receive fair wages are well-fed, whilst the greatest number, living without an eye to the future, are dependent on retailers or petty hucksters, who make huge profits on the credit system. The use of coffee strongly adulterated with chicory is general, tea is seldom drank, sugar is seldom seen and milk is a luxury. White bread is used by the upper working classes in the Walloon Country, and a good deal in the towns, but the common bread, especially that mixed with rye, is principally consumed in Flanders. Butter and lard, green or dry vegetables, fresh or salted pork, form the workman's principal nourishment.

Primary schools for young children and adults are not wanting, but scholars are wanting for the schools. The necessity of working for their daily bread, the complete destitution of a great number of families, the negligence as well as the ignorance of the parents themselves, all these cause the majority of the children of working men to absent themselves from schools, and the small number who do frequent generally do so casually, and during the winter, and then only up to 10 or 11 years of age, when they commence to get weak in body and mind from precocious labour. If instruction has sensibly developed itself during the last twenty years, there still remains much to be done; this is proved by the fact that more than one fourth of the persons drawn for soldiers can neither read nor write. In 1867, 35 per cent. of the militia could neither read nor write. This number has since dimished to 27 per cent., but the militia comprises all classes. Economists of the highest order have arrived at the conclusion that "compulsory instruction must be more than ever considered as the indispensable corollary of all social improvement." It is the general opinion, also, that instruction must be had at any price, even at the expense of parental authority. Of the persons engaged in agriculture, owing, it seems, to the great division of property, the number of working men does not greatly exceed that of their employers. The price of labour per day varies in the different employments in the country according to the season, and averages, in summer, for men, 2 francs 25 cents; for women, 1 franc; in winter, respectively, 1 franc 50 cents. and 80 cents. If, from sickness or other causes, work is suddenly short, they must have recourse to charitable aid. However, in the provinces of Liege and Namur, and principally in that of Luxembourg, several communes possess lands which enable them to give to each household a portion of fuel, and, in many cases, a plot of land. Glass-making is an immense branch of industry, and has its head-quarters in the environs of Charleroi. The best blowers can earn a good deal, from 400 to 600 francs a month, but the generality from 250 to 300 francs. The larger part lay by no savings, living from hand to mouth. A small number, however, with care, get together some little capital. In the coal establishments the position of the workmen is not good, ignorance and immorality prevailing largely. Up to this time co-operative societies had not succeeded amongst them, but distance may be an obstacle, besides which the men are seldom of the locality, and constantly shift their quarters. There are, nevertheless, in many communes of the arrondisements of Mons, Charleroi, and Liege, evangelical congregations, under the patronage of the Belgian Evangelical Society, composed in great part of workers in coal mines. These workmen were comparatively as models—most of them know how to read, and many to write; they are honest, laborious, and economical, and find means, by dint of order and economy, to dress themselves in cloth, and to maintain themselves properly and becomingly; they gain in all ways, and their employers almost more than they.

There are other branches of industry, such as linen, woollen, and cotton, the seats of these fabrics being mostly at Gand, Alost, Verviers, and some other towns in Belgium. These three industries comprise more than half of the work-people engaged in all the manufactures of the kingdom, and their position has been thus briefly stated. Workers in the woollen factories, the centre whereof is Verviers, are relatively in a position which will hardly admit of comparison with the two others. In the first place, the number is more restricted with respect to production, and the productions meet with a more ready sale. The Walloon work-people are more active and more energetic, and live better than the Flemish, and their instruction is more developed. Lodgings are much the same as elsewhere, but food is cheaper than in most places, and those in the country generally cultivate a small plot of land sufficient to make up for the deficiency in wages. At Gand, the centre of the flax and cotton mills, the misery is great; lace-making and spinning by hand occupy many women, but the convents are said to form an organised opposition to them, and cripple their resources.

GERMANY.

The qualities of the German artisan, thanks to extensive emigration, are almost equally well known and appreciated abroad as they are in his own native country, and wherever he goes they generally insure him employment and success. By dint of great carefulness, he manages to make a respectable appearance on wages which our working men would regard as totally inadequate. His every-day suit is usually very coarse and rough, but on Sundays and holidays the artisan manifests a greater amount of neatness than is to be seen in England. The condition of the industrial classes is certainly that of a transition state from the restrictions of the guilds, to which many still cling with regret. By the incorporation of the smaller German States with the North German Confederation, liberty has been granted for each native to settle and seek his livelihood in any part of Germany, so that there is an increasing change of journeymen in all branches of industry. So recently as 1862, every workman was bound to be a member of a guild, or "innüng," before he could enter on a profession. By the new law this has been abolished, and every one is free to practise his particular trade without let or hindrance. We learn from Mr. Annesley, our consular representative at Hamburgh, that by many the moral position of the workman is considered not so high as when the protective system of guilds was in full operation in every trade, and that the freedom which they have obtained has been taken advantage of by them to the injury of their employers; and that those artisans who formerly competed for quality now look upon quantity as the only thing worthy of consideration and effort. It is, however, affirmed, on the other hand, that the evils complained of are the result of the old system, the influence of which has not yet died out, and a great improvement is therefore looked forward to among them in the course of a few years, as education extends its sway. There is little doubt that the quality of the work executed is at present secured by masters appealing not so much to the honour as to the pecuniary interest of their workmen. There is, however, a superior class of workmen in Hamburgh, who are credited with the possession of a sense of honour in the execution of their duties, namely, the "quartiers-lente," or warehousemen, a body of men peculiar to Hamburgh, whose work combines the receiving and delivery of cargoes, and the weighing, assortment, and repacking of goods received from abroad, previous to their transmission into the interior of Germany, or re-shipment to foreign countries. There are about 500 or 600 of these men, who work together in companies of four or six, employing labourers to help them occasionally. One of the number usually takes the lead, but is otherwise on equal footing with his partners as regards position and share of the proceeds. The co-operation of workmen in this way for the supply of manual labour to the mercantile community is one of the characteristics of Hamburgh, and might with great advantage be introduced into England, where (as in Rochdale and other towns) the co-operative principle has hitherto been confined to manufactures of various kinds. The system works well, and as those men have an extensive knowledge of the quality of goods, and are upright and trustworthy in their dealings, they enjoy a more elevated position than is the case with any other body of men personally engaged in manual labour.

The disadvantages to which the industrial classes are exposed will be evident from the fact that the cost of house-rent for a married working man amounts to about one-fourth or one-fifth of his income, whilst in England the average expense does not exceed one-seventh. In this respect, the working man has great difficulties to contend with, and it is only by temperance and frugality that the balance is maintained between income and expenditure. We are, therefore, not surprised to find that no opening whatever is presented for the employment of skilled artisans or workmen of any description coming from other countries, the labour market being so overstocked, that within the last fifteen years nearly 1,000,000 persons have emigrated from the ports of Hamburg and Bremen to the United States and elsewhere.

Throughout nearly the whole of Prussia, we are informed by Mr. Petre, artisans, journeymen, and apprentices work regularly in summer from 5 a.m. to 12, and from 1 p.m. to 7, and even later; and in winter, from daybreak, sometimes from 6 a.m., to 8 or 9 in the evening. The hand-loom weaver frequently sits at his loom, employed in monotonous labour, for sixteen hours in the day; and agricultural labourers have to work hard for twelve hours a-day out of harvest-time, and during harvest-time for fourteen hours. The same rule applies to farm servants. The extreme length of the hours of daily labour is, indeed, one of the dark features of the condition of the working classes in Prussia, and generally throughout Germany. Night-work is especially injurious to young persons of both sexes, and, indeed, to females of all ages, and its suppression by law would produce the same beneficial effects which are due to the operation of the Factory Act in England, in raising the standard of health and morality. According to some researches made by Dr. Engel, the cost of food has been ascertained to absorb 62 per cent. of an annual income of between 300 and 400 thalers (£45 to £60), and, when the income is double, 55 per cent. In incomes which fall as low as £33, this per-centage rises to 67 per cent., and in incomes of £26, to 71 per cent. On the other hand, the outlay for lodgings generally falls in such cases from 12 per cent. to 8·3 per cent. and 9 per cent., and only exceptionally rises, preserving, on the whole, its fixed character.

Before entering upon an account of the condition of the working classes in that part of Saxony which forms the Leipzig district, Mr. Consul-General Crowe prefaces his report by a rapid sketch of the history of the Saxon people during the present century. From these particulars, we learn that Saxony is the most thrifty State of the German Customs Union. With little more than two millions of inhabitants, it has a large mining and manufacturing population, and prosperous industrial and commercial towns. Leipzig, to which the trade of Saxony converges, is the mart and emporium of Central Germany, and regulates much of the interchange between foreign nations beyond the limits of the Customs Union. For many centuries celebrated for annual fairs, to which traders came from all parts of the European continent, it gained additional influence as a centre of commerce during the wars of revolutionary France. The blockade enforced by Napoleon not only gave importance to the fairs, it also gave a decisive impulse to Saxon industry; and is characteristic of the fitness of the country for the extension of manufacturing enterprise, that neither the cessation of the blockade, nor the pernicious system of prohibition embodied in the Prussian tariff till 1833, were able permanently to affect its welfare. In 1833, Saxony was admitted into the Zollverein, and from that time we may date her progress in the arts of mining, smelting, and spinning. We learn also that in no country was the corporate spirit of the earlier times more instinct with life; nowhere was it found more difficult to compass the abolition of the guilds. Till ten years ago, with the exception of the country masons, carpenters, sweeps, and bakers of rye bread, there was not a man of any craft who did not necessarily belong to a guild. The number of masters—frequently the number of journeymen—was strictly limited; wages were also regulated by custom. What really undermined the guilds were the measures passed to facilitate the establishment of factories; the causes which precipitated their fall were the construction of railways, the consequent extension of markets, and the demand for cheaper and better wares. As the trade in coal increased, and machine-spinning superseded hand-spinning, the power-loom began to oust the hand-loom, and cottage-weaving to pine. As the factory system expanded the guilds shrank, and the population out-grew the old stationary corporations. From 1840 to 1850 the factory system arose. From 1850 to 1860 the guilds languished. In 1861 they were abolished by law.

Ten years have elapsed since the change, and much in the position of the working classes has been altered, but it would be a mistake to suppose that the transition from a state of rigid tutelage to one of comparative freedom has produced all that may be expected. Modern improvements in locomotion and traffic are, in Germany, to a great extent incomplete. The concentration of population in large centres, through it is beginning to be felt, is still but slightly apparent. Small factories have attracted many of the forces which dwelt in cottages, the local system of the guilds has been exchanged for the broader one created by the opening of the German and European labour market; but old habits still cling to the working classes, and innovations make their way with slow and measured step. Passing from a general to a closer view of things, we see how the working of the new system acted in two ways—it reduced the masters, and increased the journeymen. In 1849, the average in fifty of the principal trades of large towns in Saxony was 100 masters to 167 journeymen and 6 apprentices. In 1861, these numbers were as 100 to 238. With respect to wages, we find that the weekly earnings of the Saxon working man are low, and pre-suppose a frugal mode of living. For example, we take a few of the principal trades:—Wool-sorters, 9s.; washers (male) 12s. to 15s.; spinners, 12s. to 21s.; bricklayers, 12s. to 16s.; smiths and engineering mechanics, 12s. to 18s.; carpenters and joiners, 15s. to 18s.; printers, 15s. to 30s.; tailors, 15s. to 24s.; shoemakers, 12s. to 18s.; tanners, 9s. to 18s.; cigar makers, 10s. 6d. to 24s.; tinmen, 10s. to 12s.; agricultural labourers, with keep, 3s. to 3s. 9d.; ditto, without keep, 6s. 6d. to 7s. 9d. With respect to the purchase-power of money, Mr. Crowe observes that wheat is dearer in England than in Saxony. but the Saxons seldom or ever eat wheaten bread, and confine themselves principally to rye, which they have come to prefer. Rye is much cheaper food than wheat. But, on the other hand, coffee and sugar are dearer wholesale in Saxony than in England, and beef is as dear at Leipsig as in London. We are led, therefore, to the conclusion, which is confirmed by fact and reality, that the Saxon consumes more bread, but less meat, coffee, and sugar than the Englishman; at the same time that, as a married man, he abstains to a large extent from the favourite beverage of both countries, which is beer. The diet consists chiefly of rye-bread, butter, bacon-fat, pork, sausage, beef, and veal, potatoes, cabbage in great variety, dumplings, and soup. The meat most in use is pork, it being as cheap as beef, and more substantial. Working men are fairly protected from the demoralising effects of huckster's shops, by the system of co-operative stores, which is very much extended. The rent of dwellings is about 2s. 6d. weekly, for a working man with a wife and three children; for two rooms and a kitchen, from £6 15s. to £7 10s. per annum. The rooms in which working men live are usually healthy, being chiefly in the upper stories, and seldom under fifty yards in area. In lodging-houses, however, the healthiness of the rooms is in exact proportion to the number of beds—whether two, or four, or more that are introduced into them. The Saxon bed is short and narrow, and its furniture is an Indian grass mattrass, a wedge pillow. with straw stuffing, and a feather bed. Ventilation and drainage are good, and vaccination is so stringently enforced that small-pox epidemics are unknown.

Mr. Burnley, writing from Dresden upon the same subject, says, what is a good trait in the Saxon character is, that the lower orders attach considerable importance to a neat and clean outward appearance; even the poorest man has his complete Sunday suit. He seeks also to give the same air of cleanliness and neatness both to the exterior and interior of his dwelling; and as there is a natural tendency in the German race to acquire property, or something that they may call their own, the evils of large barrack lodgings are obviated, at least in the lowlands, so that a house has rarely more than one or two families in it. But what is particularly reprehensible is a certain amount of dishonesty which exists in several branches of industry, as in the linen and cotton trade, among the straw-plaiters and makers of toys, and other such articles delivered in large quantities, where the vendor does not give the full number of yards, or the numerical amount of articles, for which full payment is asked, with the hope that in the mass such trickery will be overlooked. This has done much to damage the old-established fame of Saxon workmanship and Saxon rectitude.

ITALY.

The inhabitants of Piedmont and Lombardy form the sinews of united Italy. Brave and energetic, they possess the qualities attributed to more northern races; while, in Lombardy at least, some of the graces of the south are not wanting. The artisans in general are intelligent and industrious, frugal in their food, and sober while at work. Mr. Colnaghi, in his contribution to the reports from foreign countries, remarks that it is difficult to give an account of the working classes in Italy; the data—which if collected could not easily be marshalled in proper order—have still to be gathered, and for this time and great labour are required. And what is true of the whole country is applicable, in a minor degree, to each of its parts, and the variations from commune to commune are often as unexpected as from province to province.

In both Piedmont and Lombardy, agriculture forms the principal occupation of the people, but no strict line can be drawn between the agricultural and industrial classes, which blend into each other in the several districts, as the necessities of the first compel them to undertake other work than the cultivation of the soil. Among the chief industries of North Italy are silk-reeling and throwing, which employ a large contingent of female labour. The woollen factories of the Biellese are of considerable importance, and promise a still further development, while manufacturers of cotton, flax, and hemp are extending in the various provinces of both regions. These industries are not all gathered in the towns. Fed by mountain streams, supplying the place of coal, they are to be found nestling in picturesque valleys, to which, though thus becoming the centres of manufacturing industry, the freshness of country life and of rural associations yet clings. The mechanical arts, if we except the manufactory of arms at Brescia and the Royal Arsenal at Turin, are in partial abeyance, but they are springing into new life with the requirements of modern times. Iron foundries are beginning to assume a certain importance; agricultural machines are being made, and the cutlery of Biella gives promise of future excellence. Special trades are exercised by the inhabitants of the different districts. In Piedmont, for example, masons and house painters are generally natives of the hills of the Biellese, the district of the Canavesan supplies brickmakers; the neighbourhood of Pinerolo, hawkers; the inhabitants of the Vaudois valleys emigrate as servants; umbrella makers come from the hills about the Lago Maggiore, and the province of Alessandria is said to furnish a contingent of professional beggars. In Lombardy the masons of the mountainous districts of Como are known throughout Europe; the territory of Bergamo supplied Genoa and Leghorn with the bands of porters whose corporations have only lately been dissolved; innkeepers and coffee-house keepers are frequently natives of the two provinces named, while other districts are the nurseries for workmen of various trades.

The handicraftsmen of Turin have no doubt suffered considerably through the transfer of the capital to Florence, but more, perhaps, owing to the improvident habits which they had contracted from former constant work than from other causes. In the mining district of Val Ossola, the living of the native miner does not differ from that of the ordinary labourer throughout Italy. He is contented with his polenta for breakfast and supper, a portion of cheese, and occasionally a "*minestra,*" or lard soup, for all of which about 80 centimes a day may be calculated; clothing from 10 to 15 centimes; lodging is usually given at the mine by the employer. About 1 lira a-day may, therefore, be put down as the cost of living of a single person of this district. It should be remembered that Italians are much more easily contented than English workmen, and that with what the former could live well the latter would be discontented. As to the quality of the work performed by the artisans of North Italy, the best workmen are not inferior to Englishmen, and wherever taste and ingenuity are concerned, they stand in the first rank. The chief defect lies in a certain want of finish, which often takes off from the effect of otherwise successful efforts. In the higher branches of each art, the artisans take pride in their occupation, enter keenly into its artistic qualities, and strive to do their best; but, as a rule, ordinary Italian workmen are said to require more supervision than Englishmen, or, in other words, are less conscientious.

The labour-market does not require to be recruited from abroad. English artisans are only employed in small numbers and in special occupations, as by the Mont Cenis Railway Company, in mining operations, but only where particular skill is required. and in temporary work for the erection of agricultural and other machines. The charitable institutions in Piedmont and Lombardy are very numerous, and include hospitals of all kinds, orphan asylums, schools, charitable trusts and foundations for granting loans of money without interest, corn, marriage portions, help to the blind, sick, and destitute, accompanied with religious exercises. In answer to the question upon lodging, Mr. Colnaghi observes also, that even now but little has been done to improve the dwellings of the artisans, though the rent they pay is not light. Owners of houses prefer other tenants, for fear of difficulty in obtaining their rent, or of losing it altogether; in consequence, they raise the amount to counterbalance the risk. At Milan, where the workmen live in distinct quarters, efforts are being made, which it would seem are attended with success, to improve their dwellings. At Turin a similar society has not met with success, chiefly from the promoters having built a block of habitations suitable to the middle classes rather than to artisans.

Any description of the condition of the working classes would be incomplete without some notice of their state of education. The system of public instruction in Italy, we believe, is divided into three great branches. The first includes the Universities and a few special upper schools; the second contains the classical and middle technical schools, linking the first division to the third, which embraces elementary, technical, and general instruction. The average state of education, though much still remains to be done, is greatly to the advantage of the northern provinces over the general mean of the whole kingdom, which is at its lowest in Basilicata, where, in 1866, 85 per cent. of the men and 97 per cent. of the women, were unable to read or write. The elementary public schools, which are almost entirely supported at the expense of the communes, are free to all; children are received at six years of age, and the ordinary courses of study is calculated to extend over four years. Education is not, as yet, compulsory, although the question has been mooted, as well as the advantage of establishing small school fees. The children of working men, even when they are able to complete their elementary studies, can rarely if ever hope to continue their education unassisted after twelve years of age. In their aid, therefore, popular industrial schools and schools of design have been established by local associations, both public and private. These schools, where the course of instruction lasts one or two years, contain the germs of much future good. In the city of Turin they are well managed and well attended. In the provinces from various local causes, they have not, as yet, given all the results expected from them.

EASTERN TURKEY.

Mr. Gifford Palgrave, our Consul at Trebizond, gives an exceedingly minute and graphic description of the inhabitants and of the country comprised in the provinces of Trebizond, Sivas, Angorah, and Kastamouni, in other words, the greater part of the north coast and the entire centre of Anatolia. This space, for the sake of convenience, he divides into two zones, different both in climate and produce. The length of the coast zone is about 450 miles, its average breadth 30 miles, from the Black Sea southwards. It is mountainous and well watered, often densely wooded up to 5,000 or 6,000 feet above the sea level; the higher summits are pasture-land and rock, where the snow lies in patches all the year through. Intermittent fevers prevail all along the coast to such a degree that those of the inhabitants who can emigrate yearly to the mountains inland, and there remain from the middle of June till the end of September.

The chief agricultural products are maize, which constitutes the staple food of the industrial population, corn and barley, rice, millet and lentils, potatoes, turnips, &c., tobacco, hemp, vines, silk (for the rearing of which mulberry-trees are being every year more widely planted), olives, lemons, oranges, and other fruits. Lastly, the coast, though possessing only two really good harbours, namely, Sinope and Batoom, abounds in roadsteads, little creeks and bays, available for boats and small craft, while the brackish waters of the Black Sea, though destitute of the better qualities of fish, abound in the inferior sorts, which are freely eaten by the natives.

The interior follows, the inland zone, or central Anatolia. Here the climate is much drier, the sky is generally clear, except in winter, though violent but not lasting rains are apt to fall at other times of the year. The forests are scanty; the general aspect of the country alternates between wide, open, undulating plains, with deep soil and rocky stretches, often interspersed with good pasturage. The climate is in general healthy and bracing, except in some of the deeper valleys, which are subject to intermittent fever, but in the open plains and plateaus nothing of the kind is known. Cereals form the staple agricultural produce. Silk does well in the valleys, and cotton has been planted with a tolerably good result in some favourable spots. The wool of the sheep reared in the pasture lands is remarkably good. The number of towns comprised within the two zones, coast and inland, is somewhere over forty; they contain from 6,000 to 50,000 inhabitants a-piece. Villages are thickly scattered everywhere, and the total population may be roughly estimated at 4,000,000. The land, under a better administration, would easily support as many more.

The industrials and artisans, with whom this report is more directly concerned, Mr. Palgrave divides into townsfolk and peasants, and for clearness sake he subdivides the former into three categories. The first and lowest class comprises day-labourers, porters, job-men, having no fixed profession, and dependent on casual employment in the coarser kinds of work, and the like. The men belonging to this category are mostly unmarried, and have seldom a home of their own. Their day-time passes in the streets and coffee-houses; by night they find shelter under the entrances of goods-stores and bakers' ovens, which they guard, or act the part of watchmen in the streets; occasionally ten or twenty of them unite to take possession of some ruined building or abandoned shed. Many, the porters in particular, are Tartar or Circassian refugees from Russian territory. But the married men of this class have in general each his little house, which consists of two rooms; the one, open on two sides at least, serves for cooking and washing; the other room is for eating, sleeping, and everything else. Assemblages of houses such as these, some a trifle better, others a trifle worse, constitute entire quarters of Anatolian towns. The head men of the district, or "mukhtars," never interfere in the interests of repairs or cleanliness, yet epidemics are, on the whole, less prevalent in Turkish towns than might have been expected, partly owing to the great extent of surface over which the cheapness of ground-room allows all this filth to be spread, partly to the free access of air and weather everywhere, and partly also, where the Mahometan population is concerned, to habits of personal cleanliness. The yearly earnings of the married day-labourer amount to £18 15s., and expenditure £18 14s. Of the unmarried day-labourer, the earnings are £15, and expenditure £11 19s. The "hammal," or porter, shows a balance of £9 in his favour, but Mr. Palgrave observes that this result is obtained by the endurance of privations to which the commonest tramp in England would not long submit; and, again, these earnings, whatever they may be, are almost certainly destined to disappear in one future week, the week of marriage, when Eastern usages impose on all ranks of society indiscriminately the most lavish and disproportionate expenditure, and the savings of years are often thrown away in a lesser number of days.

The second class consists of workmen, such as stonecutters, carpenters, boatmen, smiths, dyers, &c. Measured by a European standard, these are little better off, so far as comfort is concerned, than those of the first. The houses, though probably larger by a room or so, and somewhat better arranged, are in construction and the character of accommodation essentially the same. The food, though more abundant, is not much more nutritious; while the furniture of the rooms is restricted to two or three worn carpets, some cooking utensils, mattresses, and wooden boxes for clothes. The windows here, too, are unglazed; the chinks in roof and wall unstopped, not a lock or hinge does its duty, and the drainage is detestable. The earnings of the workman show a balance of £1 14s. 2d.; of the "kaikjee," or boatman, £6 8s. 4d. This calculation makes no allowance for the contingency of accident or sickness. Disablement, however, from whatever cause, simply implies the interruption from work, for there are no professional men worthy the name of surgeons, and if there were any, they would find few clients or none among the workmen. The sick or maimed Mahometan calls in a Koran-reader, the Christian gets a charm manufactured by his priest; the fee in the latter case is trifling, and in the former the services rendered are gratuitous. The third-class comprises all those engaged in sedentary manual labour, or in ornamental work. Here both expenditure and earning take a higher rate. The balance in favour of the average artisan shows £12 12s. 6d. The worst off among the many sub-varieties of this class are weavers and pipe-makers; their earnings seldom exceed 2s. 8d. a-day. Tailors and shoemakers easily realise 3s. 4d. to 4s.; silversmiths, who find plenty of employment in the East, and whose profits are ordinarily estimated at 5s. to 6s. 8d., a-day, stand highest of all.

With regard to the quality of the work, we are informed that what keeps matters here down to their present low mark is the meanness of the employing and the servility of the employed classes—conditions which materially react on and fortify each other. No stand is made against bad wages, and hence bad work is accepted, both by those who execute and by those who receive it, as a natural consequence. Experience has shown that neither skill nor patience are intrinsically wanting to Anatolian workman in any department, when they are once assured that their skill and patience will be paid for, either in money or in what else is money's worth to men. The great poverty of the labouring men and artisans, taken as a mass, debars them from the possibility of acquiring much in the way of tools and implements, really necessary to good success. Such articles, Europe made, are, even at their original prices, beyond the reach of ordinary Anatolian means, much more so when those prices are augmented, as is here the case, by the costs and risks of distant transport. The causes to which the actual inferiority of Anatolian workmen is to be ascribed are rather general and social in their nature than inherent and particular. Want of equity, of honesty, both in employers and employed—a want itself due to the want of law and justice in the background, poverty, aggravated, if not originated, by the non-existence of any banking or sound commercial system; the depressing influences of an effete government, and of an uneducated people; the all-pervading feebleness of division and decadence; no nerve in the masses, and no example or authority in the rulers; a pernicious fiscal system, recalling to mind that of the later Byzantine Empire in its worst days,—all these form an atmosphere in which everything flags, and which is no less fatal to excellence among the working classes than it is among other and higher ranks of society.

For the European artisan, better skill, superior implements, and punctual industry would at first procure a certain run of custom; but the higher prices which he would inevitably demand, as well as deserve, would soon drive away customers used to, and, in their hearts, contented with, cheap and inferior articles. The delays and chicane with which his Anatolian employers would meet him at every turn would wear out his patience; and the combined rivalry of the native workmen around, who would soon pick up from the new comer just enough to compete sufficiently for show, and yet to undersell, which would ultimately shut him out of the market. Want of friends in health, and of doctors in illness, would complete his discouragement, and his final failure would be a matter of time, perhaps, but still of certainty. All this is confirmed by the experience of numerous European artisans—smiths, carpenters, and others, who have tried their fortune in this manner. The same view does not hold good for Constantinople, Pera, Beyrout, Egypt in general, and probably not for Smyrna. The issue might, however, be tried, and, where tried has already proved very dissimilar, if the competitive struggle between the native workmen and the European immigrant be carried on, not by an isolated artisan, but by a body of such, combined to a definite purpose, in a factory or the like, under the direction of a steady and intelligent capitalist. As an instance in point, Mr. Palgrave notices the silk-spinning-factory and the flour-mill of Messrs. Krug, Stroh, and Co., South Germans, established at the town of Amasia, about seventy miles inland of Sansoon, and which have now worked for twenty years with considerable profit to the owners. This is a complete colony of Protestant Germans—carpenter, smith, tailor, baker, and even clergyman, included. They cultivate their own kitchen-gardens, rear their own barn-yard stock, and, except for the supply of raw materials, meat, corn, and the like, and the coarse day-labour that mere Anatolian sinews can supply, are completely independent of the natives. In a word, the factory is a colony, and therefore successful, and such alone can, and if properly conducted, always will, succeed in these countries. For experience proves that no European undertaking of this kind can prosper, or even exist, in these provinces of Asiatic Turkey, except in a condition of absolute independence from the Ottoman administration, and this can only be assured by consular protection, supported, where necessary, by the higher authorities.

By such means, silk-factories, wool-factories, and flour-mills would drive an excellent business. The immense natural resources—animal, mineral, and vegetable—of Anatolia have been often described elsewhere, and are sufficiently, though superficially, known already. Were the town labour-market in a condition to make use of them, they would flow in thither, instead of passing on, as they now do, in a raw state, to foreign exportation. Combined work, European capital and workmen, would soon render them abundant resources of manifold profit, both to the settlers and to the country.

LEGISLATION ON THE UTILISATION OF SEWAGE.

Some members of the Essex Chamber of Agriculture paid recently a visit of inspection to the farm of Mr. W. V. Hope, V.C., in the parish of Hornchurch, which is irrigated with the Romford sewage, and, subsequently, held a meeting in the town of Romford, to discuss the subject of legislation affecting the utilisation of sewage.

Mr. Hope, in introducing the subject, proposed to divide it into three parts, and consider, first, why there should be any legislation at all upon it; secondly, what legislation there has been; and thirdly, what legislation there ought to be in future. Regarding the first point, he read some extracts from a book by Professor Corfield, prepared for a committee of the British Association appointed three years ago, showing that, from 1604 down to quite recently, deficient and improper drainage had in various towns produced fevers, cholera, and plagues. The diseases so produced spread out of the towns into the agricultural districts, and thus affected the whole community. Properly to manage the cleansing of a town was always a most difficult and expensive operation, but it paid in a twofold way when done. Health and strength were the labourers' working capital; but, to the discredit of government, at present the working classes as a rule were anything but strong and healthy, and the mortality tables told a fearful tale of fevers and kindred disease, the product of dirt—that was, matter in the wrong place—and the value of the lives of these unfortunate creatures was not only lost to the community, but each death of the head of a family inflicted a fine upon the surviving population, by throwing the family on the parish. He thought, therefore, there was very little doubt that some legislation was imperatively necessary. Then he came to the question what parts of town sewage contained the dangerous germs of disease, and he was afraid that on this point as yet little was known. The Rivers Pollution Commissioners considered a certain standard of nitrogen in the effluent water capable of producing disease. But nitrogen in itself was not unhealthy. On the contrary, when we wanted to nourish ourselves we ate nitrogen, and if a patient had a bad headache the doctor ordered him ammonia, therefore in ammonia there was nothing *per se* unhealthy. But it would appear that some of the other ingredients that were generally concurrent with ammonia and nitrogen in town sewage contained the pernicious germs, and, in ignorance of what the particular sources of infection really were, it had been found convenient by the Rivers Pollution Commissioners and the Thames Commissioners to take the per-centage of nitrogen as the measure of pollution. The measure of pollution was also the measure of production to the agricultural chemist. All manures were sold according to their analysis, and the price was regulated by the per-centage of ammonia which they contained. He would now refer to the value of town sewage. A great many chemists had devoted their attention to this subject, and Professor Corfield, in his book, gave a *resumé* of the different analyses that had been made, from which it appeared that the value of the manure created by each person annually was about 8s. per year. He (the speaker) took the trouble about two years ago, in a paper which he read to the Institution of Surveyors in London, to work out the value of this wasted manure in loaves of bread. He calculated that one additional quarter of wheat, or two additional quarters of oats, over and above the ordinary produce of a farm might be obtained by the application of the sewage of four persons to each acre. Striking out the scattered population of the rural districts, there was a town population in the United Kingdom of upwards of 15,000,000, whose sewage, therefore, would produce 3,750,000 qrs. of wheat, or 7,500,000 additional quarters of oats. From particulars obtained from bakers, who differed very much on the point, he reckoned that a quarter of wheat would produce 108 quartern loaves. [A Member—A quarter of wheat will produce 180 quartern loaves.] That was so much better for his argument. If a quarter of wheat would produce 108 quartern loaves, it followed that by our present sanitary arrangements we wasted 405,000,000 of quartern loaves of bread every year; if a quarter of wheat would produce, as had just been stated, 180 quartern loaves, then something like 700,000,000 loaves were wasted every year, and at the same time the wasted matter was polluting rivers that would otherwise be beautiful, poisoning fish, and spreading disease. Many said it would not pay to utilise sewage. It was this unfounded superstition which sent these millions of loaves of bread down the rivers, which necessitated our sending ships thousands of miles for food which we might produce at home, and which compelled us to ransack foreign parts in search of manures. In ten years, from 1841 to 1850, there were only 3½ millions of people in this country fed exclusively upon foreign wheat, but in the last ten years no fewer than 8,600,000 were so fed. If a quarter of wheat would produce 180 quartern loaves, he could have fed the whole of these people with food grown in this country, if only the sewage had been properly applied. The wheat paid for by these 8,600,000 people must have been worth at least 14½ millions sterling. Next came the question how they were to extract this value from sewage. The precipitation processes had been tried and found wanting. The sewage of Romford last year contained about 4½ parts in 100,000 of ammonia; this year the ammonia was only about 2½ parts, owing to the immense rainfall, and the notion that these could be precipitated, and the value of the manure retained, was quite Utopian. The phosphate process had also been tried, but Royal Commission after Royal Commission, Parliamentary committee after committee, had sat upon this question, and they had all come back to the one idea of irrigation. But when they had settled that irrigation was the only way of utilising and realising the value of sewage, they still had to determine what irrigation meant. Irrigation by the hose or jet, which carried away his friend Mr. Mechi, was not irrigation properly so called, and could never pay. The only plan was to flow the sewage over the surface of the ground by gravitation, but here again there were different modes of doing it. There was the catch-water system, a rough and clumsy method, which in some instances, as he had seen at Tunbridge, drowned the plants, and certainly did not extract the valuable matter from the sewage. That system, he was satisfied, could not be allowed to continue beyond a few years longer. To pass on, he had brought with him some of the Acts of Parliament relating to sewage utilisation, but there was mighty little in them. They were the usual sort of permissive measures which we were so fond of in the present day, and whose chief virtue was that they afforded the Home Secretary a convenient means of shelving some subject which perhaps he did not understand. Lord Robert Montagu was the author of an Act, making it permissive to towns to do a great deal which they might equally have done without any Act at all. There was, however, one practical clause in the measure, which, he was told, enabled a town to get an Act, by asking the Secretary of State, for £15, whereas the Act he (Mr. Hope) obtained in 1865 for the utilisation of the sewage of London cost £30,000. By that Act of 1865, the towns were able to grant leases of their sewage for periods not exceeding 25 years, but in the Sewage Utilisation Act of 1867 there was a clause, under the restriction of which he was suffering at this moment, preventing local boards from granting leases of any lands which they bought for their sewage for more than seven years. [A Voice—It ought to be repealed.] Then they came to the question, what legislation was really required for sewage utilisation. At present there practically was no legislation, because he called a Permissive Act no legislation. It was playing with the subject. Legislation was to compel people to obey the law. He thought the utilisation of sewage and the prevention of the pollution of rivers ought to be enforced. The existing Acts, too, were defective, inasmuch as they did not even enable the towns to borrow the money for the purchase of the land upon the land itself. Romford only paid £10,000 for a farm of 121 acres, and they had the greatest possible difficulty in borrowing the money at less than 5½ or 6 per cent. One of the last objections raised to the utilisation of sewage by irrigation was urged six or seven years ago in a very clever pamphet by Dr. Cobbold, who said that as vast numbers of the population of every town suffered habitually from various forms of internal parasites, if the sewage were applied to the land, the eggs of those parasites would be eaten by the ox, and so would get spread through the community. To convince Dr. Cobbold that these delicate eggs could hardly be preserved through these various processes, he (Mr. Hope) had an ox fed for 22 months on sewage produce—grass, mangold wurzel, cabbage leaves, and very often the rakings of the grass—and that ox was slaughtered last Saturday week, in the presence of Dr. Cobbold and other scientific men, and, after it had been minutely dissected and examined, the united talent of all these gentlemen entirely failed to detect any trace of disease whatever. Nevertheless, it would only be prudent, in the existing state of our knowledge, that in any future legislation making sewage irrigation compulsory, the towns should be prohibited, at all events for a certain number of years, from allowing grazing on irrigation land. Not only did he think that legislation should be compulsory upon the towns to utilise their sewage, but that it should not be left to the towns themselves to choose the process of utilisation; that process ought to be prescribed by government. We had paid vast sums of money for different commissions and committees. He made a list of 34 blue books that had been published upon this subject by Parliament, 10 years ago. Many had been published since, and he really thought the time had come for some practical legislation on the subject; in fact (and with these words he would conclude) he looked upon this as being almost as pressing a question as that of secret voting.

The President said he was sorry to hear that, in Mr. Hope's opinion, the present Acts of Parliament relating to sewage were not the highest embodiments of human wisdom, for he had fondly hoped they were. Mr. Hope, when he spoke of the ox slaughtered in presence of Dr. Cobbold, might also have told those present that they had been eating the ox at the luncheon that day. He (the President) felt rather uncomfortable when Dr. Cobbold's original opinion was stated, and was immediately relieved when he heard that he had changed his views.

The Hon. H. Petre said as to the Barking farm, with which he was connected, he thought it would well repay a visit. He did not wish to contrast it in any way with Mr. Hope's farm. The Barking farm was five years old, and Mr. Hope's was not yet two. Whether from that cause or some other he could not say, but he thought the Barking farm would, in some respects, be found in a more satisfactory state than that which they had viewed to-day.

Mr. Edwin Chadwick, C.B., said he thought Mr. Hope had made a most important advance on this question. The old water-meadows of Edinburgh and Turin were enormously expensive, and created marsh surfaces. The Edinburgh meadows cost £30 per acre, while Mr. Hope's system, which was of course the most efficient, and not by any means so dangerous to health, only cost from £8 to £12 per acre. He had seen no working of the surface that appeared to him so complete as Mr. Hope's. He quite expected to see that other towns would adopt this beneficial measure. With respect to legislation, he might mention that some years ago, in order to drain a settled estate, it was necessary to make an application to the Court of Chancery. On that, he (Mr. Chadwick) submitted to Sir Robert Peel's government that there ought to be a cheaper mode of attaining this object, and the result was successful. One serious evil of the present day was the great cost of obtaining local or private Acts of Parliament for small towns. In fact it amounted to a legislative abomination, which certainly ought to be got rid of. He sincerely hoped that the county of Essex would support Mr. Hope in this important agricultural movement.

Mr. Angel, engineer to the West Ham Board of Health, agreed with most that Mr. Hope had said, and was perfectly satisfied that in this movement he would come out successful, but he disagreed with some of his remarks about past legislation. It would be a serious thing to compel towns to buy so many acres of land, or to compel farmers to take the sewage. As to making profit of sewage irrigation, that depended greatly on the geographical position of the town, but he believed in the system, and was convinced it would make its way.

Mr. Perry Watlington and **Captain Russ** also insisted upon the necessity of simpler and better legislation, and called particularly for the abrogation of the seven years' lease clause, which prevented gentlemen from taking sewage-farms.

The **President** then proposed the following resolution, of which, he said, Mr. Hope approved:—"That in view of the large amount of foreign wheat paid for every year by the population of this country, and the large amount of manure wasted in polluting rivers with town sewage, it is desirable that such pollution should now be prohibited by legislative enactment, and that the 45 sanitary Acts in existence should be repealed, and a general and comprehensive law enacted."

GENERAL NOTES.

Brewers and Beer.—An annual return shows that in the year ending 30th September, 1870, there were 32,623 licenses paid for by common brewers, the total license duty paid being £388,389. One license was for brewing 550,000 to 600,000 barrels, one for 600,000 to 650,000, and one for 650,000 to 700,000 barrels, the duty paid in these three cases, with supplementary charge or deduction, being respectively £7,878, £7,582, and £9,155. There were in the United Kingdom in the year above mentioned 98,652 licensed victuallers, 44,488 persons licensed to sell beer to be drunk on the premises, and 3,080 licensed to sell beer not to be drunk on the premises, making a total of 146,220; the last two classes being in England and Wales, and the victuallers, 69,903 in England and Wales, 12,644 in Scotland, 16,105 in Ireland. In the same year 536,946 barrels of beer, of the declared value of £1,930,083, were exported from the United Kingdom, 216,534 barrels to India, 95,398 to Australia, 27,088 to the British West Indies, 17,606 to the foreign West Indies, 24,300 to the United States, 14,074 to Brazil, 12,432 to China, 11,944 to Gibraltar, 10,985 to South Africa.

Picking Tools.—Mr. Jackman, of Sheffield, has recently patented an invention, says the *Scientific Review*, the object of which is, by the adoption of such suitable mechanical arrangements, to attach in an effectual manner picks, axes, adzes, hoes, and other similar tools or instruments, to their handles in such a manner that they may be more readily secured to or detached therefrom, than by any arrangement or construction heretofore known or used. A socket of malleable iron or other suitable material is provided for receiving the picking tool or blade; this socket is attached to a wooden handle in the usual manner. The picking tool or blade is made with a depression or protuberance which fits into or upon a corresponding part of the socket; or, if preferred, there may be a series of depressions or protuberances, so as to give the tool a firmer hold of the socket. The picking tool or blade is secured in the socket by means of a set-screw, the point of which acts upon a "gib," or separate piece, which distributes the pressure of the screw over a considerable surface of the tool; the set screw is further secured against slackening by the introduction of one or more lock-nuts. The set-screw, gib, and lock-nuts are conveniently arranged in the shaft side of the tool, thus dispensing with all projections in the end or sides of the pick, which are objectionable. The advantages of this invention are, that the tools may be easily replaced when worn or damaged, that they may be readily and securely fixed in their proper position in the socket, so that the set-screw, being provided with lock-nuts, will not easily work loose, and especially that the "gib," or separate piece, will distribute the pressure of the set-screw over a considerable surface of the tool, thereby giving greater security against slackening.

Pawnbrokers.—The House of Commons' Select Committee on the laws affecting the pawnbroking trade state in their report that it appears to them that, as all persons are now free to buy and sell goods, and to lend money upon them upon such terms as they may mutually think best, subject to the general provisions of the law, any restraint upon the business of pawnbroking should be kept within the narrowest limits which the necessity of the case may demand. The Committee regret to think that, from the necessities as also the reckless and improvident habits of considerable numbers of the people, it is desirable that the small advances which they obtain from pawnbrokers should still be regulated by statute, so that they may not be subject to imposition from not knowing or sufficiently understanding the conditions under which their goods are pledged; but, as this reason does not extend to transactions of considerable amount, there is now no ground for interfering with the freedom of contract in such dealings. The Committee are of opinion that the limit for statutory regulation should not exceed a loan of £2, and that all dealings above that amount should be left to the discretion of the parties. As, however, the public has long been accustomed to consider the business of pawnbroking regulated by law to the extent of £10, the Committee recommend that where no special contract is made, the law relating to dealings under £2 should be the measure of the implied contract between the parties, and govern the transaction. With regard to loans under £2, the Committee recommend a simpler scale of charges—one halfpenny per month interest for every 2s. or fraction thereof advanced, and a charge of one halfpenny for the duplicate for 10s. or less, and one penny on higher advances. The Committee recommend several amendments of the law, such as the abolition of fixed hours for keeping pawnbrokers' shops open; the reduction of the period for the redemption to six months, with a week's grace; that goods under 10s. value should become the pawnbroker's property if not redeemed in that time; and that he be absolutely liable for the safety of goods pledged. They suggest a general law regulating the summary jurisdiction of justices respecting the illegal disposal of goods, the receiver of them to be liable to restore them if they were wrongfully made away with and received by him without due care, but the value to be paid by the owner if they have been unlawfully disposed of through his own negligence. It is recommended that the pawnbrokers' license duty be £7 10s. throughout the kingdom, and that no licenses to new pawnbrokers be granted without the certificate of the justices, as on certificates to dealers in intoxicating liquors, such certificates to be liable to be withdrawn on conviction by a jury for fraudulent dealings or receiving goods knowing them to be stolen. It was moved that the produce of the license duty be applied in aid of the local police fund, but the Committee, on a division, rejected the motion.

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THE INDUSTRIAL CLASSES ABROAD.

(Continued from page 754.)

EASTERN TURKEY.—No. II.

In the consular district of Koordistan, statistics, as regards the artisan and industrial classes, are absolutely unknown, while the census, cadastre, and official returns are so negligently and loosely compiled as to render them perfectly useless for the purpose of judging of or guiding the wealth of the nation. The data given by Mr. Consul Taylor are merely the results of constant travel, careful inquiry, and research, noted day by day, during an eight years' residence in the villages of Erzeroom and Diarbekr. According to his authority, the population in 1868 amounted to 2,314,000 persons, and these he divides into 365,000 able-bodied males, exercising trades, &c.; 318,500 working adults assisting the same; 1,494,200 remaining members of families, women and children; besides an uncertain body of drabs and Tchetchens, who have no occupation or ostensible mode of living. The largest class in the first category are the mollas, proprietors, shopkeepers, and small traders, 19,000. Next are 11,700 handloom weavers, assisted by 6,000 youths under 16 years of age, although, generally speaking, one man is, as stated, sufficient to keep his loom working. The town weavers are all Christians, those in the country seven-eighths Christian, the rest Moslem. They maintain among them 52,500 persons. Their earnings vary in different places, but not always according to the quality or value of the stuff they weave; for instance, at Bitles, the weaver of coarse cotton cloths earns more than the Diarbekr or Khahput silk weavers, who produce the elegant but more expensive stuffs worn by the affluent. The looms are the property of the workmen; but the latter, in towns, are employed by capitalists, who give them the raw material, and afterwards pay them a stipulated sum per piece, when returned in a manufactured state. They advance them, during periods of scarcity, loans, to enable them to tide over hard times, till prices regain their normal state. It results, therefore, owing to variable prices, improvidence of the borrowers, and other causes, affecting the demand for their manufactures, that they are always in the power of their employers, practically, in fact, slaves to the capitalist. Generally speaking, in the towns, where alone all the richer goods are made, the silk weavers find employment during 200 days of the year, and the cotton weavers during 290 days. In the country, where coarse cotton cloths and bombazines, used as articles of dress by the poor, are woven, the loom is idle half the year round. But there is this difference in the circumstances of the country weaver, that other members of the family engage in agriculture, and so increase the general stock, which is not the case in towns, where the other working male members of the family can only earn a trifling sum as domestic servants.

Under ordinary circumstances, the Erzeroom weaver, by the earnings of himself and family, would have a balance in his favour of £6 11s., which, if hoarded, would render him independent of his employer for loans; but cheaper times bring with them other wants, and the sum is expended in a better style of living, dress, and other luxuries, denied him during scarcity. As a whole, then, if not heavily in debt, they are never in a position to improve their condition. Therefore it is that their employment and mode of life have become invariably heirlooms, handed to them from preceding generations, and they never seem to have improved from one to the other. All work is carried on in the weaver's dwelling-house, where the raw material is sent to him by his employer. The houses they inhabit in Erzeroom, generally speaking, consist of a small cow-house and two rooms, made of mud and rough stones, with walls three feet thick, on the ground floor, all communicating one with the other, covered with a heavy earthen roof, also three feet thick, laid on large bare pine-poles. The walls, as the ceilings, are bare, and pierced with small glazed windows, which, in winter, are pasted over with oiled paper to exclude cold. Ventilation there is none; and the previous stifling atmosphere is increased by the burning of cakes called *tazek*, made of dried cow and horse dung, collected during summer and winter in a trough, which exists at the side of every house, mixed with straw, in deep circular holes sunk in the ground, in which also the greater part of the family food is cooked. The odours exhaled, with the stench, filth, and closeness engendered in the apartments so tenanted, is indescribable, and, in the absence of drains, proper closets, and ventilation of any kind, would decimate the country, were it not for the extraordinary salubrity of the air.

At Bitlis, near Lake Van, the weavers' circumstances are far better. Not only is fuel, grain, and food much cheaper than near the central town of Erzeroom, and their houses are more comfortable and cleaner, owing to their being generally built of stone, and subject to the natural drainage afforded by the numerous streams running through the town, but their earnings are larger. This is due to the fact that it is at Bitlis only where the coarse cotton cloths they weave are also dyed red, and in that state not only used largely by the natives, but exported in quantities to Russia and through Koordistan, thus ensuring constant employment throughout the greater part of the year. Yet the madders used for this purpose are all imported from Saert and Diarbekr, where the weavers are too apathetic, or tied to old customs, to combine the two operations. The fact is, routine rules every one in the East—the profession of the father is followed by the son, and he would be considered a degenerate offspring if he deviated from the usual general rule. At Diarbekr, the weavers' gains are the same, but the rate of living cheaper, from the lower price of grain and rent. But again, their taxes are, from improper assessments, much higher, and, although wheat averages £1 12s. per quarter, it is occasionally £2. During such seasons of scarcity, then, owing to periodical ravages of locusts, or approach of the large Arab nomad tribes to buy up grain for their yearly use, they also are invariably, from their improvidence or fluctuating times, in debt to the capitalists employing them, which, owing to the exorbitant interest they pay, 30 per cent. per annum, materially alters a condition otherwise favourable.

Under the head of artisans are classed carpenters, masons, smiths, tanners, dyers, &c., who practice only the most simple branches of their several trades; consequently, there are few skilled workmen, as in Europe, and no encouragement at present for a better class. With very few exceptions, all handicrafts are exercised by Christians, Mahometans only engaging in agriculture or pastoral pursuits, and then more commonly in the latter than the former. Notwithstanding that the rates of gain differ in different places, the condition of the artisans as a class is superior to that of those already mentioned, although, of course, inferior workmen are subject to the usual deduction in their earnings attending want of skill or industry, and suffer during scarcity in consequence. The quality of the work executed is, with few exceptions, of a very inferior character; for not only are the great majority of the people in poor circumstances, and as yet far from civilised, but the richer classes, like the poorer, seem wholly indifferent to the discomforts which surround them. The great demand among rich and poor is for cheap, therefore coarse and imperfect, labour, without, excepting durability, any reference to quality, and so it is that there is no development of talent in any one branch of industry—all are stationary.

The agriculturists form in this district, as elsewhere in Turkey, the greater portion of the labouring population, and the most valuable to the nation at large. The results of their labour furnish the principal item in the whole State income, while here they form more than one-half the sum derived from every source of taxation or impost. This population, with their assistants sharing in the gains, and the remaining members of their families, consists of heads of agricultural families, 200,000; assistants, 200,000; remaining members of the family, 800,000. Although more than half the land, especially near towns, is owned by Moslems, something over three-quarters of the agricultural lads are Christians. As a rule, there are no fixed yearly rents or regular wages paid in cash; but when hired labourers are employed, a man, for the six months he is alone occupied, receives a suit of clothes, worth 10s. 10d., and 100 maunds of wheat, worth £4 10s. 10d. The general plan pursued by landlords is to advance the labourer seed, and, should his land not be in a favourable position or of good quality, a loan without interest. The proceeds of the harvest are, after deducting the seed-corn, then divided equally between landlord and tenant; the latter supplying all the labour for sowing, harvesting, storing, as well as the animals and implements. It happens occasionally that a capitalist gives a certain lump sum of money down for the use of a piece of land for a stated number of years; but rents paid yearly, as in Europe, are unknown; in either case, the pecuniary position of the labourers towards their employer remains the same. Considering the great variations in the scale of earnings through the district over which Mr. Taylor presides, the only practicable remedy which he suggests would be emigration to favoured localities. This measure, however, in a country whose grain export, as he observes, is practically during most years prohibited, owing to a high-priced and limited animal carriage to the coast, and which is unable to dispose of a surplus grain supply to contiguous famine-stricken provinces, from the the same causes becomes impossible or useless, even if the legislature permitted such wholesale deportation; but it has always been the policy of the Turkish government to endeavour to fix agriculturists forcibly to the soil or village where they are born, for the double reason of thereby promoting agriculture and equalising tax-rates, which are not levied on individuals but upon communities. Such, then, is the condition of the agricultural labourer. Practising the most primitive form of husbandry, his status approaches, as nearly as possible, that of the English agriculturist, as described by Professor Rogers in the 14th and 15th centuries. This condition can only be bettered by such public works as will, by facilitating exportation, promote and encourage the increase of the general wealth of the country, and so develop, by increasing and improving agriculture, a demand for foreign as well as native labour. Under such circumstances, there would be a large opening for immigrants possessing small capital and agricultural knowledge, in Northern Mesopotamia, about the Khaboor and Upper Euphrates included in the district of Diarbekr, particularly. The climate is healthy and equable, and not subject to extremes of heat and cold, as in other places, and essentially adapted for cotton.

At Smyrna, we are informed by Mr. Consul Cumberbatch, that living is much more expensive than it was formerly—nearly double what it was before the Crimean War, as the high prices then established have since been maintained for nearly all the necessaries of life, and persons with small incomes may economise as much as, if not more than, in England. The natural resources of the country ought to be conducive to a great extension of industrial occupation—the working of mines, the whole of Asia Minor being rich in minerals; the wine trade, which might be increased to almost any extent, and very excellent and cheap wine produced; various manufactures, of which the raw materials are products of the provinces, such as cotton, silk, wool, flax, hemp, several valuable dyes, &c.; but the existing fiscal regulations are suicidal to native industry. Among the many obstacles to its development may be mentioned the fact that all raw materials taken for local consumption are charged with 8 per cent. internal duty, and the article manufactured from them again charged the same rate of duty, when sent from one part of Turkey to another; but in both cases, if exported to a foreign country, they only pay one per cent. duty. These burdens are independent of any indirect taxes, and other adminstrative obstructions. Unless, however, emigration to Asia Minor could be supported by the strongest possible national guarantees as to protection and management, nothing but disaster awaits those who may be induced to avail themselves of any proposal; for even where the government appears desirous of commencing an undertaking with integrity, it is impossible to find disinterested and patriotic persons to carry out the views of the government, however advantageous to the imperial treasury those undertakings might prove.

WESTERN TURKEY.

The report by Mr. Consul Stuart, respecting the industrial classes, furnishes in an equally graphic and picturesque manner information that could only be gained by an intelligent resident in the locality. He prefaces his remarks by a geographical description, wherein we are informed that Epirus, the district under consideration, is a mountainous country, with a superficies of about 8,000 square miles, forming the south-west angle of Turkey in Europe. The population is composed of fragments of very dissimilar races, between whom ages of contact have failed to produce assimilation; and as each still retains its original instincts, it may be regarded as a type of the race to which it belongs. This diversity is very conspicuous in their social and domestic habits, and as it gives a special turn to their respective pursuits, it exercises a material influence upon the industrial condition and aspect of the country. They may be approximately stated as follows:—Albanians, 155,000; Greeks, 135,000; Vallaks, 32,000; Sclaves, 18,000; Gipsies, 12,000; Jews, 3,000; negroes, 2,000; total, 357,000. Divided by religions into Christians, 221,000; Mussulmans, 133,000; Jews, 3,000; by sexes, males, 130,000; females, 287,000; engaged in agriculture, 287,000; non-agricutural 70,000.

The Mussulmans, Mr. Stuart observes, are sensibly diminishing in numbers, owing, among other causes, to the conscription and annual emigration of young men to Constantinople and other places in search of employment. The same causes help also to account for the disparity of sexes which prevails among them. As to the other tribes, it is the rule of the Epirote Sclaves to seek their fortunes in other lands. Marrying early, they leave their wives and families at home, and set out sometimes for the most distant regions, bent on making money wherever they go, and never return until they have succeeded in their object, which takes them, in most cases, the work of many years. Hence, with the exception of priests, old men, and boys, their district is almost wholly inhabited by females alone. The same custom prevails also to some extent among the non-agricultural Greeks and Vallaks. The Jews, the gipsies, and the negroes do not emigrate; with them, therefore, the sexes are fairly balanced. And nearly the same may be said of the Christian peasantry, who are, in a great measure, bound to the soil. There are about 3,000 shepherds; most of them partake a little of both agricultural and industrial class, and are not, as in other countries, exclusively pastoral. They are mostly Vallaks, and are of two classes—the hired shepherd, and the owner who tends his own sheep. An active shepherd can look after as many as 300 sheep. When acting for hire, he is paid either by a share in the flock, or at the rate of 4d. per head for six months, which is generally the duration of his contract. He has, besides, a ration of bread and shoes, or an equivalent in money.

Passing over the professional and mercantile classes, Mr. Stuart brings us to the immediate object of the present inquiry, namely, the position of the artisan and industrial classes. The trades and handicrafts are nominally organised in guilds ("esnafs") of which there are five centres for the whole province, viz., Janina, Arta, Prevesa, Berat, and Avlona. Between these centres there is no fellowship or community of privilege, so that the tradesman or artisan of Janina, if he happens to be in Arta, and in distress, cannot of right apply for help to the guild of his calling in that place. There are no restrictions with regard to wages, hours of work, terms of contract, or any other particular connected with labour or business. All these matters are left to adjust themselves, according to the gravitating force of local or special circumstances; and every man has full liberty to act as he likes in the disposal of his labour, and to make the best conditions he can for himself. Out of this very freedom of action certain well-defined limitations arise by spontaneous growth, which are recognised both by employer and workman, and which serve, in principle at least, to maintain the equilibrium between labour and wages. The guilds are of thirty-five different denominations, and comprise altogether about 3,500 members, that is, supposing every shop-master to be enrolled. Giving to each master, on an average, two assistants, we have 10,500 as the number of hands engaged in industrial produce and distribution, which, with those depending on them—aged parents, wives, and families—would represent a section of the population numbering about 30,000. It is to be noted that but a small proportion of the Kalfas are married men. Again, of the thirty-five guilds, twenty-two are productive and thirteen are distributive. The productive guilds comprise about 2,000 master-workmen, who, with their journeymen and apprentices, form a sum total of 6,000, more or less, employed in handicraft pursuits. Most of those engaged in sedentary occupations are stationary; but builders—masons, joiners, carpenters, and the like—may be considered itinerant workmen. With the exception of a few established in each large town, they follow the calls of work, not only within the province, but far beyond, into Greece, Macedonia, and North Albania.

Amongst the different members of the guilds, the carriers are entitled to a special notice. They form an important class in the country, numbering about 1,500, and employing some 2,000 animals, both horses and mules. Their animals are, for the most part, of a very inferior description; capable, however, of doing 30 miles a-day with a load of from two to three cwt. on their back; for, owing to the mountainous nature of the country, and the little progress made in road-making, there is no carriage transport in Epirus. The carrier's charge is fixed at 4d. a horse per league, but this regulation is little heeded, except for government work. Private parties have to make their own bargains, and must generally pay at least half as much again. Hence there are few countries in which travelling or land-transport is so slow or so dear as in Epirus. But little capital is employed in industrial production; only what is required to provide materials and the manual tools of the individual workman. There are no large factories to localise skill; no machinery, as the term is commonly used, to aid its efforts and to increase its efficiency, by multiplying and perfecting its productive power. Whatever is done, is done either by job, or in the workshop, or by domestic labour. The principle of combination is but little acted upon. In some of the larger undertakings, it is not unusual for several workmen to go shares in a joint contract, but more commonly he works for a daily wage, under the eye of a superintendent. Domestic labour contributes largely to the industrial produce of the country. This is almost the exclusive province of the women, especially of the village women, who devote all the time they can spare from other duties to converting the raw materials into commodities fit for use. According to localities, they work in silk, cotton, flax, or wool. They reel, card, spin, knit, weave, and sew, producing in every house enough for family use, and sometimes a good surplus for barter or sale. In the pastoral districts, every cottage has its loom, which turns out strong flannels, cloth, and rugs, together with small carpets, which often give evidence of no mean taste and skill. In all these works the Vallak women pre-eminently excel.

In some of the sedentary trades, the workmen of Epirus attain considerable skill. In gold embroidery, they exhibit exquisite taste, and produce durable and highly-finished work, which is celebrated all through the Levant, and is not unknown in the fashionable circles of the West. The workers in precious metals are growing into great repute; diamond setting is now executed with great perfection, and the "Janina clasp" of alloyed silver has been in large demand, both in London and elsewhere. Not many years back, sculpture in wood was a favourite art, but now it is well nigh extinct, for want of encouragement. In this kind of work, the screen and pulpit in the cathedral at Janina are unique masterpieces; they are bold and original in design, and are of the highest order of execution. The several handicrafts are in most parts monopolised by particular races; nearly all the tin and plumbers' work is done by Jews; the Vallaks supply most of the silversmiths and coppersmiths; the best builders and carpenters come from a district called Konitza, and are supposed to be descendants of the aboriginal Epirotes; and all the blacksmiths are gipsies. Though of quick intelligence, they are not highly skilled; the women often do the work of strikers and serve the bellows, which is precisely the same as that described by Herodotus. In the spring of the year, numbers quit their homes in the towns and travel through the country, accompanied by their wives and families, and taking with them laden donkeys, tents, tools, forges, and all needful gear. They halt at certain known places, to which the country people of the neighbourhood, expecting their arrival, bring whatever work they want to be done. The Mussulmans reserve to themselves the business of farriers, but they do no more than pare the hoof and nail on the shoe. This is imported, ready made, from Salonica, and the nails are made in the place by gipsies. As a general remark, the men of this country, Mr. Stuart observes, do not possess the muscular strength required for heavy work, and their tools are of feeble power, though good of their kind, for they are imported from England or Germany; yet they show but little readiness to employ the simplest contrivances for economising animal power. In dealing with weights or resistance they use direct physical force; the aid of the pulley or windlass are but seldom called in, while hand-barrows and wheel-barrows are seen only on rare occasions. It is mentioned, as a singular fact, that during the fifty years of British occupation in the Ionian Islands, not a single mechanical improvement crossed from Corfu to Epirus, except the screw and the buckle, which found their way some years ago, and are now in limited use.

In this country, working men, even of the humblest class, share, when married, the common desire to possess every man his own house, and to have it all to himself and his family. The master artisans who are settled in towns live for the most part over their workshops; their dwelling apartments correspond to their means; and, as a rule, they are clean and well kept. Excepting among some of the rich, furniture is not much considered, owing, in some measure, to the prevailing love of out-door life, and to the influence it exercises on domestic habits. This is particularly the case with the artisan class, with whom the great object in life is, after providing for their sons and portioning off their daughters, to retire with a competence, and spend their declining years in their native villages, where they generally have a house and a bit of land, which it is their pride to improve and enlarge. In the larger towns, the Christians of sedentary crafts are gradually adopting the European style of dress, which, if not more convenient than that of the country, is at any rate regarded as the emblem of a higher civilisation. The outdoor operatives, such as masons and builders, together with carpenters and the like, wear the dress of the country, which in fashion is the same as that which was worn in very remote antiquity. In the matter of diet, the workmen follow the rule of the country, which, with the Christians, is temperance and frugality. The journeymen and labourers live chiefly on Indian corn and rye bread, helped with cheese, olives, or strong tasting vegetables, such as onions, leeks, and garlic. Black coffee is considered a great luxury with the workmen, as it is, indeed, with all classes; they are continually sipping it, but always in small quantities at a time, ten or a dozen " finjans," each holding about as much as an egg-cup, in the course of the day is no unusual allowance. In the East, a man will treat his friend to a finjan of coffee, as one would in England to a glass of wine or a pint of porter.

There are two of the effects which result from the preponderance of the female sex that are worth noticing. The one is an excessive amount of hoarding; the other, the facility with which young men can improve their pecuniary means by marriage. The birth of a daughter is regarded by most parents as a misfortune, for, whatever her personal qualities when she grows up, without money she has no chance of ever being established in life. Her arrival in the world is consequently the signal to the whole family to enter on a course of rigid economy, with a view to providing her with a portion, and the sacrifices and self-denial practised on her account are worthy of all praise. As the wife's portion, which from some parents that have passed for penniless sometimes amounts to £100 or £150, is always at the disposal of the husband, he may, if a prudent man, employ it for the advancement of his trade and business; and, in point of fact, many journeymen do in this way become masters, and many assistants heads of establishments.

With regard to the inducements for emigration, Mr. Stuart remarks that, from its geographical position and natural capabilities, Epirus is well adapted for industry and commerce. It has a long sea-board, with some good ports and roadsteads, and it lies within easy reach of foreign markets inquiring for its produce. The coastlands and the valley-plains of the interior are of prime quality, capable of yielding a great variety of returns in abundance. The rivers are not navigable, but they offer in their upper courses a vast amount of motive power for industrial purposes; while further down they might be made available for canals and irrigation. The climate is good, though hot in summer and cold in winter; and, if at any season, or in any place, it is not good, the causes are such as could be removed by drainage or embankment, or by attention to common sanitary precautions within the domestic circle. Finally, the nearest port of of Epirus is only an hour and a-half's steaming from the city of Corfu, which is but four days' postal distance from England. That all these natural advantages should still continue to be so little productive is, in great measure, owing to the scantiness of the population, which is not more than a fourth of what the soil could well maintain. But if Englishmen were to come in large numbers, their presence would be regarded with jealousy, not only by their neighbours, but in higher quarters, as the inhabitants, the various races of which they are composed, though differing in other respects, agree in a feeling of exclusiveness, which would soon make the new comers painfully sensible that they were aliens in the land. Of the Epirotes themselves, their natural intelligence is highly thought of throughout the Levant. As merchants, tradesmen, and artisans, they successfully make their way whererever they go, and hold their own against any competitors. They are distinguished in the medical profession, and some of the best literature in modern Greek, both in poetry and prose, has been contributed by Epirote authors. With all this natural intelligence, they possess a strong desire for instruction, to meet which individual munificence has made large provision. This has been effected through the custom prevalent for young men of energy and enterprise to seek abroad a wider field of action than they can find at home. Many of these adventurers succeed in business and rise to wealth. Like all mountaineers, they cherish a deep affection for their native land, and to this affection are due all the educational and charitable endowments now existing in Epirus. The amount of benefactions bestowed and bequeathed for this end commands admiration, and speaks eloquently for the patriotism of the enlightened Epirote.

The population of Bosnia, writes Mr. Consul Holmes, is chiefly agricultural. The peasants are maintained by, and work for, the proprietors of the soil, and are very poor. In the towns, the greater part of the people are small shop-keepers, and almost the only trade which offers an opening to foreigners is that of the carpenter, which comprises that of bricklayer, plasterer, painter, and glazier. The native carpenters and bricklayers can scarcely perform the most rudimentary work; but during the last ten years an increasing demand for both houses and furniture has attracted a few Austrians and Italians, who suffice for the quantity and quality of the labour required. A few foreign tailors and shoemakers also gain their livelihood by working for those who clothe themselves in the European manner. The chief supply of boots and shoes for the better classes are, however, imported from Austria, and sold by general shopkeepers, but both the clothes and shoes, or sandals, of the general population are coarsely and roughly made, at the lowest possible price, by native artisans, and the people desire nothing better or more expensive.

The wages of those trades which chiefly offer employment to foreign workmen vary from 2s. to 4s. per diem. For these a workman can live, and perhaps save money, provided he is content with native food and lodging. This consists chiefly of coarse bread, native cheese, and a few cheap vegetables, very rarely meat or poultry, and lodgings which an English mechanic would consider uninhabitable. The prices of provisions are very low, but everything is of the worst description. Consequently the purchase power of money in Bosnia is greater than in England, if quantity and not quality be required, and the native diet and habits of living be adopted; but it is not so great as in England if English comfort and good, wholesome food be looked for. The Austrians and Italians live nearly as they do in their own countries, which is not very different from the native diet in Bosnia, but all are addicted to drink. The extreme cheapness of a spirit made here in large quantities from plums, and which is by no means unpalatable, induces drunkenness in foreigners, as it does among the natives. The women even drink this too liberally. In moderation, however, it is not unwholesome, as it is quite pure and unadulterated, and not very strong. The wine of the country is plentiful, but not usually good, being often very sour and tainted with the odour of the goat-skins in which it is carried about. As to clothing, it should principally be warm for the higher parts of Bosnia, and a lighter description for the lower. The male inhabitants of Serajevo are usually clad in thick cloth or furs all the year round, while the women are clothed much more lightly, and in the coldest winter days may be seen at their doors with bare necks and arms, dressed only in light calico.

The dwellings of all classes are ill-constructed and unfit for the climate. The houses of the poor are mere hovels, without any kind of comfort or accommodation, situated in the midst of reeking filth, and as unhealthy as over-crowded and air-poisoned dwellings can possibly be. The drainage is very incomplete, and dust is left to accumulate in all directions. The best situations are those in which the richer people have large houses, surrounded with gardens, where the naturally wholesome air is able to circulate. Whenever the cholera or other epidemic declares itself, the people in the poorer, and consequently more crowded and unhealthy, quarters are decimated. The quality of work executed by workmen is miserably inferior; no artisans of any trade or class, native or foreign, seem to take any pride in their work. There is no emulation, but each gets what work he can, exacts the highest possible price for it, and usually executes it in the most slovenly and inefficient manner. All Turks and Eastern Christians, however, look far more to cheapness than to excellence in what they purchase, and good workmanship and conscientious labour is neither appreciated nor encouraged. From these circumstances, Mr. Consul Holmes concludes that the condition of the industrial classes of the country within his consular jurisdiction is not such as to encourage the immigration of the British mechanic, either with respect to income, comfort, and health, or the appreciation of good workmanship.

Servia, we learn from the report of Mr. Vice-Consul Watson, produces no manufactures, and presents few openings for English artisans, the only places where they are found being in the capital, Belgrade, and at the arsenal of Kragonievatz, where foreigners are employed as foremen of some of the departments, and a few English workmen, who are under contract for the iron and copper mines of Madanpek. The reason of this is to be found in the non-development of the peasants' wants and from the low state of civilisation. The soil is naturally fertile, but thinly populated; it is of little more than nominal value. Being intersected also by one of the principal water-courses of Europe, it presents great facilities for the exportation of pastoral and agricultural produce. All these facilities, however, which might have tempted farm labourers to settle here, are frustrated by circumstances connected with the law and civil administration of the country.

The streets of Belgrade Mr. Watson describes in appearance as almost European, but this is due to German artisans, and promoted by the desire of the government, for political purposes, to embellish the town, in order to make an impression on the inhabitants of the neighbouring Austrian, Turkish Sclave provinces, by whom they wish Belgrade should be regarded as their future capital. The larger class of foreign artisans are those connected with the building trade, to which an impetus has been given by the government lending money on mortgage on land and houses in the town. The wages earned by bricklayers and masons so engaged are from 2s. to 4s. a day, feeding themselves; their labourers, mostly women, get from 1s. 6d. to 1s. 8d.; carpenters, from 2s. to 4s.; plasterers, and the men who colour the walls, from 1s. 8d. to 4s.; and painters, from 2s. to 6s., without food. Domestic servants are paid very high wages. Servians do not like this employment, so they are generally Austrian subjects, from £10 to £20 a-year being generally paid for very bad servants. Almost every article is imported ready-made from Europe. Furniture comes from Pesth and Vienna; carriages as well; hardware from Belgium and Austria; and even common crockery is brought from abroad, and transported up the country. The people of Belgrade wear European clothes, and thus give employment to German tailors and shoemakers, and these two trades furnish the best samples of foreign artisans. A tailor working under a master, living with and being fed by him. is paid from 1s. to 2s. a-day; if he works by the piece at home, he can earn about 2s. 8d. to 2s. 10d.; shoemakers live with their masters, though they are generally paid by the piece, and, besides their food, earn from 10s. to 15s. a-week.

Agricultural labourers come from Austria for the season, and even a few Bosniac Mussulmans are to be found mowing. Servia is rather a pastoral than an agricultural country, there being no large farms or estates, and the peasant proprietor has, with his family, almost strength enough to get in his own harvest and till his own ground. Near Belgrade, however, where there is occupation for them, field labourers are paid from 1s. 4d. to 1s. 10d. a day. Mowers can earn from 2s. 8d. to 3s. 6d.; and haymakers from 1s. to 1s. 8d. At the copper-mines of Madanpek, in the interior, there are some eight or nine Englishmen employed as foremen and overseers to the native workmen; they are paid from £7 to £10 a-month. The Austrian mining foremen there get about £3 10s. a-month; the common native miners and smelters from 1s. 8d. to 2s. a-day (the latter, however, can earn more, as they make seven days' work in the week) labourers to help at the mines, from 1s. 6d. to 1s. 8d. All the people employed at these works have houses and firing free, besides the above wages. Though there is a great deal of inferior coal in the country, it is not worked; it is unknown as an article of house fuel, being used only by the Austrian steamers plying on the Danube, and by smiths. Coal-dust, such as is thrown away at the pit's month, or, at the best, used for glass-works, &c., in England, is worth 15s. a ton. Wood is used instead for domestic purposes, and from carriage being dear, costs twice as much as coal does in England for firing; it is the cheapest in summer, the roads then being good; in winter, with the roads impassable, and the rivers frozen, it is very dear. An artisan who lives from hand to mouth, would thus find his fuel a great item of winter expenditure.

Lodgings are dear and bad, and the poorer people live in the lower parts of the town. The better class of house is very dear. The houses all over the country consist only of the ground-floor, and there is no drainage. Though main-drains run through the principal streets of Belgrade, they have no communication with the houses, and are only of use to carry off the rain, which sometimes falls in torrents in summer. The extremes of heat and cold are very much greater, and the variations more sudden than in England. The heat is exhausting in summer, and an English workman could not work so hard as he does at home. Out-door work is impossible sometimes for a couple of months in winter; neither could our English artisans live so well in a town in Servia for the same money as he could in England, for though meat is cheaper, it is of very inferior quality, bullocks never hardly being fattened, but killed when past work. Respectable artisans, although the wages are higher than in the neighbouring Austrian States, do not immigrate, because, from the few employers of labour, work is not to be obtained regularly, and from the small luxuries to which they are accustomed being dearer, and lodgings, &c., worse. The refuse of Austrian labour thus far only finds its way, and does not proceed into the interior. The workmen are principally composed of runaway apprentices, or men of dissolute and bad character. Any work out of the common it is impossible to get done. The only branch of industry in which Englishmen have found employment is that of mining; and should operations be extended, it might suit the purpose of more to come out, since they are twice as well paid as those of Germany or other countries.

EGYPT.

The report furnished by the Consular Service at Cairo and Alexandria places us, for the first time, in possession of information respecting the condition of the industrial classes in Egypt. Reliable statistics are wanting, it seems, of the number of persons thus engaged; and the

Consul-General, Mr. Stanton, is indebted to the asssistance of his Excellency the Minister of the Interior, for the best approximate that can be obtained. Manufacturing and other industries, except in a rude state, are little developed amongst the native inhabitants of Egypt, which may be said to be essentially an agricultural country. and the citizen and industrial classes bear but a small proportion to the tillers of the soil and to the rest of the population. The total number of citizens amounts only to about 55,000, or to little more than one per cent. of the population, which is estimated to be about 5,000,000. The system of "esnafs", or guilds, has for centuries been established in Egypt, in every branch of native industry, and is probably maintained for the facilities it affords for the collection of the capitation and other personal taxes, as well as for the guarantee it is made to offer for the due execution of works ordered by the government.

Every esnaf is presided over by a sheikh, appointed by government nominally upon the recommendation of the higher member members of the guild; he is actually the ruler of the guild; he admits members, directs the manner in which contracts shall be carried out, fixes wages, collects taxes from his guild, and is responsible to the government in all matters connected therewith. The industrial population of Egypt, with the exception of weavers, dyers, and basket-makers, appear to be confined to Cairo, Alexandria, and a few other of the large centres. The greatest number are, the weavers 10,001; carpenters and sawyers, 6,473; dyers, 5,109; masons, 4,113; goldsmiths and jewellers, 2,630; blacksmiths, 2,605; embroiderers, 1,871. With regard to the quality of work executed, as a rule, it is said to be unsatisfactory, though exceptions exist in some departments, especially in embroidery, specimens of which are occasionally produced in Egypt of good workmanship, though inferior to European productions. Considerable numbers of Europeans are engaged in the building and other trades, and as mechanics in the service of the government and private persons. Greeks, Italians, and Maltese are the most numerous, but of all people of European origin, the Greeks are the most pliable and successful; but few English citizens have set up in business on their own account, possibly from their habits not assimilating so readily with local circumstances as those from the south of Europe.

From Mr. Consul Stanley we learn the more detailed particulars respecting wages, clothing, diet, &c. English mechanics and artisans it seems are employed, with few exceptions, exclusively as engineers to steam-ships, drivers on railways, or in charge of machinery of all descriptions, and as platelayers and fitters. They get high wages; engineers from £20 to £30 a month; drivers from £18 to £25, and platelayers from £17 to £20 per month; and, with exception of the first, lodgings are provided. Egyptian boys and girls under 15, employed in the cotton factories, can be obtained in any number in the interior for 5d. per day, working from four in the morning till sunset. Egyptian men receive 1s. per day. Besides the cotton factories, the Viceroy has in Upper Egypt, many sugar manufactories, which give employ to a large number of Egyptians, and having each one or more European engineers. Foremen carpenters and blacksmiths, generally Maltese, are paid from 6s. to 8s. per day; ordinary carpenters 5s. to 6s. Greeks, who are inferior workmen, receive 3s. to 5s., but Corfiotes, get the highest wages viz., 6s. Egyptian workmen about 2s. per day; but they are rarely employed in European workshops, their work being of inferior quality. As to provisions, beef and mutton are about the same price per pound as in England. The beef is good, but the Syrian mutton imported and generally used in Alexandria, is very inferior. English mutton is killed in small quantities weekly, at 1s. per pound. Bread is one-third dearer also. Potatoes, cauliflowers, cabbages, peas, beans, and vegetables usually consumed in England, are dearer, but tomatoes, "bamias," the egg-plant, vegetable marrow, and yams, are good and cheap. Apples and pears, cost nearly twice as much as in England; the smaller fruit, such as cherries, currants, and strawberries, are rare and expensive; but there is an abundance of excellent and wholesome bananas, delicious figs, besides apricots, melons, grapes, and oranges. These are much cheaper than in England, but cows' milk costs twice as much. Buffalo's and goat's milk, much used, is good, and cheaper than cow's milk. French, Greek, and Italian wines can be got good and cheap, and are more suitable to the health than beer or strong wines. There is an abundance of bad, harmful spirits. English stores can generally be bought at 35 per cent. dearer than in England, and when imported direct by the user, about 20 per cent. The wear and tear of clothes, owing to the sun and dust, is greater than in England, and articles of clothing are dear. Rent is high; a mechanic would pay £36 a year for a suitable house, that in England would be got for £12 a year.

As a summary to Mr. Consul Stanley's remarks, it may be concluded that skilled labour costs twice as much as in England, rent nearly three times as much, necessary provisions a very little higher, so that a steady mechanic could certainly save more than he could in England, and in the large towns would live as well, and, indeed, would have many luxuries, cheap wholesome fruit for instance, to which he was unaccustomed. In the interior he would not live so well, but much cheaper. This saving is, however, dependant on him and his family having good health. Most of the ladies of the higher European classes go to Europe during the hot months, and the men every other year; those who have time and money to dispose of, every year. This would entail too much expense on the working classes, and the greater risk of illness, with its attendant loss of employ, must be taken into consideration by any workman deciding to settle in Egypt. Should he arrive under contract, a clause should be inserted, defining the wages he would get when ill, and stipulating that he be sent home at his employer's expense if absolutely incapable of work through illness. This might in all cases be made certain, by a sufficient sum being deposited in the consulate. It would especially guard against difficulty, were his employer an Egyptian, but with the government, or a European, it would be unnecessary.

SWITZERLAND.

Besides the report contained in the former issue, we are indebted to Mr. Gould for some very interesting additional particulars upon the condition of the industrial classes in Switzerland. The position of the working man in the Swiss Confederation, we are informed, differs in most respects from that of his co-labourer in England, and among the various causes which have most effectively contributed to this result are the political institutions of the country. The Swiss Confederation, numbering a little over 2,500,000 inhabitants, comprises no less than three nationalities—the German, French, and Italian—and is, moreover, split up into twenty-five semi-independent cantons or states. They are, in their turn, subdivided into administrative districts (préfectures) and political communities (communes). The administration of the latter is left entirely in the hands of the inhabitants, by whom the local authorities are elected. The great majority of these communes possess not only special funds for the clergy, the schools, and the poor, but likewise a considerable amount of land, which constitutes the common property of the individual members of these small communities. The estimated value of the property thus held between the years 1863 and 1864, independently of the cantons, may be put down at the large sum of £23,474,133. This would give £9 7s. per head, and there is every reason to presume this amount has been considerably increased since that date. In no other country, either, is property so equally divided among the mass of the people. We learn, for instance, in the canton of Berne, which has about 500,000 inhabitants at the present time, the real property holders numbered, in 1868, no less than 88,670. There were, besides, 22,856 individuals paying taxes on an average capital of £427, and 24,301 on incomes averaging £32. Taking the number of individuals in a family to be $4\frac{7}{10}$, which is the calculation generally accepted in Switzerland, it would thus appear that nearly five-sixths of the whole population of this canton either hold or have a direct interest in real property alone; and there is no reason to suppose that, as regards the rest of the country, the same relative proportions would not be found to exist. In like manner, the Swiss are all on a footing of almost perfect equality, both politically and socially. The principle of appealing to the popular vote on all occasions seems to be gaining ground, and the result has been found most satisfactory. Military service is by law obligatory on all Swiss citizens between the ages of 20 and 44, with certain exceptions. The inconvenience, embarassment, and actual loss occasioned, even in times of profound peace, to the country at large by the enforced absence, for uncertain but short periods, of considerable bodies of men from their usual occupations, are far greater than would at first sight appear. It not unfrequently happens in manufacturing and other commercial and industrial establishments that the majority of the most indispensable hands have to be called away at the very same moment, in spite of whatever precautions the War Department may take to guard against such an occurrence.

With that practical genius of which such striking illustrations are given by the Swiss people in the management both of their private and public affairs, they have long since arrived at the conviction that the education of the masses is the only sound basis of a State with free institutions, and the most effective lever to raise the moral as well as the material condition of a nation. The primary schools are almost exclusively supported by the communes, but they are subsidised by the cantons, which exercise a general supervision over them, and maintain at the same time most of the so-called secondary schools, and all the other public educational establishments of a higher class, with the single exception of the Polytechnic School, the cost of which is borne by the Confederation. One of the many advantages possessed by the Swiss working man over his fellow-competitors in other lands, especially in England, is that, owing to the education he has received, he is able to find in a variety of national pastimes that necessary relaxation from work which the others are unfortunately but too often reduced to seek in vacant indolence or low debauchery. There are innumerable working men's associations, which have some regular place of meeting, where books, periodicals, games, and refreshments are provided for the members, whose time is chiefly engaged in debating, getting up dramatic performances, and acquiring a knowledge of modern languages, book-keeping, drawing, arithmetic, history, &c. Much attention is also devoted to music, both vocal and instrumental, as a means of innocent recreation, singing being taught in all the primary schools. The same zeal is shown in providing comfort for the working classes and forwarding their material interests, both the authorities and private individuals vying with each other in this good work. There are societies that take charge of orphans, undertake the education of viciously-disposed children; others that grant temporary assistance to the unemployed. Employers frequently found and maintain at their own expense schools for the factory children, build separate dwellings for the families of their workmen, establish eating and lodging-houses, provide means of recreation, supply medicines and medical attendance, pay wages in advance when required, find, at almost any cost to themselves, constant employment for their men, and, by deducting periodically small sums from their wages, and investing them in mutual insurance societies, secure pensions for such as become incapacitated for work.

The position, therefore, in which the Swiss working man finds himself, through the force of circumstances, perhaps, almost as much as through the action of the political and social institutions of his country, is one probably without a parallel. As the member of a distinct class, he may be said to exist, for in Switzerland he is on a par with all around him, both politically and socially. The frugal habits of all classes also tend to deaden the sting of the privations to which the working man has to submit, in consequence of the smallness of the wages. They cannot be considered insufficient, since he not only manages to live upon them, but even, in many cases, to lay by money, as the returns of the savings-banks conclusively prove. He is seldom entirely dependent on the actual amount of his wages. He not unfrequently resides in his own cottage, cultivates, with the assistance of his family, the small patch of ground belonging to him, and is the possessor of a cow or two or three goats, which at times find pasturage in the communal lands, and can draw from the same sources the supply of wood required for household purposes. With these resources, and the aid afforded by the innumerable philanthropic institutions with which the country abounds, he is better enabled to tide over those formidable vicissitudes of fortune, principally resulting from want of labour, to which he, in common with the industrial classes of all countries, is exposed. Nowhere are the products of the soil more evenly balanced with the fruits of industry. When one fails, the other secures the population from the danger of being in want. As the operative tills the land when not employed at his usual avocations, which, in many districts, he is allowed to carry on under his own roof, so the agriculturist, in his leisure, and particularly during the long winter months, when field labour becomes impossible, adds to his resources by working at some trade. In the Alpine regions, his efforts are principally directed to wood-carving, and in others to making the component parts of watches. The women, too, are far from idle. Besides attending to the duties of the household, they find time to make lace, straw-plaiting, &c. Thus, by turns, the operative is engaged in agriculture, and the husbandman in manufactures, and the combination of both, has tended as much as anything, to make of Switzerland one of the most prosperous countries in Europe.

The average rate of wages for men, women, and children may be taken at from 33 to 40 per cent. lower than in England, and 10 to 15 per cent. lower than in France. This is undoubtedly the case as regards the manufacturing districts in general, notwithstanding the great difference in the rates of wages in various sections of the country. They are, for instance, considerably higher in the French-speaking cantons than in the rest of Switzerland, but, on the other hand, living is at the same time more expensive. The cheapness of the necessaries of life, the very limited extent of their wants, and the exceptional resources of which the working classes in Switzerland can generally dispose, more than compensate them for the small amount of their earnings. The food consists principally of bread, of very fair quality, of cheese, vegetables, and fruit. Meat is seldom eaten but once a week, and even then in very small quantities. In the towns the consumption is much greater than in the country, especially among the single men, who generally take their meals in cheap eating-houses. The total annual consumption of meat throughout the country is stated to be 47 lbs. per head of the population, and it is doubtful whether it is really as much, whilst in England it reaches 68 lbs. per head of the population. All classes alike live very frugally, and confine themselves principally to vegetable diet, the fare of the middle classes being frequently very much the same as the lower. They all drink coffee with milk, at least twice a day, the proportion of chicory mixed up with the coffee being very large, and not objected to. Breakfast, taken before beginning work, or at a very early hour, generally consists of coffee, with milk, but without sugar, and a large piece of bread. Those who are highly paid add cheese, butter, or fried potatoes. The whole population, from the highest to the lowest, dine between eleven and one p.m. At this meal the working classes take soup, potatoes, vegetables, and bread, and a bowl of coffee, without either sugar or milk. The last meal is, in all respects, the same as the first.

In Switzerland the population is much scattered, and there are but few large towns. The want of healthy lodgings in some of them is admitted, and the evil is being remedied as rapidly as circumstances permit. The majority, however, of the working classes reside in the country, in their own cottages, where their work is sometimes brought to them, and they seldom have to go far to it. Their working day is reckoned at thirteen hours. This gives them nearly three hours per day more occupation than in England, and one more than in France. Their cottages are generally clean and comfortable, but, as in all cold climates, the ventilation is defective. As a rule, the Swiss workmen are competent in their several trades, and take an interest in their work, for, thanks to their superior education, they fully appreciate the pecuniary advantages to their masters, and indirectly to themselves, to be attained by adhering strictly to this course. Mr. Gould observes, in conclusion, that the Swiss workman, owing to the peculiar political and social institutions of the country, occupies an exceptional position, and disposes of resources denied to his fellow-workmen elsewhere. His wages are very small, but relatively larger than in other countries, if judged by the standard of his wants. The supply of labour is fully adequate to the demand. Under these circumstances, the foreign workman could not compete with him on his own ground, even were there an opening for him, which there is not.

ANNUAL INTERNATIONAL EXHIBITIONS.

Through the kindness of Messrs. Johnson and Sons, the publishers, the various reports on the Exhibition may be seen by members in the library of the Society.

REPORTS ON THE WOOLLEN MANUFACTURE.

The most remarkable of the reports that have appeared on the present Exhibition are perhaps those on the woollen manufacture and woollen machinery.

That on woollen and worsted fabrics is by Professor T. C. Archer, who has treated his subject in a popular, and yet at the same time in an exhaustive manner. The distinction between woollen and worsted is not very clear to the uninitiated, and it is complained that the two should have been treated as one in the Exhibition programme and catalogue. The products themselves, however, have been so carefully arranged, that the study of the two branches of the manufacture is rendered as easy as possible.

Like every one else, Professor Archer notices the very incomplete show of live wool-yielding animals. He notes the absence of the Leicester and Cheviot breeds, and we may add to these the famous little Welsh sheep, which furnishes the flannel wool. He gives explanations of the essential characters of wool and hair, and of the difference between long and short staple wools, and illustrates these by a few simple wood-cuts, which greatly aid the explanations. He also shows, what few not in the trade would suspect, that a single fleece yields wool of four and even six qualities, which are divided by the fellmonger. We could have wished that the information relative to the manufacturing value and the commercial importance of Australian wool had been more fully brought out.

Professor Archer explains, as regards the goats' hair or wool from which the famous Cashmere shawls are manufactured, that the wool, which is of delicate softness, is separated from the coarser hair by hand; and of camels' hair, he says it would more properly be called wool, as the hairs are in very small proportion, and of no use in the weaving.

The methods of dressing and finishing woollen cloths are thus described:—

"The web of cloth, after being woven, is cleaned by a series of washings with mixtures of urine, swine's dung, blood, and salt, and afterwards with soap and water. This is for the purpose of removing the grease and oil, and a certain amount of size, with which the yarn is dressed to make it smooth for the weaver's purpose. Next, it is put in the fulling-mill, with soap and water, and beaten by the heavy wooden hammers of the machine, after which it is usually passed through a milling machine, in which, by pressure with hot water and soap, the felting process is still further helped, until the fabric assumes a leathery texture, mellow to the hand, elastic, free from wrinkles, and uniform in appearance on face and back. Again it is returned to the washing machine, and every remaining impurity removed.

"The cloth now passes through the 'raising machine,' and the nap is raised by the action of teasles, and has then a fine velvety surface. The wool is raised in both directions at the same time, by two cylinders carrying the teasels and running in opposite directions. The operation of teasling lasts from twelve to fourteen hours, to bring the cloth to what is called 'full wool,' or 'rougher.' It is then stretched or 'tented' laterally as well as lengthwise. When dried, it is taken to the shearing machine, where the long pile is gradually levelled by the blades of the cutter, the cloth for this purpose being passed under them often as many as thirty times. The pile now sticks straight up, the points being all at the same level; another machine, sometimes called a 'gig-mill,' or 'dressing-machine,' lays it all in a slightly sloping position, but all in one direction, after which it is 'hot-pressed,' to make the wool preserve this condition.

"The next, and we may call it the last, process is the 'lustering' or 'decatting.' This consists in tightly and smoothly rolling the cloth on an iron or wooden cylinder, and immersing it in hot water, of about 185° Fahr., for six or eight hours, when it is allowed to cool on the roll. This is repeated often from ten to fourteen times, and, with other minor operations, occupies as much time as a fortnight, after which it is pressed and packed ready for sale."

The above description is illustrated by reference to the two admirable series of specimens exhibited by Mr. Ferrabee, which show what labour, skill, and care are required to convert a few pounds of wool into a valuable piece of cloth.

Manufacturers' designations are arbitrary, and often puzzling to the uninitiated, and a description of the various kinds of fabrics cannot fail to be interesting. The following are the leading articles of the West of England woollen manufacture:—

"1st. Coatings, mostly broadcloths, from 54 to 62 inches wide. They comprise:—

"(*a*.) Doeskins.—These are hand-woven cloths, stout and firm in texture, more or less milled, and finely dressed on the face. Their chief characteristic is in the arrangement of the threads in the loom, being what are technically called 'seven-harness,'—that is, there are in the web seven threads of the warp on the face, and seven of weft on the back.

"(*b*.) Cassimeres, which differ from doeskins in being four-harness cloths, or four threads of the warp in front, and four of the weft at the back.

"(*c*.) Elastics.—These are peculiar manufactures of the district, and are not woven, but knitted in a loom resembling the stocking-loom—that is, in a cylindrical web, which is cut open and afterwards milled and dressed as an ordinary cloth. The first manufacturer of this class of goods was Mr. Hooper, and they are, in consequence, generally known in trade as Hooper's lustres. They are especially suited for riding-coats, from their great elasticity.

"(*d.*) Sataras are cloths with a transverse broadish rib, made by using a weft considerably thicker than the warp. They are milled and finished, and often highly lustred by hot pressure or decatting.

"(*e.*) Venetians are very fine twilled fabrics, also milled and finished.

"(*f.*) Meltons are stout-made cloths, not dressed and finished on either side; usually the under side is less pared down than the face.

"(*g.*) Beaver.—Another stout cloth, milled hard, and only dressed on the face.

"(*h.*) Deerskins resemble sataras, but the transverse rib is finer, the weft not much exceeding the thickness of the warp.

"(*i.*) Diagonals.—Fancy cloths, with diagonal raised stripes across the web. They vary much in the breadth and elevation of the stripe.

2nd. Trouserings of 27 inches width, and usually of a heavier quality than coatings. Besides nearly all the varieties already mentioned under the first-class, there are a few peculiar to trouserings. For example:—

"(*a.*) Bedford Cords.—These are strong, longitudinally-ribbed, drab-coloured cloths, adapted for heavy wear. The quality of the treble Bedford cords shown by Messrs. J. H. Webb and Sons is remarkably fine.

"(*b.*) Kerseymeres.—Similar to the cassimeres, but more heavily milled.

"And in addition to these are very numerous variations derived from colour, arrangements of the pattern in the weaving process, &c.

"The whole of these varieties are exceedingly well represented in the International Exhibition."

Speaking of the fine collection of fancy trouserings sent by the Huddersfield Chamber of Commerce, Professor Archer says that the goods are well got up, but that they do not equal those of the Continental manufacturers in clearness and brightness, or harmony of colour. These defects, he declares, are almost universal in our productions of this class, and he hopes that our manufacturers will look to the matter.

The report contains a very interesting account of the modes of producing imitations of furs, sealskins, Astrakan, dogskin, chinchilla, Polar bear, &c. This is too long for extraction, and, moreover, would require the illustrative wood-cuts which accompany it, and we can only, therefore, indicate it as deserving of special attention.

A curious instance of accidental naming is given in the case of the well-known tweeds, which were first sent to London, seventy years since, under the name of twills, which they are, but the agent misread the word, and tweeds they have been called ever since.

The Royal Commissioners had the excellent idea of purchasing examples of foreign goods which they could not obtain otherwise for the exhibition, and several very interesting collections are the result; but in the case of the woollens from Morocco, Professor Archer says they are certainly of Yorkshire origin—an amusing, but very excusable, accident—in Morocco; but how did these Yorkshire moroccos pass the Committee of Selection at South Kensington?

Amongst the novelties of the exhibition are pointed out the "Saxony cloths" (6,019), which the exhibitor, Mr. Fann, says will not shrink, and recommends as substitutes for flannel; these fabrics are not woven, but knitted on the circular machine, and cut open like the West country "elastics" named above.

The carpet manufacture, like those already referred to, is ably described and illustrated by small wood-cuts, and the notes on Oriental carpets are interesting. The felt rugs from India are remarkable, from the fact that the patterns are produced by laying on wools of various colours and felting them into the substance of the stuff.

Passing to the worsted fabrics, we find a very useful descriptive list of the leading kinds:—

"The Chamber of Commerce of Bradford has, with patriotic liberality of time and trouble, made a truly magnificent display of the fabrics which constitute its now famous trade; and, as the members of that chamber have rigidly determined to withhold their names, and show only for the honour of their trade, not much more can be said than is already known all over the world—viz., that for excellence of material and make, for variety in texture and design, they are unsurpassed by any; and, as they have exhibited almost every known variety of worsted goods, the mention of the leading kinds in their collection may suffice to give some idea of its extent, and afford the information above suggested. Taken in the order in which they occur, the first is the class of cloths called

"Satteens.—These are of fine yarns, but spun light, and woven with a slightly open texture; they are either in black or in colours, and have the following varieties—common or plain, figured, and *melangé* or mixed.

"Reps.—This term is applied to fabrics of various kinds, and signifies, as far as it is possible to define it, that by an alternate system of single twilling and plain weaving, several threads of the weft are twilled alternately with a single thread plain, both back and front, so that the ribbed appearance of the fabrics called terries is closely imitated.

"Cords are fabrics in which the ribbing differs from the reps in being longitudinal, and formed by means of warps thicker than the weft.

"Serges are coarsely woven plain goods, that is to say, cloths in which the weaving is a regular alternation of the warp and weft threads, the yarn being very roughly twisted.

"Moreens are made of hard twisted worsted, with thick wefts, so as to give the appearance of small reps; they are often watered as well as plain; they are much used for petticoat skirts.

"Coatings.—Plain woven cloths for mantles, ladies' jackets, &c.; often mixtures of woollen and worsted yarns, and even of cotton.

"Plain-backs are fabrics with plain weaving at the back, and twilled weaving in front; they are usually black, and are chiefly used for petticoat skirts.

"Merinos and Says.—Two varieties of cloth, with rather a corded appearance from the thickness of weft; they are used for a great variety of purposes, such as upholstery work, and the 'says' for clerical and academical gowns.

"Paramattas are generally made with silk, or very fine woollen warps.

"Camlets.—Fine soft spun yarns, woven plain, and much used for exportation to the Chinese markets.

"Bunting.—This is the plain-woven, all-wool material, made of hard twisted yarn, and dyed in bright colours, used for the manufacture of flags.

"The above are usually made of wool only, or, in one or two instances, of silk and wool; but they are all imitated with cotton warps and woollen wefts.

"The following are all made with cotton warps, although not necessarily so:—

"Crapes.—Imitations of silk crape. They are largely manufactured for the Chinese markets.

"Coburgs are woven as very fine twills.

"Tammies are very highly glazed fabrics of mixed materials, dyed in bright colours. The dying of the Bradford tammies is particularly good.

"Summer Cloths are a light class of goods, made of lustre wool, with cotton warps for ladies' dresses.

"Melanges are made of yarns from coloured wool, the colours being mixed in when spun.

"Delaines are plain, lightly-woven cloths for ladies' dresses, thin, and of a muslin-like texture.

"Lastings are firmly woven cloths, made of hard twisted yarn, usually dyed black, and used for making ladies' boots.

"Canton Cloths are made of a finer and softer yarn, and are used for dress pieces.

"Orleans Cloths.—These are a staple article of the Bradford trade, and are shown in great perfection as dress pieces of various kinds, such as plain, striped, and figured.

"Chenes are very pretty imitations of Oriental styles; some are made like the fabrics called glacés, which are woven with coloured wefts of lustre-wool over white warps, giving a white reflection through the semi-transparent lustrous wool of the weft. Others are made expressly for the markets of China; these are distinguished by the patterns, of which there are five kinds well known in the trade—the "Lily" (two kinds), the "Stork," "Fiddle," and "Brick" patterns. Those exhibited are very nice specimens, but are not quite equal to the best made in Bradford.

"Challies.—Light, thin dress goods, plain woven, with dyed yarns, for ladies' summer mantles, &c.; the clouded ones, woven with alternate light and dark yarns, and the tartans, are very good indeed.

"Lenos.—Very lightly-woven gauzy fabrics, chiefly for foreign markets. They are made in various styles, plain or figured.

"Checked Poplins.—These are not really poplins, but are plain-woven fabrics, with the cotton warp thicker than usual.

"Fancy Tweed Gambroons.—These are thick twilled cloths, in which cotton is not only used for the warp, but also partially for the weft. They are low priced goods, made for the Continental markets of Southern Europe and America, as a kind of trousering for the poor.

"Besides these, there are many varieties dependent upon make or design, as:—

"Albert Cords, of lustre-wool, dyed black.

"Persian Cords, not in lustre wool, and usually dyed in colours.

"Chene Poplins, Chene Reps, Figured Twills, Diagonals, &c.

"When silk warps take the place wholly or partially, another class of goods is produced, which are usually very effective and pretty.

"When mohair weft is used, a similar series of varieties is produced to that of worsted goods, with which they are always classed. The beautiful lustre and whiteness of the material, and its susceptibility for receiving the most brilliant colours, give the manufacturer great opportunities for the production of tasteful fabrics, which those of the Bradford district have not failed to avail themselves of. Some of these clothes have worsted warps, and others cotton; the former have a delicate softness as well as a beautiful lustre. The latter are stronger and cheaper. Amongst the most important of the fabrics produced are the twilled sultanas, for costumes, brilliantines, glacés, lenos, and Sicilians. These last are made with a lightly-twisted weft, and when woven, the cloth is hot-pressed, so as to produce a complete flatness of the surface.

"Alpaca fabrics are also termed worsteds, and form the staple productions of the gigantic establishments of Sir Titus Salt, at Saltaire, and Messrs. Foster, at Queensbury, near Bradford. The wool of the alpaca is black, white, and various shades of brown and grey. The yarns made from the various colours are used to produce self-coloured, striped, or chequered cloths, which are very beautiful, both in texture and colour, and they possess great durability. The Bradford collection contains an admirable assortment."

The following will certainly be read with interest:—

"The Shetland manufactures are of extreme interest, as they are purely the work of the peasantry, and generally of their own designing. They are all knitted, and very generally the work is done while they are engaged in other occupations. It is not uncommon to see these industrious and cleanly peasant women on the roads, with their nimble fingers engaged in producing some prettily-designed shawl, veil, mits, or stockings, leading by a rope around their waists a cow or calf, with a basket, or 'casey,' as it is called, of peats on their backs, which they are taking home for the winter store. Some of the designs are of great beauty. Those shown by Thomas Edmondson, Esq., of Buness, as the work of one or two peasant women on his estate, are exceptionally fine, and so is the exquisite shawl of Isabella St. Clair (4,822), called, in the catalogue, mohair. A most carefully-selected series of these manufactures has been sent to the Exhibition by Messrs. Laurenson and Co., of Lerwick; Mr. John White, of Shetland and Edinburgh; Mr. William Johnson, and by Mr. Robert Linklater, both of Lerwick, in the very interesting collection sent by whom are specimens of the curious hosiery of Fair Isle, made by the fishermen's wives of that solitary island, the coloured designs upon which remind one of those of the Fijian or the South Sea Islanders. The colours themselves are nearly all produced from the lichens growing on the island. The very great difficulty of getting the pure Shetland wool, and the consequent fear that this occupation of the poor knitters may be lost, has led to the introduction of silk in the manufacture of the veils, which form an important part of their work; a few silk veils have, consequently, crept into the Shetland collection. There is so much good taste displayed in these Shetland manufactures, that it is a matter for regret that it receives so little local encouragement. Were schools of design formed for the instruction of the workers, and the abominable system of paying them by barter, instead of in money, abolished, the distinctive Scandinavian tastes of these very primitive people would be stimulated and improved, and an agreeable variety would be added still more largely to our woollen manufactures.

"Woollen-crape neckerchiefs and scarves, two very successful imitations of crape in wool are exhibited by Messrs. Wilson, Froggart and Wilson."

The report contains many other subjects of interest; and appended to it is a memorandum by Mr. Barrington, of the Legation at Athens, on the woollen manufactures of Greece, which is very interesting, and shows that the Greeks want aid of some kind as badly as the Shetland folk.

Next week we hope to notice the important report of Mr. Leech on the woollen and worsted machinery.

EDUCATIONAL COLLECTION.

Musical Instruments, Books, &c.

The report in this section is by John Hullah, Esq. He begins by drawing attention to the value of the pianoforte as an educational appliance. "At once an instrument of melody and harmony, incomparably richer than any other in its own special repertory, and competent, to some extent, to reproduce the effects, singly or in combination, of all other instruments, the pianoforte has, during its as yet comparatively short existence, drawn to itself a continually-increasing number of devotees. It has, however, uses wholly and entirely distinct from, if not beyond, those of any other instrument. It is not only, like the violin or the clarionet, an instrument worthy of cultivation for its own sake—an executant's instrument, so to speak—it is, over and above all others, the instrument of the musical theorist and composer,—so essentially this, indeed, that it is hard to conceive how, prior to the invention of the key-board—its characteristic feature—musicians were enabled to familiarise themselves even with the most simple combinations. It is quite possible for a student to make himself acquainted with the principles of harmony, counterpoint, and even musical composition, theoretically—*i.e.*, to ascertain that this or that succession or combination is permitted or forbidden—without having attained to any power of recognising such successions or combinations when they are sounded, or of distinguishing one from another. To know the effect of what is *seen* written, or to recognise, or, if need be, to write, what is *heard*, is to be a musician; and assuredly there are no means so ready, though there may be others as certain, of becoming one as are presented by a clavier acting on strings stretched over a sounding-board—*i.e.*, in modern times, a pianoforte. No conceivable means, therefore, is so likely to increase musical power, or facilitate the estimate of musical invention, as the multiplication of pianofortes; and no service to music could be greater than that which would be done by the production in large numbers of instruments which, while inferior in no essential particulars to the average products of our best makers, could be had at a lower price than is commonly demanded for them. Whether this is practicable, having regard to the material and labour involved in the construction of a pianoforte, is a question. I venture to make a suggestion, which, if acted upon, would, without any sacrifice of the strength or finish indispensable to the usefulness and durability of a pianofore, inevitably diminish its cost, and also—no small consideration—its weight. It is the very simple one of reducing the compass of the key-board, and with it the number of the strings, and the size of the sounding-board. Of late, as is notorious, the tendency has been all the other way. Pianists are still among us whose hands were formed on instruments wanting even 'the additional keys.' The additional keys have now long been constituent parts of the finger-board, which has, by degrees, been extended to six and a-half, seven, and even more than seven octaves. To what purpose? The 'additional' notes gained are, below, generally too indistinct for recognition, and above, altogether without power and sweetness. A vast quantity of music, expressly written for the pianoforte, exists, for the performance of which a compass of five octaves, or at the utmost five and a-half, is sufficient. On such an instrument Mozart, for example, made his reputation as a performer. He practised, probably, on one of still smaller range. Certainly a pianist of the highest order, in the strict style, might be formed on a key-board limited to four octaves, seeing that the whole of J. S. Bach's forty-eight preludes and fugues—as remarkable for their mechanical difficulty as for their learning and invention—lie within that comparatively narrow range. But the pianist proper is not the only person with whom a cheap pianoforte is a desideratum. For the study of harmony, as I have said, a keyed instrument is all but indispensable, as it is quite indispensable for the practice of playing from score, and of every kind of accompaniment. For students—and they number thousands—whose views in practising the pianoforte are limited to these objects, who take it up as a means of increasing their sympathy of eye and ear, and as a medium through which they can make acquaintance with, or at least form some idea of, the effect of music which they are not in the way of hearing completely rendered, pianofortes of a compass of from four to five octaves would be amply sufficient; while, from their necessarily less bulk and weight, and their lower price, such instruments would of course be more acceptable and accessible than those of the common modern form and dimensions. The pianofortes on which I have to report have, I think, without exception, a compass of seven octaves. They are all, also, what are called 'cottage pianofortes,' a kind of instrument whose appearance necessarily belies its construction. The adoption of the 'grand' form, or that of the 'spinet' of a century and a-half ago — in both of which the case follows the lines of the sounding-board, which, in their turn, are formed by the varying length of the strings—would, in connection with the restricted compass I recommend, be a step—perhaps the only one at present possible—towards the production of that great educational desideratum, a good and cheap pianoforte."

Mr. Hullah comments on most of the pianos exhibited, and then passes to the harmoniums and organs, the low price and merit of some of the former being remarkable. In one of the latter he mentions that "the action of the composition pedals exhibits an ingenious and useful novelty. Instead of being limited in their application to certain stops, a turn of any stop-handle to the right brings it under the influence of the pedal, so that any possible combination, prepared but an instant before it is wanted, may be brought on to, or, *vice versa*, taken off the keys. Not the least advantage of this invention is that, while it increases the power, it also reduces the number of the composition-pedals."

Another remarkable instrument is the orchestrion. It is self-acting, and reproduces, more or less approximately, the various effects of a concert orchestra. "A stop diapason and Vienna flute are the representatives of the stringed quartet; while the wind instruments, whether of wood or metal, which are combined with the stringed in the orchestra proper, are imitated by different registers, as varied in their 'voicing' as in their compass. The brass instruments—trumpet, horn, trombone, &c.—are imitated by 'free reeds, with sounding tubes of brass and tin.' A military side-drum and a triangle are attached to the mechanism. As many as thirty-three barrels, on which are set various overtures, operatic selections, dances, &c., have been already prepared for the instrument. This number could, of course, be indefinitely extended."

Passing to musical publications, Mr. Hullah draws attention to the cheap editions, generally clearly and often elegantly printed, of classical music; instruction books in harmony and musical composition, and for various instruments, and methods of teaching singing in class. Many of these works are fully and carefully reviewed in the report.

THE EXHIBITION OF 1872.

The Earl of Derby attended the Manchester Chamber of Commerce on Tuesday, as a member of a deputation from the Royal Commissioners, to invite support for next year's International Exhibition at South Kensington, in which the processes and products of the cotton manufacture will form a prominent feature. The meeting was held in the Mayor's Parlour, at the Manchester Town Hall.

Mr. H. Mason, the President of the Chamber, adverted to the fact that the International Exhibition of the present year had been a great success, not only because more than a million persons had already visited it, but because its results were financially satisfactory. The Commissioners would be entitled, he said, to expect every assistance from the Chambers of Commerce in the cotton districts, to insure an equal success for the exhibition of next year.

Lord Derby, who introduced himself as an old friend to many whose faces he saw, familiar to him in connection with various meetings in the Mayor's Parlour at Manchester, said he appeared on this occasion in a new character, having succeeded his father as one of the Royal Commissioners of the Exhibition of 1851. He proceeded to give a very brief explanation of the difference between the scheme of the annual exhibitions and that of their more extensive predecessors, which were held at longer intervals, especially the prominence given each year to three or four classes of articles, which were taken in their turn, with the view of their commanding more particular attention than when lost in a multitudinous assembly. He thought it unnecessary to argue in favour of the general principle of these exhibitions. They had taken a deep hold on the public mind, and, although the charm of novelty had ceased, they had not ceased to be popular. It was generally agreed that improvement in many branches of English art and manufacture dated from the Exhibition of 1851. Foreign competition with us was more likely to increase than decrease, and it was obviously desirable that our producers and their workpeople should have the opportunity of seeing by comparison what was really the best in every department of production, and of benefiting by all the latest ideas that might have been introduced in any country.

Sir Thomas Bazley, M.P., who was a member of the deputation, said he regarded these International Exhibitions as schools of industry for the nation. He had attended all the great exhibitions of our own country, and had visited also those in Paris, and had witnessed with great satisfaction not only the improvements to which they had given rise, both in manufactures and in taste, but also the increase of employment to which they had powerfully contributed.

The other members of the deputation were Mr. Ayrton, First Commissioner of Works; Mr. Henry Thring, Mr. Thomas Fairbairn, Mr. C. B. Vignoles, and Major-General Scott, secretary.

Mr. Fairbairn, speaking as one who had been connected with many exhibitions in this kingdom, and had visited every exhibition abroad, expressed his belief that the Commissioners were now in the right groove in illustrating various classes of articles separately in the successive exhibitions. No one who had visited the exhibition of pottery at South Kensington this year could fail to observe how delightful and instructive it must be to the potter or the student.

Resolutions were passed, thanking the deputation for their attendance, expressing an earnest desire to support the exhibition of next year, and asking the Chamber to promote the formation of local committees.

Mr. Ayrton said it was confidently expected that the exhibition of next year would be as far superior to that of the present as the cotton manufacture was superior in importance to the industries illustrated in 1871.

In the evening the President of the Chamber entertained the members of the deputation and a large assembly of gentlemen at the Queen's Hotel, Piccadilly.

Lord Derby, in response to the principal toast, said—Gentlemen,—When you drink "Success to the Exhibition of 1872" you are expressing a wish for that which is, to a great extent, within your own power, and I wish I were permitted to stop there; but your Chairman has also called upon me to answer to the sentiment which is added, "the promotion of free competition in international skill and industry." It lays upon me a burden and a duty which very few men—and certainly I am not one of the few—could adequately discharge. The sentiment seems to be one of the most comprehensive benedictions ever bestowed upon the human race, that is, if you take it in the sense in which I have no doubt the words were framed. International skill and industry may be shown in various pursuits, in war as well as in peace, and there has been a very keen and altogether unrestricted competition between France and Germany in the course of the last twelve months, but I do not think that is a kind of competition the promotion of which would be of any general benefit to mankind, or that it has been satisfactory to those who took part in it, least of all to those by whom it was brought about. The experience of the last 20 years has not corresponded with the sanguine hopes of 1851. But if the hopes were illusory I cannot find it in my heart to ridicule this illusion. It was at any rate the mistake of noble minds, who thought better of mankind than it has unhappily deserved. It is a question upon which it seems best to keep our wishes and our hopes for the future distinct from our judgment for the present. Let us labour that the hopes shall be fulfilled, and let us trust that men may in the future be that which they ought to be. But while we have to deal with them in the present, let us not forget to consider them as they are. While I say that, I will add that no failure of premature hopes at all affects the principle that the spirit of trade and of commercial enterprise is the great rival and enemy of the military and aggressive spirit. If I wanted an illustration, I should point to the relations between this country and the United States at various times in the last half-century. We speak with truth of the kindly feeling between the two countries; yet I would not undertake to say that peace would have been preserved throughout that period between them if it had not been for the conviction in the minds of all rational men on both sides of the water that they could not go to war without striking a most fatal blow at their prosperity. If I am to look at another part of the world, I would ask you to observe how strong is the military feeling of the population of almost all the Continental Powers compared with what it is England, and how much more importance they attach to military glory and all that kind of thing, and I would say ask you to notice as a coincidence that, great as is the material prosperity of some of those countries, more especially France, still the extent of their foreign commerce and commercial relations with other powers appears comparatively insignificant in proportion to their population and resources. We in England are, by the admission of all the world, the one great trading power; and it is also a fact, about which there is no dispute, that we are the one power whose political influence is invariably exercised upon the side of peace. Well, why is that? Some foreign writers, and perhaps some people at home, are induced to say it is because we are afraid of war, dislike its hardships, and shrink from its inconvenience. My answer is that no foreign country can show a military conquest such as that of India or colonies like ours, where every inch of ground has been gained by the adventure, the enterprise, and the self-devotion of individual Englishmen. If we systematically abstain from quarrels, and put no high value upon military glory, we have given abundant proof that it is not from fear of war, or inability to make it, but because we believe any needless war is a crime, or, to put it in the mildest terms, a perversion of human nature and industry. I am not going, in this mixed audience, to trench upon any ground which may seem political, and therefore will say nothing about the rule we have in general laid down for the conduct of our foreign relations—the plain and simple rule of leaving other people alone, in confidence that if you do so they will let you alone. Of course, like all human rules, it is subject to exceptions. There are many ardent spirits who look upon it as an antiquated and obsolete theory, but those words are no great terror to me. I have heard them for many years, and I mean to stick to this rule until I can find a better, which will not be in a hurry. For us at home, the question of unrestricted competition is pretty well settled; what its prospects are in other countries there may be those present who know better than I do. I do not pretend to prophesy, and I believe that with the infinitely better sources of information which Lord Granville and Lord Lyons possess, even they would not be able to say positively what the French may do about the commercial treaty, and for this single reason—diplomatists cannot tell us what men or nations mean to do before those men or nations know it themselves. I do not think the French quite know their own mind upon that subject; perhaps they do not know it upon a good many others. All we can say is, that we trust our own interests are their interests, and that they may come to a sound conclusion. I may add, as the expression of my individual opinion, that they are more likely to come to a sound conclusion if we do not press, and urge, and enforce the question upon them as if the adoption of our views were to be a favour conferred upon us. We have taken our duties off, and have found it to our benefit. Let them learn the lesson, and if they take off their duties, they will also find it to their benefit. I know that there are two views upon that question, and I only venture to hint mine. With regard to the other country with which we have the greatest of our commercial relations, I hope we have more reason to be sanguine as to the course which they may take. Their present tariff is not exactly in accordance with the principles of unrestricted competition. It was adopted, I believe, under two influences, the one the opinion of the trading interests at home, which, of course, will operate now just as much or just as little as it did a few years ago; the other influence operating upon them, equally national, and much more creditable—viz., an intense desire to begin by any means, by whatever means might be readiest at hand, to reduce the enormous debt which they had contracted. Well, they have set themselves to that work in earnest, and they are doing it; they are paying off their debt at the rate of £14,000,000 a year. We may not admire all the means taken to accomplish that result, but the result itself is a respectable one, and I wish we could borrow a little from them in that respect, and that we thought a little more than we are apt to do of the burdens we bear of this nature. But this is a digression. What I meant to say was that now they are beginning to see their debt clearing off, and that it is within their power to reduce it materially, if not to dispose of it entirely within a limited time, their attention will be less exclusively fixed upon that point, and they will think more of the weight of taxes they are imposing upon their people, and thus in time they will be led to reform their tariff. We know that on the other side the Atlantic they do not do things by halves, and if they go in for free-trade, which they have not done hitherto, I should expect that they will do it in earnest. As to the state of things at home, I think we may congratulate ourselves upon the material prosperity of the present year. But we have to look to the future as well as the present. I believe that with cheap coal, cheap iron, and admirable raw material in the way of workmen—I say nothing of capital—with all the natural advantages we possess I see no reason why we should not hold our own. But I do not think we ought to blind ourselves to the possible dangers of the future. I believe that is one of the questions which is turning up. It is not a political question, and therefore I may refer to it. A question which will every year grow in importance is the question of giving better and more general technical education to our working men. I read some time ago a book by Mr. Scott Russell on that subject. I confess it rather alarmed me. I hope and believe he takes a somewhat alarmist view of the situation. But it seems impossible to resist the evidence he has accumulated, that there is for the intelligent artisan and working man who is pursuing his business upon the Continent a far greater opportunity of acquiring needful preliminary instruction than is at present to be obtained in this country. If that is so, it is a great question to be looked to, and I venture to think it is a question even deserving the attention of so important a body as the Manchester Chamber of Commerce. I believe that the men themselves are taking up the subject, and I heartily hope that they are, because unless they go into it themselves, there is not much good to be done by other parties. In all matters of that kind I hope that the very limited and humble body whose head-quarters are at South Kensington will do what they can to help; but they can do very little; it is here, in the centre of the manufacturing districts, the real work has to be done, and to you I leave the subject.

In connection with subsequent toasts the speakers were Mr. Ayrton, M.P., Mr. Platt, M.P., Sir T. Bazley, M.P., Sir Edward Watkin, Mr. John Cheetham, and others.

THE COAL SUPPLY.

The report of the Royal Commission on the coal supply—adopting 4,000 feet as the limit of practicable depth in working, and making allowance for waste and loss—gives the quantity of coal still lying available beneath the surface of the United Kingdom as 90,207,285,398 tons; that is to say, considerably more than ninety thousand millions of tons. This is exclusive of beds less than a foot in thickness. The hypothetical coal-beds of the south of England are also excluded from the calculation. But the estimate lies within still narrower limits, seeing that it is confined to areas within which the coal-bearing strata are at the surface, or have been proved by mining operations to underlie more recent formations. Geological principles lead to the conclusion that large tracts of coal exist under the Permian, new red sandstone, and other superincumbent strata, in districts where the fact has not yet been demonstrated by actual exploration. If these unexplored coal-beds are taken into account, they add 56,273,000,000 tons to our reckoning, constituting a total of more than one hundred and forty-six thousand millions of tons. If we extend the depth beyond 4,000 feet, we get still more; but, for the present, we leave that out of the account. We have, therefore, to see how long the 146,480 millions of tons will be likely to endure. In 1869, the quantity of coal raised in the United Kingdom exceeded 107 millions of tons. Professor Jevons, in his work on "The Coal Question," which appeared in 1865, estimated that the rate of growth in the aggregate annual consumption of coal amounted to about $3\frac{1}{2}$ per cent., reckoning each per-centage on the previous year's consumption. On this basis, he reckoned that the consumption in 1871 would be nearly 118 millions of tons. So far as can now be computed, the quantity of coal raised in the United Kingdom during the present year is likely to be about 115 millions. Professor Jevons further showed that, at his computed rate, the coal raised in the United Kingdom would amount to no less than 2,607 millions of tons at the end of a century. Upon this assumed rate of increase, the whole quantity of coal reported available by the commission would be exhausted in 110 years. While it is admitted that Professor Jevons' theory has up to this time nearly accorded with observation, the commissioners object to the supposition that the annual per-centage of increase in the consumption of coal will continue unabated for any considerable period. Mr. Price Williams, who has given great attention to questions of this kind, and who has been employed by the Commissioners in matters of calculation, lays stress on the fact that, although the population of the United Kingdom is rapidly increasing, yet the rate of the increase is diminishing. This is a principle which Professor Jevons has not recognised, and when it is applied in correction of his theory, the duration of the coal supply is extended to a period of 360 years, the estimated population of Great Britain at the end of that period being 131,700,000. The Commissioners also give a calculation based on an arithmetical instead of a geometrical increase in the rate of the consumption of coal, simply adding a constant quantity equal to the average annual increase of the last 14 years, taking that at 3,000,000 tons. Upon this basis, the consumption of coal a hundred years hence will have risen to 415 millions of tons per annum, and our available supply would then be exhausted in 276 years, a period considerably shorter than that allowed by Mr. Williams, who, while taking a geometrical ratio also, reckoned that it would be a decreasing one. There is "yet another view," which the Commissioners regard as "the extreme opposite" to that of Professor Jevons. It is that from this time forward the population of the whole country, and the consumption of coal per head of the population, will remain constant, or merely oscillate without advancing. Taking, therefore, the present consumption of 115 millions of tons per annum, the supply would be gone in 1,273 years. This may be called the full length of our tether, and it is certain that we should feel an inconvenient tightness long before the end was reached. Supposing that coal could be worked at a greater depth than 4,000 feet—and the main difficulty is that of the intolerable heat at such a depth—we might add 48,465 millions of tons to our store, including the quantity believed to exist beneath the Permian formation. Supposing the whole to become available, the 360 years allowed by Mr. Williams would be enlarged to 433, the

276 years based on the arithmetical ratio would become 324 years, and the 1,273 years based on the theory of a stationary consumption would be lengthened to 1,695 years. As the commissioners observe, the whole question is subject to contingencies which cannot be foreseen, and every calculation involves something speculative. But they say—"It is certain that, if the present rate of increase in the consumption of coal be indefinitely continued, even in an approximate degree, the progress towards the exhaustion of our coal will be very rapid." One weighty consideration comes at the close—that we cannot suppose the production of coal will continue in full operation until the last remnant is used up. A period of scarcity and dearness will first be reached. The consumption of coal will then be checked, but the effect will be injurious to the prosperity of the nation. The absolute exhaustion of coal is a stage which the report observes will "never be reached." The best coal will go first, and much of the coal which is included in these estimates is of a kind which could never be worked except under conditions of scarcity and high price. Before complete exhaustion is arrived at, the importation of coal will become the rule, and "it may well be doubted whether the manufacturing supremacy of this kingdom can be maintained after the importation of coal has become a necessity." What science may do for us we cannot say. But clearly our coal supply is by no means inexhaustible.

CORRESPONDENCE.

DEAF AND DUMB INSTRUCTION.

Sir,—For about twenty years I have taken more or less interest in, and had more or less knowledge of, deaf-mutes and their instruction, and I, therefore, read very attentively the letter of Mr. Van Oven in the *Journal* dated 10th August last. My attention has but lately been drawn to it, or I should before now have taken the liberty of making a few remarks about it. The writer of the letter alludes to an institution established now in the Euston-road, and formerly conducted, I believe, by Mr. Van Praagh, in Burton-crescent, where I had the pleasure, two or three years ago, of seeing something of what can be done towards teaching deaf-mutes to rely upon the lips for intercommunication. Your correspondent is, however, in error if he supposes that this system of teaching has not been long known and long practised in this country; for I think I am correct in stating that it always was, and is certainly now, practised at the original Asylum for the Deaf and Dumb, in the Old Kent-road, where any visitor will, I am sure, be permitted by the principal, the Rev. James Watson, to witness some wonderful achievements in the way of reading from and speaking with the lips. It is true that at the Asylum in the Old Kent-road signing is very much in vogue and is used as an adjunct; but the reason is that, whatever your correspondent may allege to the contrary, experimental teachers find that signs are useful as a sort of intermediate language, are certain to be substituted at any convenient opportunity by the deaf-mutes themselves, as an easier medium of communication between themselves than the lips can be made, and are the only form in which the majority of deaf-mutes can be taught to read by, understand, or make understood, what they would fain hear or say. It is possible that, if men generally lived as long as Methuselah, every deaf-mute might learn to read the lips; but as things are, only the most exceptionally endowed can be expected to attain to anything like a full command of the mouth, so as to satisfactorily interpret its motions, and by imitation use them also for the formation of intelligible vocal utterances. Anything often repeated, such as the prayers of the Church, ordinary salutations and remarks, common questions and answers, the orders habitually issued to servants, and the like may, no doubt, be read from the lips by very many deaf-mutes; but it is a mere dream to imagine that there can ever be more than a very small number, if any, of deaf mutes "who," to use your correspondent's words, "mix in ordinary society without difficulty, who go to places of amusement (*sic*) and hear, or rather understand, what is being said by the preacher (*sic*), the lecturer, or the actor, by the mere use of the eye." Still, as the majority of mankind are articulately speaking, and are not deaf, and are not likely to take the trouble of learning the sign-language simply to oblige deaf-mutes, and as many deaf-mutes may be taught to so master the lips as to understand an employer's orders or wishes, or a friend's observations slowly and carefully enunciated, and even to reply briefly and intelligibly, there is no cause why the system of lip-reading and the lip-language should not be strenuously encouraged; and, if "its introduction is opposed," as your correspondent asserts, I have high authority for assuring him that it is not, and never was, at that institution in the Old Kent-road, which is the eldest sister, if not the mother, of all similar establishments in this country.—I am, &c., Robert Black, M.A.

6, Northumberland-street, W.C., September 9th.

Sir,—The special subject which has led to the correspondence in your columns under this head is a very proper one, both for discussion and for experiment. It is not, however, my present intention to enter into the discussion, though I regard the experiment with very great interest. My object in writing is to notice two assertions in your paper of the 1st inst., which I hold to be as unwarrantable as they are injurious. 1. That in this country "all is stagnation in all that concerns the education of the deaf and dumb." 2. That "our pupils cannot get . . . . a good education." To both these statements I give the most emphatic contradiction. The proofs which I might adduce are abundant and conclusive, but they would occupy too much of your space. Indeed, to anyone fully acquainted with the subject such evidence is unnecessary. The allegations I am now disputing are the result of only narrow views and limited experience. The writer I have quoted is certainly practically acquainted with one institution, and only one; but "Paris is not France," nor is London the whole of Great Britain. There are institutions for the instruction of the deaf and dumb in every portion of the United Kingdom—long established, well-supported, well-conducted, and successful; but with these your correspondent has no acquaintance whatever. Are they not to be taken into account? What would be thought of any one who, from an intimate knowledge of St. James's Palace alone, should pronounce all the royal residences in this country to be old-fashioned, cramped, and inconvenient? You would naturally ask if he had ever seen Windsor, Osborne, or Balmoral. And when you ascertained that he had never seen either of them, inside or out, you would know what weight to give to his testimony. So, in the case before us. Change only the name, the analogy is complete. Your readers will now be able to draw their own conclusions. Much harm has been done to this good work by writers who are supposed to be better qualified to pronounce opinions than they really are. A man who only looks through the port-hole of his own cabin cannot possibly see so much as the observant passenger who sweeps the whole field of vision from the upper deck. This seems a very obvious truth. I only wish it may be accepted and applied. I shall then have discharged, once for all, the duty of correcting a growing evil, by reducing the testimony of such witnesses to its proper value.—I am, &c.,

David Buxton.

School for the Deaf and Dumb, Liverpool,
September 11th, 1871.

GENERAL NOTES.

The Public Libraries Act Amendment.—By an Act passed last month, the Public Libraries Act of 1855 is amended. Local Boards are now empowered to put the principal Act in execution. Local Boards are not to expend for the purposes of the Public Libraries Act more than one penny in the pound. Such boards may borrow on mortgage of the general district rate or any separate rate. The statute is not to apply to any district the whole or any part of which is within any municipal borough or within the jurisdiction of Commissioners under any Improvement Act.

Domestic Economy.—The committee meetings recently held under the presidency of the Earl of Shaftesbury have matured, and will secure the speedy establishment of a training institute in domestic economy. The prospectus states that "The institution hopes to counteract one of the greatest evils of the day, viz., the ignorance of women in all that relates to household management and domestic economy." Miss Faithfull's preliminary circular shows that she has obtained the cooperation of Lord Shaftesbury (chairman), Lady Blanche Balfour (who has subscribed £100), Mr. Peek (£500), Lord and Lady Alfred Churchill, Lord Lyttelton, the Countess of Warwick, the Marquis of Lansdowne, and others. The institute will not only furnish practical lessons in cookery, and a restaurant for members and shareholders, but will comprise a reading-room and parcels-room for ladies only. Full particulars can be obtained on application, by letter, from the secretary, 14, Princes-street, Hanover-square.

Emigration to the United States.—Of the 196,075 emigrants who went to the United States in 1870, 140,895 embarked at English ports, 16,682 at Scotch, and 38,318 at Irish, viz., from Liverpool, 137,321, of whom 16,587 were married men, 19,888 married women, 49,318 single men, 17,458 single women, 12,557 boys between the ages of 1 and 12, 10,760 girls between the same ages, 3,668 male and 3,212 female infants, 2,404 males and 1,469 females not distinguished as to age; 65,807 were English, 4,494 Scotch, 29,453 Irish, 33,694 foreigners, and 3,873 not distinguished. From London, 3,574 embarked, of whom 487 were married men, 561 married women, 1,288 single men, 366 single women, 345 boys between the ages of 1 and 12, 373 girls between the same ages, 69 male and 77 female infants, and 8 males not distinguished as to age; 3,109 were English, 30 Scotch, 234 Irish, 193 foreigners, and 8 not distinguished. From Glasgow, 16,862 embarked, of whom 1,057 were married men, 1,055 married women, 6,607 single men, 3,675 single women, 1,831 boys between the ages of 1 and 12, 1,647 girls between the same ages, 594 male and 396 female infants; 11 were English, 12,114 Scotch, 406 Irish, 4,330 foreigners, and 1 not distinguished. From Cork, 30,227 embarked, of whom 1,458 were married men, 2,312 married women, 12,610 single men, 9,727 single women, 1,550 boys between the ages of 1 and 12, 1,507 girls between the same ages, 348 male and 273 female infants, 326 males and 116 females, not distinguished as to age; 8 were English, 2 Scotch, 29,759 Irish, 18 foreigners, and 440 not distinguished. From Londonderry, 8,091 embarked, of whom 346 were married men, 367 married women, 3,289 single men, 2,918 single women, 452 boys between the ages of 1 and 12, 475 girls between the same ages, 118 male and 121 female infants, and 4 male and 1 female not distinguished as to age; 8,039 were Irish, 46 foreigners, and 6 not distinguished. Of the 196,075 emigrants, 19,935 were married men, 24,183 married women, 73,112 single men, 34,144 single women, 16,735 boys between the ages of 1 and 12, 14,672 girls between the same, 4,797 male and 4,079 female infants, 2,742 males and 1,586 females not distinguished as to age; 68,935 were English, 16,640 Scotch, 67,891 Irish, 38,281 foreigners, and 4,328 not distinguished.

British and Russian Trade-marks.—The governments of the United Kingdom and of Russia have agreed upon the following arrangements for defining and rendering more efficacious the stipulations in the 20th Article of the Treaty of Commerce and Navigation of 1859:—1. The offering for sale, or the placing in circulation, of goods bearing counterfeit British or Russian trade-marks, wherever fabricated, shall be considered as a fradulent operation, prohibited within the territory of the two States, and shall be liable in England to the penalties prescribed by the Act of Parliament of 1862, and in Russia to the penalties prescribed by the Articles 173—176 and 181, inflicted by Judges of the Peace, and by Articles 1,665—1,669 and 1,671—1,675 of the Penal Code (edition 1861). Such fraudulent operation shall give the right, before the tribunals, and according to the laws of the country where it shall have been proved, to an action for damages, at the suit of the injured. 2. British subjects who may desire to secure to themselves in Russia the proprietorship of their trade-marks shall be bound to register them at St. Petersburg, at the Department of Commerce and Manufactures. In case trade-marks should hereafter become subject to registration in England, the same rules shall be applied to Russian as to English trade-marks. The declaration containing these articles was signed at St. Petersburg on the 11th of July (29th of June), 1871. The articles came immediately into operation, and are to be considered as forming part of the treaty of 1859.

Cultivation of the Tapioca Plant.—His Highness the first Prince of Travancore has addressed a letter to the Madras Government on the importance of introducing and extending the cultivation of the manioc or tapioca plant in the Madras Presidency. "Some twenty years ago," writes his Highness, "the manioc was scarcely cultivated in Travancore, but of late years its cultivation has been rapidly extending. A large tract of undulating land between the great forests fringing the ghauts on one side and the sea-coast on the other, is formed of hard laterite soil, little fit for cultivation, excepting the valleys which intersect them, and overgrown with stunted vegetation. These hill-sides are fast becoming green with manioc plantations, carried on principally by the peasant population. Limited as the cultivation of manioc is, even in Travancore, it has, I am convinced, amply shown that, in the ease and cheapness of production, in the abundance of yield, in its adaptability to almost any soil, in its almost entire independence of the seasons and water supply, in its nourishing quality as an article of diet, this stands behind no other agricultural product known in India. While rice will meet the necessities of the higher and middle classes, the manioc is, one may reasonably believe, destined to a great extent to become for the poor classes of India what the potato is in Ireland, what the bread-fruit is in Java and other islands in the Indian Archipelago, and what the date-palm is in Arabia. After describing the process of cultivation and of preparing the tubers for food, his Highness thus sums up the advantages of the tapioca plant:—1. It grows in almost any soil. 2. The labour required for its cultivation is comparatively small, and of the simplest sort. 3. Except during the first month or two, its growth is almost independent of rainfall or irrigation. 4. Its productiveness is decidedly larger than that of any other article coming under dry cultivation. 5. The mode of preparing it for the market or for domestic consumption is simple. 6. The dietetic nature of it is excellent. The government, in their order, write that they highly appreciate his Highness's enlightened wish to extend the cultivation of the tapioca plant, which is said to succeed so well in the poorer soils of Travancore, and to be so acceptable as an article of food. The collector of Tinnevelly and the Committee at the Sydapett farm have been instructed to make experiments of the cuttings which his Highness very liberally offers to transmit, and report the result in due course.

Ipecacuanha.—Professor Balfour has made some observations on the cultivation of ipecacuanha, in the Edinburgh Botanic Garden, for transmission to India. As a curative for dysentery, the value of this plant is very great, and, in consequence of the partial failure from various causes—such as the rashness and carelessness of collectors—of its cultivation in its native country (South America), its cultivation here for sending out to India became a matter of much importance. A difficulty, however, till within a short time ago, stood in the way of this design, as the perfect seed of the plant had not yet been obtained, and its propagation was accordingly but slow. A short time ago, however, Mr. James M'Nab, of the Botanical Gardens, discovered that by cutting the root under the ground surface numerous shoots could be got, and the plant so propagated much more easily and plentifully. They had thus been enabled to send out a number of healthy plants to India, which, it was hoped, would be there equally successfully cultivated. Mr. M'Nab is endeavouring, with fair prospect of success, to get the perfect seed of the plant, and, if that can be done, the difficulty of propagation would, of course, disappear. There are two varieties of the plant in the Botanical Gardens, one of which has been cultivated there for forty years, and the other has just been sent from South America, through the kindness of Dr. Gunning and Dr. Christison. It was hoped from the union of these two varieties to get a perfect seed.

The Forest Trees of Hindostan.—Foremost among the crowd of leafy princes in ornamental beauty and commercial value stands the ironwood tree of the Burrampooter valley, *Mesua ferrea*. Tall, straight, and symmetrical, it rears itself some sixty or seventy feet high, tapering upwards in its glossy green mass of waxlike foliage, beset with snowy, fragrant golden-centred flowers of the camellia character, its timber unmatched for weight and hardness by any other in all the immense wilderness of Ind, and its worth enhanced by its comparative rarity, for the axe has played sad havoc with the very partially scattered groups to be met with at the present time. The dried flowers are sold as a perfume. There are certain conditions of soil, clime, and natural production which have hitherto baffled the zealous arboriculturist in his labours to propagate this beautiful wonder of the woods. A rival in beauty and utility, though quite of another type, appears in profuse array—the gorgeous *Lagerstrœmia reginæ;* every spike of rose-red flowers enough to fill a market-basket. Grand in its regal bloom and stout in its growth, yielding durable though crooked logs, preferred by the Burmese for ships' "knees," and by the 'cute Anglo-Indian adventurer for the roof supports of his residence, this lovely tree attains a moderate size in cultivation, and flowers annually in the gardens of Lower Bengal. On entering Central and Lower Assam, the European stranger is overpowered with admiration of the gigantic woodland scenery. As he ascends the noble Burrampooter winding among ranges of little hills and grand mountains, he will with his telescope scan the interminable tracts of dark forest, and occasionally define its constituent Sylva. Spreading over the lower country, his glass will, from the poop of the steamer, proclaim that here *Shopea robusta* is indigenous and paramount, its sombre and silent shade telling the well-known tale of death-dealing malaria, which has laid low many a bold hunter and brave botanist in the regions of heat and moisture; the combination so necessary to the life of this valuable timber tree, attaining its proudest dimensions here, and in the equally noxious atmosphere of the Nepaul Terai. The government gun-carriages, the transport tram, the military buildings, the warehouses of the merchant, the craft of the native boat-builder, all constructed of the heavy fibrous wood, supporting great strain and shock, while so heavy as to sink in water, and hence requiring rafts of bamboo and earthen pots to give it floatage in conveyance by river. Were it not for the annual conflagrations caused by the primitive custom of burning the old grass lands, India would at the present time have been indeed overstocked with this invaluable tree. The grain of the wood is much like that of our English elm. The railways have availed themselves largely of its comparative abundance and good qualities, and the Government conservators are keeping a strict eye upon the herdsmen and other incendiary tramps to save the young seedlings (self-sown) from annihilation. This is not the only precious individual in that remarkable order, *Dipterocarpaceæ*, for *Vateria indica* supplies that elegant resin known to commerce as East Indian copal, closely resembling amber, and often containing flies and other minute natural objects. Combined with boiling linseed oil and a little pale dammar, it is in general use by carriage and house painters in the East as a varnish; while among the aborigines of Malabar it is manufactured into candles, which burn with a clear light, no smoke, and fragrant odour. This gum resin is highly electrical, *Vateria lancifolia* yields the incense used in Hindoo temples near the coast. *Dipterocarpus lœnis* and *augustifolius* furnish the balsamic oil known as gurjun. An old tree will supply, by tapping and charring, 40 gallons in one season, but will soon perish; for this reason the product is rapidly rising in price. The virgin forests of our north-east frontier, and also Burmah, are its localities, growing in the most dark and pestiferous jungles. *Cedrela* species are superb timber producers, yielding the finest wood for cabinet work, the darker kinds being almost equal to mahogany, and taking an exquisite polish. The older the timber, the finer the grain and the darker the veins. This is the favourite wood of the cabinet makers and house carpenters of the luxurious East. Such furniture as bedsteads, dining tables, chairs of every shape, sofas, cabinets, chests of drawers, &c., are to be daily seen in all the splendour of French polish, and of the latest European designs; it is generally known as "Toon wood," and is very remarkable for its lightness, being only a little more heavy than deal, unless of the scarce mountain species, when its density increases, as its beauty also. This latter kind is rather rare in commerce, though so plentiful in the virgin forest of the Upper Burrampooter districts, the reason being that no local saw mills have yet been started, and the rapids are too heavy to raft such fragile logs; indeed, there are few woods that can withstand the terrible grinding force of those vast cataracts, which not only smash gigantic trees into drift-wood, but more frequently impound them for ever in some unapproachable cavern beneath the waves. In the vicinity of the great north-east rivers, the Upper Burrampooter, the Debong, and Dehong (the latter supposed to be the veritable Sampo of Tartary), the nomadic tribes have long ago felled and cut out into canoes all the specimens of this valuable tree, not only for their own use, but for barter with strangers and frontier traders in salt and cloth, their two chief *desiderata.* In this valuable order of timber trees, we have the satin-wood of Southern India and Ceylon, yielding also a useful oil for painters; also *Suretenea mahogani*, or mahogany tree, long introduced and partially acclimated; in fact, the first instance of this exotic seeding has just occurred at Madras. The cyclone in 1864 or 1865 destroyed one or more noble specimens in the Calcutta Botanic Gardens (said to have been planted by the founder of the establishment, General Kidd, a century before). There are still a few experimental trees at Berhampoor, planted in low alluvial ground, where they do not appear to make any growth. Then, we have the fine *Chickrassia tabularis* in this family, scattered over the more rainy of our climates, for it is a moisture-loving tree, in large demand by the Calcutta upholsterers and cabinet makers, being beautifully veined. All this order contain a great amount of febrifugal property in their bark, their habitat being the most feverish localities; like the cinchona and and the willow, both furnishing the potent alkalines, quinine and salicine.

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THE INDUSTRIAL CLASSES ABROAD.

(*Continued from page* 764.)

RUSSIA.

The condition of the industrial classes can only be imperfectly ascertained from the reports of the consular officials, at the various districts scattered throughout the Russian Empire; these reports present certain features of interest, although there is but little deserving of imitation.

The Consul-General, Mr. Abbott, observes that the country of New Russia and Bessarabia, forming the government of which Odessa is the principal city, is not likely now to attract to it emigration from other parts of Europe. Though many colonies of Germans were founded in this part of the country at the end of the last and early in the present century, and those communities have, through the favour of the government, become very flourishing, this system has not been followed up, though it could not be otherwise than advantageous. The country which goes under the appellation of New Russia is, generally speaking, an open, bleak region, exposed in winter to intense cold. The same may be said of Bessarabia, though, towards the north, it is wooded, and rendered fertile by frequent rains; but throughout these countries the communication, excepting by the solitary lines of railway, is difficult, made roads unknown, and communication rendered almost impracticable after each fall of rain. Though possessing few attractions for the general emigrant, a good many English and Scotch have met with employment in it, either as engineers, mechanics, paviours, or stone-cutters, and many governesses and nurses from England are found in the country. The Russian artisans themselves are fast acquiring greater skill in all departments of their trade, for the Russian is of an imitative if not of an inventive turn of mind, and as he improves in skill he will naturally improve in the care and quality of the work he executes. The contract system prevails, so that parties dispose of their services in gangs, by the year or season, for any work that can be obtained. If a house is to be built, the architect has only to warn one of these contractors that so many masons or carpenters are required, and they are immediately supplied. The system has these advantages for the working man; he is provided for so much of the year, without having to seek more frequently for labour, and he has a certain sum to depend upon instead of an uncertain prospect of wages. With respect to the purchase-power of money, as compared with England, Mr. Abbott reckons it about two to three for the upper classes, whilst for the lower orders, whose diet is of the simplest and least expensive kind, living must be infinitely cheaper than in England. With respect to diet, the conditions essential for the preservation of health do not differ from those required generally in other parts of Europe. Provisions of most kinds are abundant and good. There would be great difficulty, generally speaking, for working men from abroad with respect to house accommodation as good as they have been accustomed to in England, and the distance from their work would often be unendurable; and if all the inconveniences are taken into account by an intending emigrant, very few, if any, would quit the shores of England to reside in Russia.

At Kertch, Mr. Consul Barrow informs us a house that would cost 200 roubles a-year rent, or £25, may be procured in England for as many shillings, say £10, and of a much better sort. The same with regard to clothing; a coat that costs 30s. in London is sold in Kertch for 30 or 35 roubles, each rouble on an average being worth 2s. 6d. Woollen shirts are from 10 to 15 roubles. As to provisions, meat, bread, and poultry alone are cheap, though the first item is much higher now than it was four years ago. Bread about 1d. a pound; sugar, 6d.; fresh butter, 1s. to 1s. 3d.; eggs, from 8d. to 1s. per dozen; fowls, from 1s. 6d. to 2s. the pair; salt butter, from Siberia, 7d. to 8d. per lb.; tea, of an inferior quality, 6s. per lb.; better quality at 8s.—the Russian lb. being less than the English by nearly one-tenth. Every item purchased in the shops may be reckoned in roubles for shillings, so that in reality wages of £20 a-month are scarcely worth more in purchase money than £8 to £10 at home. Fish is very cheap, and at times very abundant. The most wholesome beverage is the red Crimean wine, made from Bordeaux vines transplanted, diluted with water. The most injurious of drinks is the Russian "watkey," invariably detestable to the inhabituated, but upon the second or third trial it possesses an extraordinary fascination; and, after a few months, men who drink it, from being hale and hearty, are known to become grey-headed, stupefied, and rapidly approach the last stage of *delirium tremens*. In the hospitals, there is a scarcity of nourishment bordering on starvation, and an utter want of feeling or sympathy for the sick among the attendants.

Mr. Vice-Consul Stevens, writing from the district of Nicolaieff, gives some instructive advice upon the subject of this inquiry. He observes how recent Russian resolve requires all Russian enterprise to employ no foreigners or foreign material if they can be avoided; and it is notorious that foreigners are only sought where and when the Empire fails in supply, and then the most binding contracts are useless once the foreigners' art is learnt tolerably well by the natives, who are quick at imitation. The smallest pretext is made an excuse for dismissing the foreigner; he is arbitrarily dismissed, and his only hope for even moderate redress lies in the influence and painstaking of his consul, who, in nine cases out of ten, refers the applicant to the civil tribunals, where no sane man would venture a law-suit unless he resolves to settle down in the country ten or fifteen years to await an uncertain issue. The workmen are generally competent but careless, and demand constant supervision. This is most difficult to obtain; and Mr. Stevens mentions that very recently he refused to assist Russians to obtain Englishmen for ship-building and other purposes, from experience of the shabby and scanty treatment palmed off upon all foreigners. No native, it appears, takes a pride in his work, and his employer is equally indifferent on this point; and none hesitate to copy and mould English patented machinery and implements, not even caring, in most instances, to avoid casting the name of the foreign manufacturer, a forgery which many a landed proprietor discovers to his cost when he puts his purchase in the field; a piracy which not unfrequently brings discredit on the manufacturers in the west of Europe, and a system adopted in every factory of south Russia.

Our representative at Warsaw, Lieut.-Col. Mansfield, in his contributions to the reports, states that, in no country, perhaps, is the government apparently so indifferent to the condition of the industrial classes as in Poland, but it must be admitted also that there is but little interference. Certain regulations exist in respect of apprenticeship, and formerly various guilds had the power of exercising vexatious rights; the latter, however, have all come to an end. Strikes are unknown, and would probably be put down with a high hand. Several years since, the hands in an iron-foundry exhibited a recalcitrant demeanour, but the interference of the police was obtained, and the mechanics compelled to resume work, under the threat of worse things. Sanitary legislation does not exist; no special attention is paid to the supply of water, which is invariably drawn from pumps in the streets, or in the villages from ponds or ditches. No attempt is made at drainage in the villages; every dwelling has an open cesspool, often at the door; while in the towns all drainage is on the surface, and of the most pestilential character. No regulations are in force respecting the state of repair of lodging-houses occupied by the artisan, or in regard of the overcrowding of dwellings; and there is no system of parochial relief, or of medical supervision, except in a crisis, such as a very virulent outbreak of cholera. In some of the larger industrial establishments scattered over the country, often at great distances from the towns, various arrangements have been carried out for the benefit of the hands. In most of the sugar-factories there is a medical dispensary, and in several a school for children. Complaints of over-work are almost unknown; the ordinary time is twelve hours, with two deductions of half-an-hour and one of one hour for meals and repose, giving ten hours' actual work.

As regards the purchase power of money, we learn that it is greater than in England as regards the merest necessaries of life, but for other articles the prices, owing to the tariff, are preposterous. The native and German mechanic are both satisfied with an inferior style of diet and living that would not content an Englishman, who, if prepared to make the necessary sacrifices, might probably make a more considerable saving than in his own country under corresponding circumstances. For instance, a brass-fitter or a weaver, with a moderate family, and receiving eight roubles a-week (about £1 1s. 8d.), might make an average weekly saving of from 2s. to 4s., without denying himself anything which is suitable for his class—perhaps, with care, even a larger sum. Owing to the extreme dryness of the climate, it is more or less necessary to follow the diet of the natives of Poland and Russia, and to eat daily a portion of black bread, and use various aliments containing vegetable acids, such as sour and cabbage soups, pickled vegetables, &c.; neglect of the above produces a tendency to scrofula, more especially with young people. With regard to the quality of the work produced, it may be assumed that the Polish manufactures are considered to be better, more durable, and to possess a superior finish, when compared with what is produced in the rest of the Russian Empire; and that such is the case is demonstrated by the circumstance that, at the exhibition held recently at St. Petersburg, out of 1,990 exhibitors, 240 came from the kingdom of Poland, and 122 received prizes or were favourably mentioned.

In most factories, the rate of wages is determined after a few days or weeks' probation, and every opportunity is afforded to careful and industrious workmen to obtain a fair and liberal remuneration. The only careers, however, in which there would be the smallest opening for the British artisan and mechanic are the woollen and cotton factories, and the metal works. At the present moment, the demand for labour in these branches is amply provided for, and no Englishman would do wisely to seek employment unless in answer to a definite application on the part of a manufacturer. The German workman has attained a permanence and a position in Poland from which it would not be easy to displace him. He has the advantage of language, German being pretty generally understood among the business people; he is thrifty, and less difficult in his mode of living than the corresponding classes in England, and comparatively close to his own country. On the other hand, English workmen, if they give satisfaction, are highly prized, and can command excellent remuneration; they meet with no ill-will or jealousy on the part of their fellow-workmen, and when already some time on the Continent and acclimatised to foreign habits, they frequently make a prosperous career in Poland.

THE UNITED STATES.

The reports from the United States present many features of remarkable interest. Although there are but few promising fields for the artisan in the Old World, the reverse is apparently the case when we cross the Atlantic. The information asked for in the earlier despatch of Lord Clarendon (dated October 27th, 1869), respecting the conditions of labour in other countries, when compared with those which exist in the United Kingdom, and the indications of any possible openings of which the skill and enterprise of the labouring classes may take advantage, with the subsequent inquiry (dated June 7th, 1870), respecting the purchase-power of money, has been amply supplied by her Majesty's representatives throughout the United States.

Writing from Buffalo, in the State of New York, Mr. Consul Hemans observes, that a glance at the generally neat and comfortable cottages clearly shows the very prosperous state of the industrial classes. These cottages are, as a rule, built of wood, painted white, with a porch before the door, and green venetian blinds to the windows. They are almost invariably detached, standing gable end towards the street, in little gardens, averaging sixteen to the acre, well planted out with vegetables. The smallest sized cottage ordinarily contains three rooms, a living-room and two bed-rooms, with a wood-shed, to which in the hot season the movable cooking-stove is transferred. In the next size, the sitting-room and kitchen are distinct; and the skilled artisan, with high wages, and an average family to support, has probably a third bed-room, and a "guest-chamber," which is sometimes let out to a boarder. The cost of building a substantial four-roomed cottage averages from £70 to £80, and the rent of such a cottage is from 30s. to 35s. a-month. The smaller sizes rent as low as 16s. a month, and the larger, with gardens of perhaps eight to the acre, go up to £2 to £2 8s. Of course, when the working man builds his own cottage—by no means a rare case—the cost varies with the greater or less solidity of the structure. Cottages are usually taken by the year, but the rent is paid monthly. The proprietors, however, of the great iron works build cottages for their own men, which they let out on the understanding that the tenancy is to terminate with the engagement. In the neighbourhood of a large rolling-mill, employing between 600 and 700 men, a whole village has been thus erected, all the inhabitants of which hold their houses on this sort of contingent tenure. Single men find board either with an artisan family who have a spare room, or in one of the numerous second-class boarding-houses and hotels scattered over the town. Except the immediate neighbourhood of the large iron works and some of the streets near the harbour, no part of the town is specially inhabited by working men. Their little white cottages are seen everywhere, side by side, perhaps, with some stately villa in this irregularly-built city. The working man is thus enabled to locate himself, generally speaking, within easy reach of his work. Where the case is otherwise, he makes use of the "street cars," which run on the principal lines of communication, and charge 3d. for the course.

Buffalo is, on the whole—at least for the healthy—a healthy town. Its situation, in a plain slightly inclined towards the lake, is favourable for drainage, and its system of sewers is a very good one; but the arrangements for getting rid of the sewage at its outlets are entirely defective, and would undoubtedly be seriously prejudicial to the healthiness of the town, but for the sanitary advantages secured by its general plan. With a population of barely 120,000, the city spreads itself over an area of nearly 40 square miles, giving an average of only 3,000 inhabitants to the square mile. Fresh air, therefore, is almost as plentifully supplied to the citizens as it is to the dwellers in the country, and it is to this that the low death-rate of the town is probably in a great measure due. The changes of the temperature are often abrupt and extreme, especially in the spring and fall of the year. Great care must consequently be taken both to resume woollen under-clothing in good time and not to lay it aside too soon, as the occurrence of hot days long before the regular set in of warm weather often tempts the stranger to do. This simple precaution is almost the only one which need be given to the emigrant from England. He will do well, however, in selecting his lodging, to keep away from the lower parts of the town, near the lake, as the typhoidal fever prevalent throughout the eastern states are usually of a more virulent type in those localities than on the higher ground.

Wages in Buffalo, Mr. Hemans remarks, although gradually falling, are still very high in comparison with their rate before the war. The day's wage of a skilled artisan averages from 6s. to 16s., and even reaches, in exceptional cases, 24s. In the great iron works and machine shops of the place, blacksmiths and foundrymen receive from 8s. to 14s.; machinists, from 8s. to 16s.; rollers, from 18s. to 24s. Puddlers, heaters, and nailers are usually paid by the ton, and can earn from 16s. to 22s., according to the expenditure of muscle and skill. Carpenters, bricklayers, and tailors receive from 6s. to 14s.; house painters and plasterers, from 7s. to 12s.; masons and stone-cutters, from 10s. to 16s. Shoemakers usually work by the piece, and earn 8s. to 12s. a-day. The wages of lake sailors depend upon the demand for freight; at present they are £8 a-month, but in 1864 they were 14s., and at one time even 20s. a-day. Unskilled labourers receive from 4s. to 6s. a-day. The dock labourer, generally an Irishman, is paid 1s. 3d. to 1s. 5½d. per hour, and when fully employed, can make 16s. a-day. The ordinary working day here is ten hours. When the agitation in favour of an eight-hour day first began, some of the leading manfacturers substituted payment by hour, at the rate of one-tenth of the ordinary wage of payment by the day, thus anticipating the difficulty, and effectually shelving the question. Wages are usually paid weekly, unless where the job is short, as with dock-yard work. But engagements, as a rule, are simply by the day, so that the workman may at any moment either receive his discharge or change his master. In large establishments, however, where a steady business is done, a week's notice is generally expected on either side, but cannot be enforced.

With regard to the cost of living, it would seem, looking at the relative prices of articles, that the condition of the labourer is inferior to his condition before the war; and such a fact is the conclusion arrived at by the various writers who have dealt with the subject. From personal inquiries, however, Mr. Hemans learned, to his surprise, that, at any rate, the majority of both the employers of labour and the working men themselves, hold a directly opposite opinion. The exorbitant rise in prices caused by the war did, without doubt, produce at first a considerable amount of discomfort and embarrassment among the labouring classes. But as this rise was unequal, affecting some articles of consumption much more than others, a compensating economy in the use of those articles most affected soon brought the domestic expenditure into equilibrium again, and allowed the substantial advantages of a steady rise in wages and of continuous employment to have their full weight. The unusual number of boys, too, who found work during the reduced supply of labour, at wages quite equal to the former adult tariff, helped to swell the family earnings. From the nominal value of American wages, before comparing them with the wages paid in England, at least one-third may be fairly deducted. Taking the various necessaries of life in their turn, and London prices as the term of comparison, the English emigrant will find butchers' meat about 20 per cent. cheaper than at home; bread, milk, and vegetables pretty much the same; butter and eggs full 40 per cent. dearer; beer 25 per cent., tea and sugar 50 per cent., coals 60 per cent. dearer, with at least double the quantity required for consumption; gas 200 per cent. dearer; and lodgings from 100 to 250 per cent. He will also have to pay double for his tools, of equal quality. The additional cost of clothing is more difficult to calculate, as the very inferior durability complicates the question, but since the fall in "dry goods," it may probably be put at about 150 per cent. Mr. Hemans mentions the substance of a conversation with an artisan respecting the great saving in the necessaries of life in his native country (Germany), as compared with his adopted country, and his opinion upon the matter. He replied, "I am ever so much better off. My earnings in Germany (as a plasterer) would be barely 3s. a-day, while here they are 11s. to 12s. My eldest boy, who is just sixteen, makes his 4s. a-day already—more than I could have done myself at home—and pays me something for his board. Even my youngest (thirteen years of age) earns 8s. a-week, while he learns a trade. In Germany neither of the two would bring me home a sixpence. In short, if I were there, I should, with my large family, be little better than a pauper, while here I have saved enough already to purchase a comfortable cottage, and I have something in the savings bank still."

With regard to the openings for the introduction of labour from without, the opinion general among employers is that the present annual average of applicants is pretty well equal to the demand, even for skilled labour; while, as far as unskilled labour is concerned, the place has, owing to the constant influx of Irish and Germans, reached the point of saturation. At the opening of the navigation, but not later, there is always a good chance of employment for sailors on the lake. Servant girls are in demand, but in other directions the field of employment for women seems considerably narrower than in England. We learn that the artisan in America prides himself on keeping his womankind at home. His wife attends to the domestic duties, and his girls go to one of the excellent schools provided by the municipality, generally remaining there longer than their brothers, and therefore carrying their studies further. In contradistinction to the American, the thrifty German makes all the available members of his family work—women, girls, and boys; and it is worth noting, that a very much higher per-centage of savings-bank depositors, and of cottage freeholders, is supplied by the German element of the population than by any other. The better quality of work, it seems, is confined to new arrivals; but the restless craving for change, born of the stored marvels of the Great West, and its short cuts to fortune—which has become endemic in America, soon seizes upon the new comer also. He becomes, as the phrase is, "Americanised;" he loses all artistic interest in his work, and is satisfied with fulfilling his task to the mere letter. The Germans are, however, in good repute, both in regard to steadiness and intelligence; and as they keep much apart from the rest of the population, inhabiting a distinct quarter of the town, and encouraging the practice of their own language, by German theatres, concert-halls, libraries, and beer gardens, it may be safely concluded that the process of "Americanising" goes on much more slowly with them than with the English and Irish.

In California, writes Mr. Consul Booker, the condition of the artisans and industrial classes has been one of unparalleled prosperity; and as yet the Trans-Continental Railway has affected them but little, although it must tend eventually to equalise the value of labour throughout the Northern States, if not the entire Union. In 1868, the Legislature passed an Act making eight hours a legal day's work, and thus caused a conflict between capital and labour, which was maintained with much firmness on both sides. It would appear to have been a suicidal act on the part of the working classes to raise the issue just as the railroad was on the point of completion, and when a reduction in the rate of wages was looked for as an immediate consequence. The conflict caused some suffering amongst the working classes, and occasioned the suspension of numerous projected enterprises. After many months, the majority of the members of the different trades unions became convinced that the point could not be carried, and, rather than remain longer unemployed, gave up their connection with their several leagues, which resulted in a gradual revival of activity, and the employment of nearly all at the previous current wages, working therefore ten hours. Three or four of the largest leagues have been able to maintain their position—the bricklayers, plasterers, and stone-masons still continuing to find work at full wages for the day of eight hours. The stevedores, ship-carpenters, caulkers, and riggers' unions soon effected a compromise upon nine hours. In some branches of industry there has been a slight falling off in the rates of wages; but amongst the trades comprising the greater portion of the mechanics there has been no appreciable decline.

It has been feared that the labour-market would be seriously affected by competition from the Chinese, but, although there are about 12,000 in the city, and 40,000 in the State, they have been absorbed in the various industries without producing any sensible effect on the value of white labour. It is estimated that 30,000 are employed in ordinary labouring work, and the remaining 10,000 as domestic servants and in divers trades. When the Chinese first appeared on the coast, some fifteen years ago, they confined themselves chiefly to the mining districts, taking possession of "placer" claims, abandoned as worked out by the American or European miner. Later on, they were to be met in great numbers as domestic servants and laundrymen. The first skilled labour they were employed at was in working the looms of the woollen mills, to which handicraft they were found to adapt themselves with great facility. The early completion of the Trans-Continental Railroad was due to the thousands of Chinamen employed; they proved to be admirably suited to the work, displaying not only great intelligence and industry, but capacity to endure the extremes of heat and cold necessarily encountered in the Sierra Nevada and Rocky mountains. The wages of a Chinaman in domestic service ranges from £2 per month for an active boy, to £5 for an experienced servant; the wages for those employed either in skilled or unskilled labour is usually 4s. per day. Notwithstanding mail steamers make monthly voyages between this port and China, the immigration of Chinese is not greatly in excess of the departures and deaths.

The Labour Exchange, established in April, 1868, has proved a great boon to the newly arrived immigrant and the employers of labour throughout this State and the neighbouring State of Nevada. Several of the Unions prohibited the apprenticeship of boys, but in all the iron-working and printing establishments, and in fact in most of the leading trades, apprentices are now taken for four or five years. In the different factories and industrial works of the City of San Francisco, there are employed 8,000 hands, distributed among the different establishments. According to a list given by Mr. Booker, we select a few of the principal. The number employed were as follows:—Cigar manufactories, 1597 hands; iron foundries and boiler shops, 953; woollen-mills, 750; saw-mills and ash-door manufacturies 523; boot and shoe manufactories, 660; breweries, 218; pickle and fruit preserving works, 214; sugar refineries, 225; tanneries, 125. The wages paid in the leading mechanical and industrial works were also:—Iron-moulders, 12s. per day; painters, 14s. to 16s.; labourers, 8s.; glass-blowers work by piece, and make from £20 to £35 per month; sugar boilers, good, £30; second class, £15 to £18; sugar-house men, £8 to £10. At gas-works, the foremen get 12s. a-day; purifiers, 10s. to 12s. At water works, the chief engineer gets £50 per month; steam engineers, £20 to £30; firemen, £16; foremen, £25. In the printing and publishing trade, bookbinders work by piece, and make £4 14s. 6d. per week; finishers ditto, £6; compositors (male), £4 to £5; female, £2 to £3. In the tanneries, yard hands, £7 per month and found; beam hands, £8; carriers, £9. In miscellaneous trades, the following wages are paid:—Bricklayers, 20s. per day; plasterers, 16s.; stonemasons, 18s. to 20s.; painters, 16s.; carpenters, 16s.; stevedores, 20s.; maltsters, 18s. to 20s.; cigar makers, white men make from 56s. to 72s. per week, and Chinamen 30s. to 48s. The demand for domestic servants continues to exceed the supply, and it is very difficult to get females to go into the country; hence the employment of a great number of Chinese men and boys, the latter being frequently employed as nurses to children. The wages of nursemaids are ordinarily £3 to £4; of housemaids, £4 to £5; and of family cooks, £5 to £8 per month.

Very few native-born Americans are to be found employed in unskilled labour in the cities, and a large proportion of the mechanics throughout the States are foreigners; it is in some measure to be attributed to the disposition of Americans in the Eastern States to seek their fortunes in the west, where farming offers attractions more alluring than the continuous daily work of an artisan. Western men of the labouring class invariably prefer to work on farms to any other employment, and the high rate of wages soon enables them to start a farm of their own. The number of farm labourers required in proportion to the land is less than in any other State of the Union—it probably does not exceed one hand to the hundred acres. The climate, Mr. Booker observes, cannot well be surpassed in point of salubrity; the heat in the plains in the interior of the State is excessive in summer, but the atmosphere is so dry that labour can be performed without the system being exhausted to an extent beyond what the invariably cool nights can thoroughly restore. On the coast, the sea breezes in summer keeps the temperature cool, so much so as to render it unsafe to wear anything but woollen clothing. In Sacramento, very light woollen or linen clothing is required in summer, and woollen, of ordinary thickness, in winter. To preserve health, only very ordinary precautions are required to be taken—fewer than in England. The country is not subject to epidemics. The sea breeze in San Francisco, and on the coast, renders prevalent, during the summer, colds and influenza, but not to any serious extent. Some of the inferior valleys are subject to malarious fevers, but they are not of a malignant type. An immigrant arriving experiences no difficulty in finding accommodation of a healthy character. In San Francisco the markets afford an abundance of meat, various kinds of vegetables, including all that are to be met with in England, and a vast assortment of fruit.

The working classes usually live very much better than they would do in England, denying themselves scarcely anything in the shape of meats, vegetables, and fruits. The cost of providing the necessaries of life is not a great deal more, but clothing, and imported articles generally, are dearer than in New York, and from 50 to 100 per cent. over what they can be procured for in England. A considerable number of the labourers in San Francisco, and in the larger towns of the State, own the houses they live in; the formation of homestead associations have assisted them in this, as those societies purchase large tracts of land, sell them in plots of 25 by 100 feet, receiving payments in monthly instalments, extending over two or more years. Mechanics, if married, usually occupy neat frame cottages, the rent varying from £3 to £4 per month, including water and taxes; ordinary labourers occupy smaller houses less neatly furnished, which are rented at from £2 5s. to £2 15s. a month. The tenement house system has scarcely yet been adopted, but two or three large buildings, in every way fitted for the purpose, are now in course of erection. Single men almost invariably live in boarding-houses, at a cost of, for board and lodging, from £4 10s. to £6 per month. In those houses everything in season the market affords is provided.

With regard to the quality of work, there are a great many first-class workmen in the State, and particularly in San Francisco, and among them are many who do their work very faithfully; but, to take the artisans as a body, they do not show a spirit of emulation in regard to the character of their work. Some become demoralised by an accumulation of money; others find that the employers do not properly appreciate their endeavours to give character to their labour, giving a preference to quantity over quality; and again, others, with every disposition to take pride in their work, find themselves surrounded by such lukewarmness in regard to it on the part of their fellow-labourers, that they, almost imperceptibly to themselves, lose their earnestness. Some of the foundries and manufactories turn out work which would not well be excelled in any part of the world. And Mr. Booker remarks that it would be unjust, both to the employers and the *employés*, to say that they do not look equally with pride upon the product of their labour, but he fears these may be classed as an exception to the general rule.

Acting-Consul Briggs, in his report on the industrial classes in the State of Louisiana, describes the district as essentially agricultural, New Orleans being only the place of temporary deposit of the varied products of the Mississippi Valley; and the demand for artisans not being so constant as it is in the settled manufacturing centres, it is therefore variable, and workmen can sometimes find no employment; still, at certain seasons there is a great demand for particular descriptions of workmen, during the summer and fall seasons especially, for all those who are concerned in the various branches of house building, at which period of the year every kind of edifice is put up. The agricultural occupation is, doubtless, the most profitable. The negro labourer, who constitutes the chief farming element in the country, finds it only necessary to work five days in the week to receive all he wants, the remainder of the time being given up to idleness and amusement. The industrial white class, in the cotton or sugar districts, in a healthy locality, can live in great ease and comfort, with an amount of exertion which will in no wise prove injurious to health; and there are thousands of the white denizens of these parts who can wear out any negro by competition in work, through the possession of better staying qualities. The impression also prevails that it is quite possible to populate this southern country with English emigrants, at least the healthy portion of it.

Food of the best quality in great abundance is obtainable, owing to the peculiar situation of New Orleans, close to the sea-board of the Gulf of Mexico, and nearly at the mouth of the most important navigable river of the world, in close propinquity to the West Indies, and in constant communication with Central and South America, from which places, in a short and expeditious manner, the various products daily arrive by sail and steam-vessels, while the whole continent of North America is tributary to it by river and rail. As regards labour, exertion, and exposure, and the effects resulting from them, the stranger can, during the cool season, say for eight or nine months in the year, exert himself out of doors at any hour of the day with impunity; but in summer he cannot stand the powerful influence of the sun between the hours of twelve o'clock at noon and four o'clock in the afternoon without suffering. All in-door work, however, is practicable, and free perspiration, unchecked by sudden cold winds, conduces to the maintenance of health. Out-of-door work, early in the morning and late in the afternoon, can be successfully accomplished. Regular habits are essential; and, with industry, perseverance, frugality, and temperance, it is quite possible for any ordinary individual to acquire, by economy, a capital, after ten or fifteen years of work, without any adventitious circumstances to bring it about. Cases could be cited of men who could neither read nor write ten or fifteen years ago, who now possess a capital of 8,000 dollars, or £1,500, acquired simply in this manner, in one of the ordinary occupations of mankind, as a gardener, for instance, and that without any more than the usual share of intelligence, with no extra gifts in his speciality.

Lodgings can always be procured in good, well-ventilated buildings; the dwellings of artisans and labouring people are generally separate tenements, sometimes in rows, with yard-room in the rear, well-supplied with water in wooden cisterns, and all conveniences of civilised life. The system of lodging is entirely unknown, from the fact of there being plenty of space to build single dwelling-houses on, and land cheap and abundant, not only in New Orleans, but in all the towns and country within a range of 800 or 900 miles of it. There can be no overcrowding of people, from the fact that the city, with a population of 250,000 inhabitants, extends over an area of 360 square miles, having a front of fully 12 miles on the Mississippi river, with a depth of three miles therefrom towards the lake, in the rear of it, and furnishes space enough for innumerable single dwellings, with vacant ground attached for gardening purposes, and, of course, with ample room for thrice the amount of population, with habits and modes of living such as now prevail. A good artisan or mechanic need not be long in the country before becoming possessed of a house and grounds of his own. Building companies will enter into a contract to provide a person with a house built of wood, containing two, three, or four rooms, in a lot of ground of moderate dimensions, for a sum not exceeding 600 or 700 dollars; the house costing 500 dollars, and the land 200 dollars, in British money, say, £100 to £175, the cost of same to be paid in instalments equal to a monthly rent, until full reimbursement has been achieved by the party furnishing the property, and these buildings will be situated so as to be within range of the centre of work, and easily accessible by horse-car or railroad communication. Steamboat and railroad travelling is cheap in the locality, and offer inducements to emigrants, who do not find the place equal to their expectations and become dissatisfied, to travel in any direction they may fancy—to Texas, Mississippi, Arkansas, and Tennessee, lands of great promise and resource, into the Western States, at a cost quite inexpensive, viz., 5 dollars or £1 sterling, by steamboat to St. Louis, Missouri, a distance of 1,200 miles.

The quality of work performed by artisans, Mr. Briggs remarks as being good, but perhaps not generally of the first-class, the majority not being operatives of first-rate skill. Artisans of a higher order of capability would always secure remunerative employment; manufactories too are on the increase, and much desire and ambition are shown by the community to foster and promote it. On the other hand, undoubtedly, there is to be found a large class of ordinary workmen, who think only of remuneration for their labour. These men play their part in the cheap work required, and some on an extensive scale, in a country where everything is in a state of quick transition, and nothing lasts long to reproach or commend the author or orignator. There is nothing permanent or lasting; everybody and everything changes, and passes away rapidly, and the acts and results go with the actors, and the nature of the institutions of the country favour the movement. To sum up the results of various observations made on the industrial class in his district, Mr. Briggs concludes that their state is not an unfavourable or unpromising one. There are several well sustained saving-banks, which show an increase gradual and regular in the financial economy of all classes. Free-schools abound for all grades of society, and of several religious denominations, which are universally attended, all instrumental in elevating and improving the masses of the population, and emulation is created to improve the position and standing of every one by this means. The proportion which the industrial classes bear to the other or the commercial class —for there are none which live in ease and independence —cannot be very accurately determined. In the other towns, independent of the agricultural labourers, it might be equally divided,—set down as one-half of each. But the agricultural is a very preponderating body of workers, every one has to work for support. The effects of the late civil war are still apparent in this—so much material wealth was destroyed and swept away by it, that it is not uncommon to see persons of seventy and eighty years of age still engaged in business, and attending methodically and regularly to it. The capabilities of the country, especially the agricultural portions of it, are so great that a very flourishing state of affairs, it is hoped, must soon become a reality.

At the present moment particularly we are informed by Mr. Briggs, there is a very general inquiry from the rural districts—both cotton and sugar plantations—for waggon makers, blacksmiths, common engineers, ostlers, or men who can take care of and understand the management of cattle, horses, and the details of a farm, or those who can set on foot a market-garden in the vicinity of some of the inland towns. White labour is much preferred to black people, and would always command a choice of employment. The opportunities in the agricultural districts for the above mentioned class of labourers and artisans is undoubtedly very great, and the prospect of success in the country is greater than in the city. The labourers are generally on good terms with their employers, and strikes are rarely heard of, or trouble of any kind.

The tide of emigration from Europe has hitherto flowed uninterruptedly in the direction of the Western States of the Union, which open a new field of almost boundless extent, and offer greater inducements to the enterprising labourer, farmer, and mechanic than the Eastern and Northern States, where the labour market is already in a great measure stocked. The normal tendency of mankind has always been westward, within an isothermal belt of equal temperature encircling the earth in the North Temperate Zone. Owing to these and other causes, Mr. Consul Kortright observes, the emigration to other portions of the Union has been more gradual and sparse, and there are, doubtless, other States—east, north, and south—which still offer highly advantageous conditions to the labourer, farmer, and mechanic. Not the least important among these may be classed the State of Pennsylvania, ranking as it does, second in the Union for population, wealth, and industrial and mineral resources. It embraces an area of 4,600 square miles, watered by numerous large rivers, and enjoying a healthy climate, pure and dry, though variable, the thermometer in the summer reaching at times upwards of 100 degrees Fahrenheit in the shade, and in winter sometimes descending as low as some degrees below zero. The mean temperature throughout the year is 49°.

The State is replete with mineral wealth, especially coal, iron, and petroleum, and produces all the cereals and other agricultural crops found in the temperate zone. For farming purposes, under proper conditions, it is especially favourable, but it would not be advisable for persons of advanced age, or burdened with large families, to settle in that capacity. The work is continuous and hard, and better adapted to the young and vigorous. The improved lands are rapidly and constantly increasing in area and in value. The rye, wheat, and grass crops are larger than those of any other state, and it ranks third in the value of live-stock, and in the production of wool and potatoes. The agricultural status of Pennsylvania, according to the last census in 1860, is reported as follows:—Number of farmers, 180,613; improved lands in farms, 10,463,296 acres; unimproved lands, 6,548,844; waste, 12,427,860; number of farms, 156,357; average number of acres to each farm 109. The value of this improved and unimproved land is over £500,000,000 sterling, or about £20 per acre for improved, and from £2 to £5 per acre for unimproved land. Small improved farms, including house, barns, and other out-buildings, with good fencing, &c., range in price from £8 to £130 per acre, according to locality, improvements, soil, &c. The lands in the mountainous districts, without fencing and buildings, bring 8s. to £2 per acre. The farms are composed of from one to fifty acres when near cities and towns, and from 50 to 200 elsewhere, the land on each farm being usually all connected, and in most instances easily accessible by railroad to a market. The system of occupation is by small proprietors and tenants under proprietors, the tenants averaging only about one-sixth of the number of proprietors. The tenants under proprietors pay a rent equal to about 6 per cent. interest of the value of the farms, or running from £1 to £200 per acre per annum. The labour in farms is performed, to a very large extent, by Germans, English, and Irish, though the latter, as a rule, prefer to congregate in towns, as draymen, porters, stevedores, and house-servants. There are 50,000 miners in the State, principally English, Irish, and Welsh, the Welsh working in the slate quarries, the coal and iron being chiefly worked by English and Irish. There are portions of the State inhabited almost entirely by Germans and Dutch, who still preserve a remnant of their original language, called "Pennsylvania Dutch." They adhere to the habits of their ancestors, publish their newspapers in their own language, and, on the whole, enjoy a peaceful and prosperous existence, becoming useful and valuable citizens.

Political influences, in conjunction with other causes, have of late years tended to keep wages up to an unprecedented rate. There was, however, a downward tendency in 1870, as compared with 1869; whether permanently so or not remains to be seen. A decidedly beneficial influence has been exercised in this direction by the action of the trades unions, which, whether self-impelled or following the action of similar societies in Great Britain, have either entirely dissolved their union or greatly relaxed the stringency of their conditions, as existing in 1867 and 1868. The strikes, so fatal to industry and entailing so much misery on the working classes, have in a great measure ceased. As compared with 1867, the reduction in all employments would be 15 per cent., while special classes are reduced 25 per cent. The relation of the wages paid to the cost of living remains, however, nearly the same as compared with 1869, and shows an improvement over 1867; that is to say, the general cheapness of food and supplies is greater than the reduction of wages. Most articles of food were fully 20 per cent. cheaper in 1870 than in 1867, many 25 to 30 per cent. cheaper, and dry goods, clothing, and miscellaneous articles 25 to 30 per cent. cheaper. The highest wages are paid in the mechanical and building trades, so far as relates to physical labour, bricklayers, stonemasons, plumbers, painters, plasterers, paper-hangers, roofers, stair-builders, &c. Many of these received 14s. 11d. per day, or £4 10s. 6d. per week. This is more than the average paid in machinist establishments, iron-works, and metal working generally. Carpenters are an exception in Philadelphia, as the general use of machinery in making the wood-work of houses has reduced the grade of skill, and consequently the wages to 11s. per day as the standard, but many are employed at a less rate. The hours of labour in the cotton and woollen manufacture, and, indeed, generally throughout the State, are ten hours a day. Extra work beyond that period receives extra compensation. An attempt was made to reduce the number of hours to eight, but it has been attended with no success. An Act of Congress was passed, legalising eight hours as a day's work, and the President issued a proclamation rendering it compulsory in the government dockyards and other workshops, but it met with no responsive echo among the general public, and the rule remains, that if a labourer desires to work only eight hours he must work by the hour.

With regard to the houses, or lodgings of the industrial classes, we learn from Mr. Kortright's report that nearly £4,000,000 are invested in houses for sale and to rent in the city of Philadelphia, which yield an average interest of 12 per cent. per annum. These houses are occupied by the working classes, and are peculiar in many respects, the site of the city greatly favouring cheap expansion, and the erection of buildings of moderate size in accessible streets. In the other parts of the State the houses or lodgings of the working people are similar to those in the country districts and interior towns of the United States generally. In Philadelphia these buildings are of brick, and are distinct houses in regular "blocks." The greater number are built 14 feet wide, and two stories high, in lots averaging 50 feet in depth, the house containing four complete rooms, with usually a bath-room in addition, projecting back from the second floor, and a covered porch beneath. As both these can be used in case of need, the one for a sleeping-room, and the other for an outer room or summer kitchen, the house may easily be converted by its occupant into a six-roomed house. The height of the cellar is eight feet, two feet of which is above the level of the pavement; the ground-floor, a first story, as it is called, is nine feet, and the second seven feet from floor to ceiling. The rooms are fifteen feet each in depth, and the entrance-hall is three feet wide, the staircase rising at the rear to the second-floor. The cost of houses of this class is £300 to £400 each for a title in fee, and they can be purchased by making a small cash payment, say, one-fourth to one-eighth of the whole cost, with mortgage and other security for so much more as shall make up one-half the value, the other half being left at a permanent rent of 6 per cent. per annum, called a "ground-rent." This ground rent may vary in amount, as it represents the cost of the whole property. The interest is always at the legal rate, 6 per cent. Thus a mechanic, with £50 or £100 cash, can always purchase a roomy, well-ventilated, and very comfortable house, arranging for the payment of the balance of the consideration money in easy instalments, and obtain the title in fee, subjected to the ground-rent above referred to. The house may be rented at £2 10s. for the cheapest, £2 16s. for others, and from £3 to £3 10s. for the very best. Great numbers of this description of two-story dwellings have been erected in Philadelphia within the past fifteen years. All are neatly built, pleasant, and attractive, many having dressings and door-steps of white marble. They constitute a striking and interesting feature of the newer districts of the city.

Another class of two-story brick houses is largely built for the residence of the same class, differing only in making six full rooms, three in each floor, and in giving a better finish to the whole, adding heating furnaces gas-fixtures, &c. These are valued at from £400 to £700 each, according to location, and may be purchased in the same way, half cash and half in ground-rent. They rent at £4 per month on the average. All have bath-rooms, and are supplied with gas-fixtures. The more costly are 16 feet front, and 40 to 44 feet deep, the lots being 55 to 70 feet deep. All these two-story houses front in regular streets, the length of the square being 400 to 500 feet, the streets 30 to 50 feet wide, and at the rear all open into alleys from 4 to 6 feet in width. Three-story brick houses are also largely occupied by mechanics and working men in Philadelphia. These dwellings are similar to the best class of two-story houses, with an additional story and larger lots. They can be purchased in the same manner as the smaller houses, and rent from £4 to £7 per month, according to the amount of interior conveniences. Very few of these houses contain more than one family, but often young men, or other boarders, add one or two to the family. It may be stated generally, that one-half the industrial classes in Philadelphia occupy separate houses, the other half being in houses of an older style, and with more than one family, or with rooms occupied by lodgers. Of those living in separate houses, built within the last fifteen years, about one-half are owners of their houses, the others paying rent. The builders state that two-thirds of the houses of this class erected by them are sold to their occupants, a portion being sold to investors, who purchase them as an investment, and a few being held for rent by the original builders.

Besides this account of the dwellings, Mr. Kortright sums up the question of the relative purchase-power of money in the State of Philadelphia and in Great Britain. This, he observes, is a most difficult problem to solve with anything like accuracy; and it is to be borne in mind that the respectable mechanic in the former can obtain, as a rule, continuous employment, an advantage he has over his less fortunate British comrade. His normal state is better. He is better housed, better fed, and equally well clothed, but still at a far greater expense. Owing to the admirable system of public schools, he has every facility for educating his children at the public expense, though it is much to be feared that a large number of this class who ought to profit by the free education neglect to do so, and the result is, that in the State there are 75,000—in Philadelphia alone 25,000—children who do not frequent the public schools, and who lead a life of reckless Bohemianism. Nothing but a compulsory system of education will eradicate this evil, and relieve the prisons and penitentiaries from their fast increasing burthen of criminal inmates. Without dwelling too much on the marked tendency throughout the commonwealth, and, indeed, throughout the States generally, to a luxurious style of living pervading all classes, from the railway potentate, or the successful merchant or tradesman, to the humblest mechanic, all ardently pursuing the almighty dollar, no little importance is to be attached to the nature of the climate—more varied perhaps than any in the world—in regulating the diet of the Pennsylvania labourer. He could not, or would not, subsist on the food the British labourer would be content with. No respectable mechanic or labourer is satisfied without meat once a-day, few are content without it twice a-day, and many even three times a-day enjoy meat in some form at their meals. The British labourer's compulsory abstinence from meat on several days in the week is, perhaps, amply compensated by his beer, on which he probably thrives better than the Pennsylvania labourer on his excessive meat diet. If the latter indulge in any beverage stronger than tea or coffee, he flies to that fatal compound of noxious ingredients called "whisky," the fruitful fountain of crime, misery, and poverty, and which tends more than anything to fill the prisons of the Commonwealth.

ANNUAL INTERNATIONAL EXHIBITIONS.

REPORTS ON THE WOOLLEN AND WORSTED MACHINERY.

The report on the machinery used in the woollen and worsted manufacture is by George Leach, Esq., and the evident competency of the reporter, and the tone of the report, will be sure to command attention. Mr. Leach's report is anything but common-place; his opinions may not meet with universal concurrence, but his facts and arguments cannot fail to attract attention, and possibly may call forth opposition. There will be no harm in this; the opinions of a well-informed man are always acceptable; and, as he states his reasons clearly and fearlessly, they can easily be controverted if not well founded.

The preamble of Mr. Leach's report is so characteristic that we feel compelled to give it in its entirety:—

"Woollen and worsted machinery are classed together in the Official Catalogue without distinction. The general visitor should, however, understand that the woollen and worsted trades are very dissimilar, and that the manufacture differs in almost every process.

"The workpeople engaged in each require a separate experience altogether, whilst the machinery employed is as opposite in principle as woollen machinery is to that of cotton or silk.

"As a rule the 'woollen manufacturer'—and especially the maker of 'broadcloths,' or felted goods—uses a fine-haired, short-stapled wool, and endeavours to produce from it a yarn, in which the fibres are transversely disposed to the axis, or length of the thread. The points or ends thus projecting from the exterior or circumference must be as numerous as possible. The limit of the quantity of fibres in a given length of thread desired is determined only by the tensile strength necessary for weaving and holding the fabric together, and imparting to the same the required firmness. This feature in 'woollen' yarn is termed 'pile' and subserves two purposes. The first, that the felting process may knit together, or interlock this multiplicity of fibres into a compact mass of matted fabric; and the second, that from this same felted substance additional points may be subsequently raised to the surface in the finishing process, so that it resembles as much as possible a fine, short fur.

"The worsted spinner's aim, on the contrary, is to elongate or stretch the fibres, and lay them parallel to each other, and thus produce a yarn which shall be even and strong, and yet be composed of few hairs or filaments.

"The character of worsted goods is estimated not only by the peculiar staple, or the properties which the various growths of wool or hair possess, but also by the fineness or length to which yarn can be spun, and the corresponding increased number of picks or shoots which may form a square inch of the fabric. In worsted stuffs the number of the warp and weft threads per square inch may be counted by the aid of the usual magnifying eye-glass. In felted dress woollens, such as broadcloth, this is not possible, inasmuch as the threads are hidden from view by the felting process before referred to.

"It will, therefore, be remarked, whilst examining the machinery employed by each trade, that although the raw material brought into requisition by these two important industries (the woollen and worsted trades) is derived from the same source, chiefly that of the sheep, the nature of the manufacture is so opposite, that it becomes necessary to review the machinery in the Exhibition under two distinct heads; but before doing so, we must again insist that the injury arising from classifying the two manufactures together is greater even than at first sight appears; and if only one good result springs from this, the first of a series of Annual International Exhibitions, and that result be the awakening of the attention of the Board of Trade to the necessity of keeping the returns of the imports and exports of these two important branches totally distinct, Her Majesty's Commissioners will have reason to congratulate themselves on having brought about, at all events, one practical boon to the interests concerned.

"From the want of this most necessary division, the respective quantities of yarns imported into this country have been left to mere conjecture, and the spinners of certain classes of woollen yarns have been thus kept in the dark as to an important foreign competition which has been growing up against them.

"Although the causes of this competition are mostly, if not entirely, of a mechanical nature (which will be explained in reviewing the exhibits of machinery from the Continent), the conclusion is warranted that, had correct returns been published of the quantities of these woollen yarns which from year to year were being imported into our Scotch markets, our spinners would, at an earlier date, have been put on the alert.

"They would then, with such fatal statistics confronting them, have been more willing to trace, with a less self-satisfied and unprejudiced disposition, the real truth of these causes to their actual origin, than to have flattered themselves that they were due to political or other accidental occurrences, over which they, individually, had no control.

"Like all other changes which have a permanent effect, or result in a real success, the development of this importation of foreign-spun carded woollen yarn has been of gradual growth. At this time, however, it has gained firm hold of one of our most important markets, and in certain specialities defies the rivalry of our home producers.

"As an illustration of the misfortune which our fine woollen yarn spinners have suffered in consequence of the absence of warning, which correct and separate returns of the importations of woollen and worsted yarns would have afforded, reference need only be made to the "Statistical Notes" on the industries and commerce of the United Kingdom, published in connection with the catalogue, issued by Her Majesty's Commissioners, of the British section of the 1867 Paris Exhibition.

"Doubtless the amounts published were derived from the best sources at the command of the compilers, and were stated as follows:—

Imports of "both Kinds of Yarn," between 1861 *and* 1865.

1861	1,577,000 lbs.
1862	2,244,000 „
1863	4,526,000 „
1864	4,654,000 „
1865	4,392,000 „

"Here a large increase in the five years is shown; but, by way of proof that these accounts must have been given under reserve, the commissioners qualify them by stating beforehand that, 'the English trade accounts do not distinguish the imports of woollen from those of worsted yarns, but that the increase is probably more owing to the demand in the worsted than in the woollen branch of trade.' Now this opinion is much to be questioned, for the lesson to be derived from these figures is based upon mere conjecture only, and, as will be presently shown by a comparison with other authorities, is one highly calculated to mislead. The choice of machinery would, doubtless, be very much influenced by the necessities of the demand of a certain product; but since the renewal of machinery (although the same may be upon an improved principle) is an expensive alternative, a repetition of positive proofs is required before the millowner will venture upon a change so serious and costly. He must be satisfied about the existence of an opposition before he will attempt to discover its cause.

"The word probably, used in reference to the accounts before stated, was not, unfortunately, employed without occasion or necessity. It will be well, therefore, to weigh the contrary opinion before proceeding to review the machinery which is to be found in the Exhibition, for this intimately concerns the subject under consideration.

"By adopting this course, both the trades directly interested in this question, as well as the general public, will be able to appreciate the benefits conferred by Her Majesty's Commissioners in bringing into existence the nucleus of the first really national and technical industrial school introduced into Britain for "carding wool," and thus affording a rare opportunity for instruction in certain branches of the woollen trade.

"Of exhibitions there have been many repetitions, but the new complexion of things must not be confounded with the old; for although the stereotyped word 'exhibition' has become associated with the idea of a huge, heterogeneous, odds-and-ends 'bazaar,' it must not be supposed that, at the present day, our leading minds, our social and political economists, our scientific philosophers, or our philanthropists are blind to the necessities of our case as a nation, and are not able to profit by past experience.

"Differing from the opinion hazarded in 1867, it has been stated by very good authority, that £2,000,000 worth of Belgian-spun woollen yarns have been imported into the Glasgow and other Scotch markets alone in one year!

"Assuming this value to be correct (and of which there is little doubt), the aggregate weight of the material supplied may be approximately arrived at by taking the average value of each pound of yarn to be two shillings. The sum total of yarn imported will therefore amount to 20,000,000 lbs.

"An estimate of the machinery employed in producing this large importation will be striking and suggestive, even if it should not awaken the enterprise of our capitalists, and induce them to combat the difficulty.

"Now, allowing that one set of carding engines (consisting of three separate cylinder machines, similar to those exhibited by Messrs. Platt, of Oldham, or M. Celestin Martin, of Verviers) will card and condense 11½ lbs. per hour, or 690 lbs. per week of sixty hours, it will be discovered that, making allowance for holidays, at least 560 sets or assortments of these machines will be engaged turning out the amount of 20,000,000 lbs. weight, or £2,000,000 worth per annum. Then, estimating ten sets of these machines for each mill, which would not be a small or despicable concern even in Yorkshire, and 5,000 self-acting mule spindles, fifty-six mills and 280,000 spindles are thus employed abroad in supplying one of our own markets!

"It is evident from this that the opinion ventured in connection with the statistical notes before referred to—namely, that 'the increase up to 1865 was probably more owing to the demand in the worsted than in the woollen branch of trade'—was erroneous. No more convincing proof, therefore, can be adduced of the mischief which may be wrought upon two important industries by the mixing and jumbling together of customs' returns, than the instance quoted.

"Although, as here maintained, this mischief has been aggravated by false statistics, or by ignorance of the extent of the trade which was springing up, the actual cause is, as has before been stated, unmistakeably due to inefficient machinery and uninstructed, undisciplined labour.

"In proceeding to examine the machinery to be found in the Exhibition, which will prove this assertion, the principle here advocated of considering the two trades perfectly distinct in all cases, will be closely followed; woollen machinery and the processes connected with woollen manufacture being taken first."

The reporter declares that in carding machinery suited for pure wool, mixed with waste of any kind, the Exhibition contains the most perfect examples from the Continent hitherto shown; while the English makers exhibit the most beautifully made and finished set of carding engines a mill-owner could desire to possess.

The yarns in which the Belgians and Prussians excel are not those used for milled or felted goods, but for shawls, flannels, and dress goods, principally for female wear. The desideratum is an even, "woolleny" thread, spun as long as possible from the cheapest raw material, and yet very strong. Cheapness is, of course, very important, and the sort of wool required was found in that of the River Plate, known as "Buenos Ayres;" but its defects were so serious that our north country carding machinery, the "cards" generally in use, and the want of skill in the workmen, rendered the production of the desired yarn absolutely impossible, irrespective of cost. The successful treatment fell to the Belgians and Germans, and gave rise to the wool sales at Antwerp, and an almost entire monoply of this growth of wool.

We cannot quote Mr. Leach's excellent description of the preliminary and subsequent operations in the preparation of wool, but must content ourselves with touching upon a few salient points, and directing the attention of our readers to the report itself.

Mr. Leach is not quite satisfied with our wool-washing machinery, and hints pretty broadly that in that, as in carding-machines, we are in arrear of our neighbours. In fact, Mr. Leach draws special attention to the fact that the wool used with Mr. Martin's Belgian burring machine is washed scrupulously clean, is as clear of grease in fact, as cotton.

The technical description of the Belgian burring and other machines are most careful, and not only their advantages, but the causes of them pointed out at length. The same careful attention is given to the cards and carding machinery, one of the most important questions that can possibly occupy the attention of the woollen manufacturer.

Declaring that nothing can surpass, if equal, the examples of English machinery exhibited by Messrs. Platt, Mr. Leach says that our inferiority with respect to the woollen yarns in question lies simply in "want of knowledge of the proper card to be used, and the skill to use it;" and he adds, further on, "it is a fact, proved by the Belgians, that a coarser wool, by being equalised in length by proper treatment, can be spun to a longer length than a finer and softer wool where this condition does not exist."

Mr. Leach alludes to the fact that the superiority of the continental workers in the carding of fine wool, or mixtures of wool and cotton, was noticed in the reports on the Paris Exhibition of 1867; but that the spinners of Great Britain have been content to refer that superiority to the price of labour, a position which Mr. Leach combats energetically, and produces figures in support of his view of the case.

"Under such circumstances," says the reporter, "there should be no vain boasting that a monopoly has been preserved in the heavier class of woollen goods. Time is fleeting, and changes are rapid in these advanced days; and, before competition waxes keen in these national productions, it is wise to endeavour to estimate the losses we do suffer, and have suffered, from interlopers in other instances, and to ascertain their causes, in order to apply the remedy, and arrest the injury we run the risk of sustaining. And what is the remedy? In one word, 'Education?'—Education in natural and physical science.

"An example in this respect has been well set by her Majesty's Commissioners in this Exhibition. Little has been done in bulk, but that little has been done well; they have, in fact, been instrumental in providing the first example of a real technical 'Wool Carding School,' long needed in the north of England and Scotland.

"Mention has frequently been made of late of 'weaving schools' on the Continent. Does it not, therefore, seem strange that, as perfect weaving of woollen goods of every description must depend upon perfect carding, equal or even extra attention should not be first bestowed upon this all-important process?"

Worsted Machinery.

This second portion of the report under hand is more satisfactory, yet less interesting, and rather less exciting. Here we have no foreign competition in the Exhibition, and no inferiority to record in comparison with any nation.

Of Bradford, the great centre, Mr. Leach says:—

"Of all the textile manufactures of England, there is, perhaps, none which has been developed so rapidly and solidly as that of "worsted." And there is, perhaps, no parallel instance where, in the same period of time, any town in the world has created for itself so world-wide an industrial reputation as Bradford. Although, as regards proximity to extensive and rich coal-fields, Bradford occupies a situation favourable to the rise of this great and peculiarly national industry, in every other respect it has fought at a disadvantage.

"The position of the town, situated as it is at the bend of rather an abrupt and steep-sided valley, is not favourable to the easy erection of large-powered factories; whilst the very limited supply of water (of a chemically hard mineral analysis) has contributed little towards the expansion of so enormous and versatile a trade as that which this celebrated town at present possesses.

"There is, therefore, but one cause to which this marked progress can be attributed, and that is the intelligence and enterprise of its manufacturers and mechanicians.

"Many years have not elapsed since the chief merchants who bought their worsted goods from the small country manufacturers in the 'piece-halls' at Bradford were domiciled at Leeds. The pieces were 'carted' over to the latter town, and there 'finished' and merchanted.

"Presently, however, the demand exceeded the supply; the manufacturers were masters of the situation; foreign merchants interposed, especially the Germans, and lethargic 'Leeds,' with its select coterie of ancient buyers, was ousted in its monopoly, and its merchants had to migrate to the seat of production.

"The astute talent of buying and selling, with its conservative spirit, had to succumb to the higher intelligence displayed by the manufacturers and machinists—the real producers and brain-workers. To the genius and the ability of these, the wonderful machines displayed in the Exhibition bear testimony.

"Differing from its neighbour, the 'woollen trade' and its machinery, English 'worsted machinery' and its manipulation enjoy a prestige unapproachable by any other in the world. It is true that the processes connected with the manufacture of worsted goods are more reduced to mechanical precision. They depend less upon the individual skill of the workman, and are less varied and intricate than those referred to in the other part of this report. From these causes it may be inferred that, as a whole, this manafacture is more suited to the peculiarities of our English workpeople and their education. There is, besides, less change and liability to those accidental hindrances which tax the patience of the woollen manufacturer. As was also mentioned at the introduction of this report, the very fact of the spinning always remaining visible in the fabric or yarn renders a fault more easily and certainly detected and remedied."

The action and advantages of the various worsted-working machines are described as no one could describe them who had not for a long time been thoroughly conversant with the subject, and the many technicalities are explained in the simplest possible manner. The same remarks apply to looms. Two special novelties are noticed in connection with the looms in the Exhibition, which will interest all who have any taste for scientific applications, namely, the adoption of magnetic and pneumatic power as aids to the machinery. Of the former, Mr. Leach says:—

"To unite in one machine all the mechanical arrangements necessary for these purposes is a triumph of ingenuity. In this department, however, we have evidence of a startling advance in scientific knowledge, and the utilisation of one of nature's most profound and unsolved mysteries. Cranks, levers, wheels, catches, hooks, and numerous other mechanical paraphernalia, are entirely dispensed with in one difficult part of the 'wiring' process; the simple attraction of 'magnetism' being substituted. Chemistry, or whatever magnetism may be, aids and simplifies mechanism.

"In what is otherwise an ordinary Brussels carpet loom, Mr. Robert Hall, of Bury, introduces a magnet which attracts the wire and holds it in position for being pushed into the "shed." When the wire is sufficiently inserted, and out of danger of 'stabbing' the sley, the pressure upon the wire itself is sufficient to disengage it from the attraction; then the pick is made, and the weaving proceeds as usual. From the simplicity of the arrangement, there is little doubt but that this clever substitute for a number of small mechanical complications will, before long, become general. In fact, at the present date, Mr. Hall is delivering several of these looms weekly."

And of the second:—

"Mr. Edward L. Paraire shows a 'pneumatic loom' (No. 6,235). Neither the construction of this loom nor its working parts can be praised; but the idea of dispensing with that most 'jerking' movement common in all power looms (that of 'picking' the shuttle), and effecting this by means of one common reservoir of power for a number of looms, is one in the right direction, and deserving of every encouragement. In machinery, frequent instances are found where sound principles and very valuable inventions are condemned as impracticable, simply from faulty construction and the lack of zeal, necessary in all cases to perfect and introduce a new operation. Should Mr. Paraire succeed in so perfecting his air-propelled shuttles as to pick up to 300 or 400 per minute, and avoid all jerk and noise, what an economy this would effect in an establishment like that of Mr. Hodgson, who would be then able to dispense with the 200 or 300 pairs of 'picking-tappets, picking-cords, and picking-sticks,' which he supplies with his weekly delivery of looms; providing in their stead only one simple single air-pump and compressed air accumulator. Who will say that, in 1881, this will not be the system in vogue?"

Of the miscellaneous machines and accessories exhibited in the woollen machine gallery, the only one that Mr. Leach mentions specially is the tailor's pressing machine, patented by Messrs. Summerfield and Sanderson, in which the seams of garments are ironed by passing under an iron cylinder heated by gas. Mr. Leach believes this machine likely to be of great value in large establishments.

Altogether this report deserves great attention; it possesses that thoroughness which alone gives value to such documents. We are not prepared to say that Mr. Leach is always right in his views, but he is always earnest, and his contribution to the literature of the Exhibition cannot fail to arouse attention, and perhaps produce valuable discussion, and lead to new and important efforts amongst our woollen manufacturers.

EDUCATIONAL COLLECTION.

Examination Papers and other Specimens of School Work.

The report on this section is by the Rev. Muirhead Mitchell, H.M. Inspector of Schools. It appears that specimens have been forwarded from more than 100 schools of the elementary class, including National, Church of England, British and Foreign, Roman Catholic, Jews, commercial, training colleges, army, industrial, public, and grammar schools. The reporter says that "the education provided in the different classes of these schools, judging by the results, is pretty uniform. In very few cases does it mount higher than a rather low average level, though many times it sinks far below it; and, on the whole, the results cannot be considered satisfactory. Some of the specimens are so inferior, both in matter and form, that it is difficult to conceive the object of the exhibitors in forwarding them to an exhibition at all. The writing, in most cases, is good; the spelling not always correct, and the selections for dictation are not always appropriate. It will always be a question whether the writing does not require too much time, at any rate for the necessary requirements of a public office. The ornamental writing, even when of artistic merit, which is rare, is hardly a useful accomplishment, when so much has to be learnt in a short school-life." While on this subject, Mr. Mitchell suggests that copybook heads might assuredly contain some useful information, instead of unmeaning and sometimes foolish phrases.

"Most of the dictation is written on lines, but in the upper classes dictation should be worked on plain paper, as is directed by the Committee of Council on Education.

All mere mechanical aids should be dispensed with at the very earliest age possible, and the child be taught to depend entirely upon himself. Very small writing is not to be encouraged. It has an appearance of neatness, but at the expense of much useful labour, and great trial to the eyes. Most of the writing in these specimens is large and well-developed; but there are several written in the pointed and not very legible style. Girls especially are much practised in this form; it is more easily acquired, and has a certain pretence of excellence, but is much to be objected to. The exhibited specimens show that children of ten years of age may be able, if well taught, to write from dictation sufficiently for all the ordinary purposes of labouring life, and may acquire sufficient elementary knowledge to enable them to progress to a higher education if opportunity offers in after years. The results from adult schools show very little success, except in few and isolated instances, and the papers are very limited in number. It may be that most of the scholars shrank from an exhibition of work that had only been performed for their own personal pleasure or usefulness, and not for purpose of display. Here and there are good specimens, mostly rare, and from men of higher education and position. In one school phonetic writing is practised; it looks very neat. I question, however, the usefulness of the introduction, amid school work, of a subject that, at least at present, can be so little required. In another school, a better subject is introduced, and seems well taught—viz., stenography. This may become very useful if the children continue its practice in after-life. I have always heard, however, that the difficulty is not in writing, but in reading the written after an interval of six weeks. In some schools the practice of the elder class includes the writing of letters (private and commercial) in due form. This should be introduced into all schools; also writing from memory and translations. The subjects given for dictation should be made to include really useful and intelligent matter, and not confined simply to rather prosy anecdotes and fables, without point or interest.

"The writing in all the Jews' schools is to be particularised as very good, and all the work seems to be true, neat, clean, and with a purpose. The printing of the Hebrew is very excellent and satisfactory. The papers of these schools leave an impression that they are very intelligently, sensibly, and truly conducted, and with credit to the managers as well as teachers.

"There is a fair amount of engineering drawing, which is well and neatly done. This style suits the feelings of the youths; it has an air of business, and may result in future successes of life. Boys with talents of that class, if intended for engineers, may better devote their whole time to this and kindred pursuits; to do it well requires more time and attention than ordinary periods of school education will allow for its useful cultivation. I regret to add that very many of the drawings appear to me to have been touched up by the teacher—*i.e.*, not entirely finished by the boys themselves. In many cases the amount of work performed could not, I believe, have been executed in the time specified on the paper. The maps appear also to have been frequently copied—*i.e.*, not done from memory. They have also been traced—*i.e.*, not freehand; all of which is much to be condemned, being dishonest and imposing."

Passing to the foreign department, the reporter says:—"The Swedish department is highly to be commended, and if the general education of the country at all equals the specimens exhibited in their little cottage-like building, they may well boast of their rank in this respect among the nations of Europe. Every paper is carefully and very neatly worked. Many of the maps are so well done as not to be distinguishable from copper-plate engraving. Indeed, I am not quite persuaded that they are not so. The general appearance of the whole school is so creditable to the nation, and to the managers who have got it up, that it forms one of the most pleasing objects in the whole Exhibition."

It appears that the total number of schools which applied for admission was about 500, of whom 462 forwarded papers; of these 462, 262 were rejected. The Committee of Selection decided to accept or reject schools as a whole, and not simply selected pupils, so as to show the general work of the school.

Drawing, Design, and other Art Work exhibited as Specimens of School Work.

The report on this section is by Geo. A. Stewart, Esq. In his introductory remarks he says:—

"A problem, perhaps the greatest of the many great questions that have arisen in the present age, regards the means by which the mass of the people may be brought under the influence of education. As a practical sequel to this, in its application to a large and important section of the population, we must consider how the industrial classes may be supplied with the special technical education which may enable them to compete with other countries, to the success and honour of our own. It is a question which concerns ourselves; it is a question in which every right-minded member of the human family should feel the deepest interest, for with the advance of education is intimately united the prosperity and happiness of the civilised world. It is not only the individual who is exalted and benefited by the culture of mental powers, it is the nation also that is raised to a height of material and moral excellence that without education it could never have attained. This has been felt at all times by the greatest kingdoms in history, and the advance from barbarism into the light of civilisation has followed the gradual improvement of their systems of popular education.

"In modern times, a new impulse has been given to manufacture of every kind, by the practical application of the truths of science, the greater rapidity of production attained by machinery, and, above all, by the recognition of taste and skill as the true causes of excellence in national art. Hence, therefore, the employment of every aid that can be gathered from the copious store of the arts and sciences is the only pathway to a real and lasting success. This principle has been essentially acknowledged by Continental nations, and the consequent improvement in their educational systems has given to their manufactures an equally rapid advance. Their scheme of industrial education includes all classes, and is supported by government, corporations, and societies of every kind. Technical schools for workmen, liberally provided with appliances, have been opened in all large towns, in most of which the education is given free. In France, eighty such schools have existed for many years, some with large revenues and staffs of teachers, completely eclipsing our own schools. One in Paris, dated from as early as 1766, is supported by a government grant, by annual subscribers, and by a voluntary tax on trade corporations. In Lyons, a school has existed for more than fifty years, with a government grant of £500 and a local corporation grant of £2,000 per annum. Located in a splendid building, having attached to it a museum, library, and botanic garden, it gives free education to 200 students annually. Of the schools in Bavaria, the principal are at Munich, Nuremburg, and Augsburg. Out of five large schools in Austria, one at Vienna, with a revenue of £11,000 and a staff of fifty-eight professors, educates 1,600 students gratuitously. In Saxony, there are three schools; in Prussia twenty-six schools. The Berlin Trade Institute, established for forty years, has 170 free students, 11 professors, and a government grant of £7,000. In Baden, Belgium, Holland, Switzerland, Denmark and Sweden, similar schools are found in all large towns. It will readily be believed that such abundant facilities of education have had a wonderfully beneficial effect; genius has been raised from obscurity, and the whole people inspired with the idea of the beautiful; science has rapidly progressed, industry has been encouraged, and trade and manufacture proportionately improved.

"In England, the artisans, influenced by a few far-seeing men, were the first to attempt to supply their deficiency, in the establishment of mechanics' institutions —first at Glasgow, in 1825, then Edinburgh, London, Liverpool, Manchester, and Birmingham, and gradually throughout the kingdom. But although these institutions were of wonderful value in diffusing general knowledge amongst workmen, they could not supply more than the foundation of the technical education immediately required. At length, in 1837, the attention of the government was directed to the great need of this instruction, and a grant of £500 was made for the foundation of a school of design in London, and soon afterwards further grants for the establishment of similar schools in the principal manufacturing towns of the kingdom.

"About this time also the practice was commenced of holding exhibitions of arts and manufactures, which, though often limited to the character of bazaars for the promotion of charitable objects, yet were of great educational value in keeping the attention of the people fixed upon progress. Such were the early exhibitions of Manchester, Leeds, Birmingham, and Dublin; the great Free Trade Bazaar, in Covent-garden Theatre, in 1845, and the Exhibition at Birmingham, in 1849, all naturally preparing the way for the Great Exhibition of 1851. In that great world's fair each nation was able to study in detail the progress and prospects of industrial production in others, and award to each the merit to which it was entitled. Three nations shone forth in this noble competition as incomparably superior to the rest. England, in her capital, mechanical power, rich resources, and free trade; France and Germany, in their elegant taste, wonderful skill of workmanship, and energetic desire to excel. Each nation, having measured the strength of its competitors, henceforth prepared to encounter on the same ground; France and Germany in the development of commercial resources and free trade—England in every effort to raise the taste and skill of the people. The first great effort, under the new impulse, was made in the attempt to preserve the beautiful structure in which it originated, as a national palace of instruction, which has fortunately been accomplished in its re-erection at Sydenham. The second effort was made under the auspices of Government, and consisted in the foundation of museums of a special technical character, and a great extension of schools of art and science. Thus was established the great Art Musuem at Kensington, now admitted to be the most instructive collection of the kind in the world; also a museum of geology, of animal and vegetable products, of educational apparatus, of architecture, engraving, and photography. The art schools, nineteen in number, were re-organised, and, in addition to their former object of educating the manufacturer and the artisan, were now to assist in conveying elementary instruction in art into every class of society, and to recommend it in every way as a necessary branch of common education. So general was the feeling of this necessity that, although only partial aid was granted by government under the new system, no less than 57 localities applied for and obtained the establishment of these schools. At the present time, the number of institutions engaged in art instruction is, 107 art schools, 249 secondary schools, and 1,094 primary schools; and the total number of persons under education 157,198.

"It may still be a question whether this educational machinery has completely answered the expectations of the nation; but it cannot be disputed that it has contributed to improvements that are not likely to have been developed by any other means. Besides, it is impossible that so many schools can exist, and so many persons have had instruction, without producing the desire to cultivate art and science in their respective localities, and without carrying into different occupations and trades the means of radical improvement. But it is quite possible to show positive results arising from them. Thus, in the metal works of Birmingham and Sheffield; the ceramic art of the potteries; the fabrics of Manchester, Coventry, and Macclesfield; the lace works of Honiton, Nottingham, and Dublin; and the shawls of Paisley and Norwich; the designs are mostly of local production in the place of foreign, either through the improving influence of association with art upon the manufacturers, or through the direct education of their assistants.

"The art-education of a people is necessarily of a double character, one part embracing all who can be brought under direct instruction, the other affording the best possible means of inspiring and guiding all those beyond school influence. This latter indirect kind of instruction is given in our museums, where the finest specimens of industrial production of every age and nation are placed before the people, so as to lead to an appreciation of the value of art in connection with manufacture, to an observance of the law which should govern all productions, and the development of every improvement. Our direct instruction now extends over the whole country, in national, middle-class, and art schools. It is fostered and encouraged by government payments on results of instruction, as shown by examinations taking place periodically. By this means also we obtain, in a great degree, the observance of a regular system of practice throughout all institutions, and a certain standard of merit in their work. The favourable educational position we have already secured is due to the liberal provisions of government, to the lively interest taken by the whole people in the subject of education, and the support they have given to the most comprehensive schemes. Another great advantage we have enjoyed is that, in establishing our educational machinery, we have had the experience of nations who had so long preceded us as a foundation for the framing of our own system.

"The plan of special training now adopted in all our schools of art consists of a series of progressive exercises leading to a knowledge of ornamental art, and to the acquisition of the power to make a proper use of it. In other words, a double object is kept in view—to educate the eye and hand to see correctly and copy accurately, and to train the mind to a knowledge of the laws which govern perfect colouring, composition, effect, and form. In the most elementary stage, or freehand outline, such examples are used as are pleasing in arrangement, typical of beauty, or illustrative of ornamental construction. In the next class of work, the imitation of an object by means of light and shade, a student learns how far the beauty of it may depend on its interior form thus expressed, as well as upon its exterior expressed by outline. Again, in the imitation of coloured objects, he not only acquires the power of representing them, but he also collects in this study useful rules concerning the harmonious arrangement of colours, and their modifications under the influence of light and shade. So far, these stages of work form a part of the general ordeal which every student is supposed to pass through. From this point the system branches off into special divisions for every variety of artistic or industrial requirement. There are classes of figure, flower, and landscape; of painting, modelling, carving in different materials; also, for the analysis of natural plants and flowers for ornamental purposes, the study of the historic developments of ornamental art, and, finally, the various applications of decorative art to manufacture. The most important of these is the class for the study of natural forms. The student is directed to copy all parts of plants in their different stages of growth, and under every variety of view, since an ornamentist should have as perfect an idea, as certain a knowledge of any plant he selects, as if the plant were before him. But plants or flowers may not possess perfect beauty, or may be merely suggestive of it. His power of delineating them must therefore be combined with a power of selection, given him in another branch of instruction, concerning the properties or qualities which by general consent constitutes the beautiful. A student is next exercised in elementary design, and gradually familiarised with the principles on which all decorative art should be based. These may be shortly explained in a few words. For many years past it has been generally admitted that numerous errors had crept into the modern style of ornamentation, through the indiscriminate use of floral forms. In the great Exhibition of 1851 these defects were very apparent in English art, in contradistinction to the beauty and fitness of the decoration of most of the goods received from Eastern nations. The evident agreement of the principles on which their superiority was based, with those recognised in the venerated styles of antiquity, recalled our chief ornamentists to the necessity of remodelling and establishing the laws of decorative art. After the most careful study and discussion, a series of precepts was arranged and published, and though at first received with some hesitation, they are now generally accepted. Under the old system, all floral forms were considered appropriate for decoration, and the most exact imitation constituted the most perfect ornament. The new laws declared that the prevailing character of surface-decoration should be flatness. The direct imitation of natural objects was found incompatible with that requirement. Moreover, it was decided that ornament should be as perfect in detail as in general effect, so as to convey a pleasing impression, independently of any associations connected with it. In plants and flowers these excellences are seldom found ready formed; they should, therefore, serve merely as a store from which decorative material, perfect in form and fitness, may be derived. Whilst studying in the schools, students are supposed to be bound by these conditions; they are not, however, thereby unfitted for ordinary practice; on the contrary, the greater care and thought habitually demanded by the new system renders them better qualified to fulfil any common requirement. In the practical working of such a system of education many objections have to be encountered; first, as to the nature of the exercises, and, secondly, as to the time occupied in working through them. Students on entering a school are frequently horrified at having to make imitations of geometric or architectural works, and are tempted to assert that as such forms are never used in their several industrial occupations, they can be of no service to them. Once, however, persuaded to surrender their judgment for a time, they gradually discover that the simplicity and regularity of such forms develop their power of imitation much more rapidly than the study of the finest floral or other irregular or complex forms would have done. As to the time absorbed in study, it is the common custom to give three, or even seven, years for training in a trade or occupation. It is somewhat unreasonable, therefore, to assign a much shorter time to a training of a higher character, or to expect more immediate results from an art that requires the constant exercise of the mind in the combination and execution of its designs. Moreover, the objects on which a designer's imitative skill is to be exercised extend over all the works of nature; his educational practice should, therefore, be of the same extended character. Neither is a designer's education limited by the class of manufacture upn which he may be be engaged, for the same power and principles should regulate alike the lowest and the highest; and the nearer a designer for the simple check-patterns of the cheapest fabrics approaches the first epic painter in knowledge and skill, the more beautiful and valuable will his compositions become.

"In an examination of the art branch of the educational collections of this Exhibition, and a comparison of the works of different nations, it must be borne in mind that, owing to the disturbed state of the Continent, scarcely any are fairly represented. Belgium, indeed, sends a collection of a very instructive character, from nearly all its schools, and therefore takes a prominent position. But Germany and France, the great educational centres, are entirely absent, and the works from Sweden, Hungary, Baden, and Denmark, are so few in number, or of such an unimportant character, that they cannot be accepted as illustrative of their present standing.

"In the primary schools of Belgium, as in those of almost every continental nation, the children are taught elementary drawing and geometry as a branch of their common education. In the middle and industrial schools the instruction, where the pupils are resident, sometimes ranges from the merest rudiments to designs of the most elaborate character, made for and purchased by manufacturers. In the highest schools, or those established for fine art, decorative art is also tenderly cultivated, and every facility and encouragement given for its development. In almost all the schools of Belgium there is some appearance of a recognised order or system in their elementary stages of work, beginning with geometry, perspective, mechanical drawing, and freehand; but beyond this point the study seems to depend more on the peculiar taste of the teacher than upon a system, in some schools the study of the figure prevailing, in others flowers or ornament. The work throughout the schools is also of a very varied character—clearness, precision, and care being peculiar to a few, whilst in the majority effectiveness seems to be the chief aim, resulting too commonly in deficiency of truth and finish. The chief characteristic of all of them seems to be largeness of work. Their freehand outlines seems to be from large copies, executed boldly with chalk. Their studies from elementary models and ornamental casts are the size of the originals; their studies of plants, both in drawing and modelling, are from large leaved-examples, such as the arum, dock, Indian corn, and grasses. Many of their studies from life are life-size, and some of their exercises in design are on a gigantic scale. This practice undoubtedly gives great power and freedom of treatment, but, unless corrected by alternations of smaller exercises, is apt to lead to coarseness of style, and to smartness rather than beauty.

"The studies of most of the schools in Hungary in respect to the geometric, perspective, and mechanical drawing are very complete, founded on an excellent system and worked out with the utmost neatness. The best illustration of this section of study is shown by the High Realistic School of Bude, in which the pupils are resident, and range from ten to seventeen years of age. The school is divided into two sections—one for mechanical drawing, the other for freehand study—and each study is again divided into six classes. The first class of the mechanical section, for pupils from ten to twelve years of age, have six hours' instruction per week, and show all kinds of line exercises and patterns, executed by freehand alone, in black and coloured ink, of the most remarkable correctness and beauty. The second class of pupils, eleven to thirteen years of age, with two hours' instruction per week, show studies of geometry and elementary plan-drawing executed with instruments. The third class, twelve to fourteen years of age, show excellent elementary drawings of building construction. The fourth class, thirteen to fifteen years of age, exercises in higher geometry, as conic sections and intersecting figures of all kinds. The fifth class, fourteen to sixteen years of age, show good work in mechanical drawing and the delineation of shadows. The sixth class, sixteen to seventeen years of age, have four hours' instruction per week, and show excellent machine and architectural studies of an advanced character. In the freehand division the classes are similarly arranged, but the pupils receive four hours' instruction per week. The work they show is of a very ordinary character, consisting chiefly of exercises from copies, and though executed with neatness, are not such as would seem to lead to the development of any special talent."

The reporter then proceeds to comment upon the works exhibited by the schools of Belgium, especially at Molenbeck, Antwerp, Bruges, Liège, Louvain, and Brussels. From Copenhagen the works shown are mainly elementary, and the same may be said of the collection from Sweden.

There is a very complete collection, illustrative of the course of study in our English schools of art, very fairly exhibiting the progressive stages of our system, and also the average degree of merit required of a student in passing through them. The English school-work includes not only school of art productions, but also a large contribution from eighty-five primary schools, and eighteen grammar and middle-class schools. The latter are particularly worthy of examination, as showing the extent to which art-training is now diffused through every kind of institution over the whole kingdom.

In conclusion, Mr. Stewart says:—"The importance of securing a good system in elementary schools cannot be overrated, since education in them is now the foundation for almost all others. This, however, it is often difficult to preserve, first, from the want of advanced power in the teacher, and secondly, from the deficiency of good examples. Some scheme to tempt teachers to qualify for a higher standard of efficiency might seem desirable. As to the second point at issue, most of the popular drawing copies, even those issued by eminent publishing firms, are too small in character to be of use, and many, such as shaded drawings of animals, flowers, and landscape, are even pernicious in their effect. In grammar and middle-class schools a more elastic system is allowable, but if copies of any kind are used, they should be such as are of recognised, approved character."

The following rules for the removal of British goods have been issued:—

1. The removal of exhibits will commence on Tuesday, the 3rd October.

2. The doors will be open at 8 a.m., when preparations for removal may commence, but nothing can be removed before 9 a.m., or after 4 p.m.

3. Every exhibitor must apply for his exhibits, either in person or through an agent; but in either case a written order, on a form supplied herewith for the purpose [see annexed sheet], must be given at the door, signed by the exhibitor himself, for the whole of his objects or such portions of them as he may wish to remove at any one time.

4. Aid given by her Majesty's Commissioners will be auxiliary only to arrangements made by exhibitors themselves, and exhibitors or their agents must bring with them force sufficient to ensure security, and safe and speedy removal.

5. The whole responsibility of every kind for loss, theft, breakage, or damage in removal of objects, will rest absolutely with exhibitors.

6. Exhibits must be taken away unpacked.

7. The doors for removal of exhibits of the various classes will be as follows:—

Royal Albert Hall—East Balcony Entrance. Class 3, engraving, &c.; 4, architectural designs, &c.; 6, designs for decorative manufactures; 9, woollen and worsted fabrics; and 10, educational works.

East Goods Entrance—Class 5, tapestries, carpets, &c.; 7, reproductions; and 8, pottery.

West Goods Entrance—Class 2, sculpture; and machinery in Class 9.

South West Entrance—Class 1, painting; and Division III., scientific inventions.

8. The days for removal of exhibits of the various classes will be as follows:—

3rd to 7th October.—Objects borrowed by her Majesty's Commissioners, and miscellaneous fine art.

9th to 14th October.—Classes 1, 8, 9, 10, and machinery.

16th to 21st October.—Classes 1, 3, 4, 5, 6. Division III, and machinery.

23rd to 28th October.—Classes 2 and 7.

9. Aid will be given in the various classes by her Majesty's Commissioners only on the days specially appointed for each class. Exhibitors failing to remove their exhibits within the appointed time must make their own arrangements for the removal of their goods, which will be left at their own risk.

CORRESPONDENCE.

DUTCH TECHNICAL SCHOOLS AND PRISON SYSTEM.

SIR,—The interesting letter on Holland by "Rob Roy," inserted in *The Times* a few days ago, suggests a few observations on a topic which his aquatic sphere of observation probably precluded him from giving attention to—the social institutions of Holland. Having recently visited some of these, I may be permitted a few words on three of them—viz., the technical schools for the poor, the prisons, and Dutch treatment of obstinate paupers and vagrants.

Owing to several causes, there is comparatively little pauperism in Holland, and workmen of all descriptions find general employment, although wages are lower than in many other countries. One of the causes of this general occupation is to be found in the existence of the excellent institutions termed "Ambacht" schools, or technical schools for the children of the poor. Such schools are to be found in Amsterdam, Rotterdam, Groningen, Saardam, &c.

The one in Amsterdam gives instruction to 104 poor boys, who are taught in such a manner as to enable them, on leaving school, to earn wages at once by their practical and intelligent skill in various handicrafts. The hours of attendance are long, being from 8 in the morning till 8 in the evening, with a recess of two hours for dinner and recreation. Fourteen hours per week are devoted by each pupil to reading, writing, and mathematics, geography, chymistry, electricity, and various branches of science; 16 hours per week to manual occupation at carpentry, smiths' works, turning, telegraphy, &c., and 18 hours per week to drawing, designing and sculpture. The full course of study extends over three years. The charge for each pupil is 15 guilders (25s.) per annum, paid partly by the parents and partly by the aid of subscriptions.

During the hours of labour, the school presents a scene of much animation, when one sees in the large smiths' shops a number of boys busy at their anvils and forges, and in other spacious apartments groups of young carpenters sawing, planing, chiselling, while others, again, are actively turning the lathes, or intently engaged on various handicraft occupations. The King of Holland takes much interest in this particular school, and visits it whenever he goes to Amsterdam. One room is stocked with every description of tools and instruments of the best description, presented by his Majesty for the use of his young subjects in the institution. It is a matter of surprise to an English visitor (but there are comparatively few English visitors to Holland) that such useful institutions have not been established to any extent, if at all, in his own country, either by the government, by town corporations, or even by private benevolence or enterprise, for such schools would probably pay well as a matter of business.

There is also in Amsterdam a technical school for middle-class girls, where, for a payment of 20 guilders per annum (£1 13s. 4d.), they are taught the use of sewing machines, &c., and to act as apothecaries or nurses, and are also instructed in drawing, music, and embroidery.

The technical schools, by facilitating industry and self-support, tend to diminish the number of idle and criminal persons. In visiting the chief prisons in Amsterdam, it was interesting to find that out of 1,089 prisoners committed during the year, 758 were able to read and write, thus indicating that, as elsewhere, much more is requisite in education than mere secular and intellectual instruction, which, without handy industry and good morals, may be more mischievous than sheer ignorance.

The Dutch government have decided to introduce into all their prisons, by degrees, the cellular system of total separation from criminal companionship by day and night, not even permitting silent congregate labour, but (and it is very important to observe it), arranging for frequent daily visitation of each prisoner, not only by the officers, teachers, and religious instructors, but also by voluntary visitors known to be prompted by philanthropic motives, and acting as members of systematic organisations formed for the purpose. This particular feature of special encouragement to judicious private visitation, carefully guarded from interference with official management, is one which might with great advantage be increasingly adopted by other countries.

There are no treadwheels, cranks, or shot-drills in the Dutch prisons; for the absolute separation from evil companions is found to be not only a boon to the well-disposed inmates, but a sharp deterrent to the evil, very few being recommitted to the prisons already rendered entirely cellular. One year in these prisons is found to be more punitory, and infinitely more reformatory, than many years in prisons on the mixed or congregate system.

Useful work and profitable handicraft industry are also a prominent feature of Dutch prisons (as they are happily becoming by degrees in our own). The inmates are not absolutely compelled to work, but, unless they chose to do so, they are limited to a nauseous fare of black-bread, &c. This speedily induces the lazy to exert themselves; for all food of the better kind, and various little indulgences, such as flannel, stationery, and tobacco, must be earned by steady industry, the profits of which are shared between the government and the prisoners. The latter are thus enabled to render their condition more tolerable, and to earn a small fund for an honest start on discharge. A well-stocked library also forms a feature of each Dutch prison.

The chief prison occupations are, tailoring, shoemaking, brushmaking, sorting peas and coffee berries, making gloves, sabots, shirts, stockings, &c. These manufactures are carried on in connection with a carefully-regulated contract system, but permitting no external interference (as in American prisons) with the order and discipline by the contractors. Nor are there in general any grounds for complaint on the part of free workers outside. I was told that there had only been one such complaint.

After going through the Amsterdam cellular prison, the governor asked me for my opinion of it. I was able to praise it entirely, with the single exception that it perhaps appeared too comfortable to be duly deterrent, for a prison should be penal as well as reformatory. But the governor assured me that the strict discipline, and, beyond all other things, the entire separation from former and familiar companionship, were found to be amply sufficient to counterbalance the more comfortable elements of prison earnings, libraries, and sympathetic visitation. And as to health, both of body and mind, the venerable Mr. W. H. Suringar (the "John Howard" of Holland), who was for 47 years connected with prison administration (he is now 81 years of age), informed me that, with the existing ameliorations, he considered it perfectly practicable to adopt their cellular system, in sentences of any length, or even for life, in lieu of capital punishment. For Holland has totally abolished capital punishment (in 1870) after having tried its disuse for ten years previously, and I was assured by the Minister of Justice at the Hague that murders have "certainly not increased" in consequence. Permanent imprisonment is regarded as being, at the same time, a more severe, a more merciful, and a more deterrent punishment than the capital one.

As to the treatment of habitual vagrants and determined paupers, a few lines here must suffice. Such persons are arrested and sent to one or two large agricultural colonies in the east of Holland, and in particular to Fredericksoord, where they are compelled to earn their living. To each is alotted a shanty, a plot of ground, some tools and seeds, and some rough subsistence to start with. Opportunity is afforded of earning a plot of land by a few years of industry, and also of possessing a cow and a few pigs or sheep. But escape is carefully prevented, and no further preying upon the public is permitted, the system being one of limited imprisonment on a penal but beneficently reformatory colony. The effect is most excellent in the formation of honest habits and self-supporting lives. Such institutions are worthy of general study and imitation.—I am, &c., WILLIAM TALLACK.

MONTHLY NOTES ON SCIENCE.

It is well known that even the best achromatic object-glasses for telescopes are not so well corrected as not to show secondary spectra. The energies of scientific opticians have been devoted to the reducing or eliminating of this kind of error, but in the meantime without success. Mr. Wray (a few years ago) obtained a patent for an object-glass in which this evil was said to have been overcome, but it is said that, after more matured trials of it, the gain was not found to compensate for the disadvantages in connection with its construction, for it partook, to a slight extent, of the nature of a fluid lens. A protracted series of experiments to obtain the same result, viz., the reduction of the secondary spectrum, made by the late Rev. W. V. Harcourt, was brought forward at the recent meeting of the British Association by Professor Stokes, who had been interested in Mr. Harcourt's experiments ever since 1862, owing to his having at that time received from that gentleman some prisms formed of a peculiar kind of glass. On a careful examination of these prisms, it was found that their powers of dispersion differed from those possessed by ordinary glass prisms. Theoretically, any three different kinds of glass may be made to form a combination that shall be achromatic as to secondary as well as primary spectra; but in practice, as already hinted, this is beset with serious difficulties. Mr. Harcourt entered into the subject with great zeal, and found that by combining a concave lens made of a glass containing terborate of lead with positive lenses of ordinary glass, or else a positive lens of glass containing titanium, with negatives of crown and flint, or a positive of crown and a negative of low flint, triple combinations, free from secondary spectra, might be formed; and that by substituting a borate of lead for the flint glass, and titanic glass for crown, still further advantages might be gained. After encountering much difficulty in the preparation of glass of this kind, free from tears, striæ, and those other defects which are fatal to the production of a good object-glass, discs of terborate of lead and of titanic glass have at last been obtained of a homogeneous character, with which it is intended at once to set about the construction of an object-glass which shall give images free from secondary colour. Should the instrument turn out according to expectation, the researches of Mr. Harcourt will have marked a new era in the history of the astronomical refracting telescope.

The venerable editor of *Les Mondes*, M. L'Abbé Moigno, has recently proposed the establishment of what he terms a "Salle du Progrès," in which will be given, on the lowest possible terms, and gratuitously in many cases, a sound education in physical science and in art. He intends that a main feature in the lectures will be an abundance of illustrations by means of the magic lantern, from photographs or drawings on glass, and prepared for this purpose. These popular scientific lectures are being eagerly looked forward to.

In connection with the forthcoming eclipse, it is gratifying to be able to record that the committee are to receive aid of the most valuable kind from the Peninsular and Oriental Steam Navigation Company, and from the British India Telegraph Company.

The estimation of the distance of the fixed stars has hitherto baffled the skill of the astronomer. Mr. Fox Talbot has proposed the following manner of effecting this object. Suppose the plane of the orbit of a binary system to pass through the sun, *i.e.*, that the observer is in the plane of the orbit, and that in the spectra of the individual stars there are lines belonging to the same element. The spectra of the two stars, taken through the same slit, should be observed and compared. When the stars appear in the same straight line, it is clear that their velocities relative to the earth are the same, since both are moving perpendicularly to the line of vision; the lines from the two stars will therefore coincide. But when their apparent distance from each other is greatest, the difference of their velocities relative to the observer is equal to the velocity of either star, in its velocity in its orbit about the other. This difference of relative velocity will produce a displacement of the lines, which displacement may be observed and even measured. This gives the value of that velocity; but we know also the periodic time. We have, then, at once the circumference, and thence the diameter of the orbit. We know the greatest angular distance between the stars; we have, then, the distance of the stars from the earth.

Professor Whitfield, of Alabama, who has bestowed much attention upon the subject of tornadoes in the Southern States of America, has published some details concerning them which convey a vivid idea of their immense power. For example, during a very destructive tornado in May, 1868, there was a large two-storey framed house, the timbers of which were scattered for miles along the path of the storm. The bodies of the family, five in number, who were all killed, were found nearly a quarter of a mile away, almost all the clothing of the females having been stripped from their bodies. A piece of pine, sixteen inches square and fifty feet long, which, being unattached to any timbers of the house, was moved by the force acting on its own surface only, was carried across the intervening valley to an adjacent hill, into which it plunged end foremost, opening a deep trench, broke, and was carried farther on. The professor calculates that, to produce such results, a pressure of least one pound to every square inch would be required, a force fearful to contemplate as possible for the wind. The house, to the destruction of which reference has been made, presented a front area of a hundred and eighty thousand square inches, and therefore encountered a pressure of ninety tons. The velocity of the wind necessary for such an effect must have been a hundred and sixty miles an hour. From the observations he has made, Professor Whitfield concludes that the gyration of the tornado is not horizontal but spirally upwards, for not only does it displace heavy bodies, but it carries them up to a considerable elevation. He has seen, for example, a pine tree, sixteen inches in diameter and sixty feet long, float out from the black vortex of one at the height of a quarter of a mile and sail round, to all appearance as light as a feather. The velocity of gyration, which is always from right to left, he estimates at a hundred and twenty miles an hour, to which must be added forty miles more, being the average rate of its progression, which is nearly from the south-west to the north-east.

In a recent number of the *Moniteur Scientifique*, a paper was contributed by Dr. E. Kopp, on the "Means of Detecting and Separating Silk, Wool, and Vegetable Fibres from each other." *Apropos* of this, some valuable investigations made last year by Mr. John Spiller may be advantageously referred to. Mr. Spiller, in the course of his experiments, found that hydrochloric acid was an energetic solvent of silk, although it left wool and cotton unacted on, at least for a lengthened period. The practical bearing of this discovery was exemplified by the immersion of several so-called pure silk ribbons and other fabrics in the acid, when the silk was dissolved away, leaving the threads of the adulterating material intact. A lady, previous to making purchase of an alleged silk material, may thus be able to satisfy herself that the fabric is really what it is professed to be, by obtaining a small sample of it and immersing it for a few seconds in the hydrochloric acid, or preferably by dropping a little of the acid on the centre of the sample, when, if it be pure silk, a hole will be produced, but if impure, the threads left will immediately indicate the nature and extent of the adulteration.

In the india-rubber of the Gaboon, M. Girard has recently discovered a new substance, dambonite. When treated with nitro-sulphuric acid, it is transformed into a gummy, thick, translucid substance, and when thrown into water, it precipitates in the form of flakes, which, when carefully washed and dissolved in boiling alcohol, deposits crystals of nitrated dambonite, which is insoluble in alcohol, and detonates under the hammer. The new base, when treated with fuming hydriodic acid, yields dambose, which acts in the same way.

PRESERVED VEGETABLES.

It will be remembered that last session Mr. Buchanan read a paper before the Society on the preservation of vegetables by a cold, dry process. Having submitted samples to the Admiralty, the following satisfactory report has been received upon them, and forwarded to Mr. Buchanan:—

Seamen's Hospital, Greenwich, S.E., July 17th, 1871.

Sir,—In accordance with a request received, I have the honour to submit the following report to the Board of Trade, relative to certain samples of preserved vegetables, prepared by Mr. George Buchanan:—

1. *As Regards Present Condition.*—All the samples are sound, and in a very good state of preservation.

2. *As Regards Nutritive Properties.*—Quite equal, if not superior, to those of compressed vegetables.

3. *As regards general flavour.*—The spinach, onions, savoy cabbage, and brocoli are exceedingly good, in some respects comparable to vegetables in the fresh state, and the other varieties are fully as good as any average specimen of mixed or compressed vegetables.

4. *As regards facility of Cooking.*—No special care or caution appears to be required.

Having regard to the foregoing, and to the important assurance of Mr. Buchanan as to the age of these preserved vegetables, I consider them commendable:—1. Because they possess nutritive properties. 2. Because they keep well without special exclusion of air. 3. Because they are easily cooked. 4. Because they are palatable.

I may also take leave to suggest that, with a view to inaugurate the permissive use of these vegetables in the mercantile marine, it is competent for the Board of Trade (on medical and sanitary grounds) to substitute the word "preserved" for the word "compressed" vegetables (mixed) in the scale of medical stores issued and caused to be published in pursuance of the "Merchant Shipping Act, 1867."

If this proceeding be adopted, either the compressed vegetables, or any other kind of preserved vegetables (including those now under consideration) can be chosen.

I am, &c., (Signed) Harry Leach.

The Assistant-Secretary, Marine Department,
Board of Trade.

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FRIDAY, SEPTEMBER 29, 1871.

ANNOUNCEMENTS BY THE COUNCIL.

THE LIBRARY.

The following works have been presented to the Library:—

Minutes of Proceedings of the Institution of Civil Engineers, for 1870-71 (2 vols. Nos. 31 and 32), and Index of Minutes of Proceedings from 1861 to 1871. Presented by the Institution.

Model Houses for the Working Classes, by Banister Fletcher. Presented by Messrs. Longmans, Green, and Co.

Transactions of the Institution of Naval Architects, for 1871. Presented by the Institution.

Elementary Astronomy, by R. A. Proctor, B.A. Presented by the Author.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ON THE SANITARY ADVANTAGES OF SMOOTH AND IMPERMEABLE STREET SURFACES.

By Edwin Chadwick, C.B.

I promised last session to bring forward for discussion in the Society, the sanitary condition of the street surfaces of towns, and the means of improving them and of better cleansing them—neglected sanitary topics of greater importance than is commonly conceived; but I could not get time to do so. As I am apprehensive that I may not have the opportunity during next Session, I now take the occasion of the great interest created by the new asphalte roadway pavement in the City of London to advert to those subjects.

The condition of the surfaces of the streets, courts, and alleys of the metropolis formed an important topic of examination under our Metropolitan Sanitary Commission. The state of the unpaved districts; the noxious emanations from the subsoils; the absorbent surface mud; the stagnant pools containing dung and other decomposing animal and vegetable matter;—the filth collected on the person and on clothes derived from it, and taken into the habitations, powerfully affected the cleanly habits and the health of the population, especially of the children, who are always out playing upon such surfaces. In places where self-cleansing house drains and sewers have been brought into good action, and where the death rates have been reduced, but where some amount of typhoid and foul-air diseases yet lurk, they have been found to be very much confined to those streets where the surface is unpaved and badly cleansed, and the subsoil sodden with foul matter. The pernicious effects of these conditions are, as might be expected, most severe on children, from their being, by reason of their lower stature, nearer to the emanations, and from their being more weakly, and thence susceptible to their influence. The sanitary condition of the then best paved streets was very bad, presenting "seas of mud" in winter, and in summer giving off "clouds of dust," which settles on the clothes, the skin, and the hair, and gets into the lungs. The worst is, that this dust is chiefly dung dust. The experiments of Professor Tyndal go to prove that the whole of the visible particles floating in London rooms are of organic origin; and other experiments have stated that horse-dung furnishes the greatest proportion of them. In some of the leading thoroughfares as much as a cartload of dung was removed daily from every mile of street. In the City there were, I was informed, about one hundred loads of surface matter, chiefly dung, removed daily. To persons coming from the rural districts the streets frequently smelt like badly cleansed stable-yards.

At the first General Board of Health, in times of severe epidemic periods, we directed that the affected districts should be carefully and thoroughly surface-cleansed. This was directed to be done by jets of water thrown by engine power, or from the mains where water at high pressure was available; but in many districts the jets, in clearing away the dung deposits from the interstices of the paving, often also washed away or tore out much of the supports of the large stones, and even, where they were firmly jointed, left much objectionable surface water and evaporating moisture. The only remedy available in some excrement sodden districts was to cover the street surfaces over, for the time, with fresh mould or soil, which, when it was done, made the people feel, as they said, as if they were living in another atmosphere.

It resulted from our examination that, by some better mode of paving, which we hoped might be obtained—than that of large stones put down to resist the shock of heavy carriages, which again entails the construction of heavy carriages to withstand the shock of the large stones—and by lowering the gradients, and by the introduction of tramways at some points, half the usual horse power might be saved—a saving of great importance in itself in the economy of traction and of intercommunication, but in our view of peculiar sanitary importance as a diminution of half the horse-dung and its noxious evaporation, and the injury of the dust and dirt, and a reduction of expense of the surface-cleansing of the streets.

I certainly expect that the saving of horse power, from the paving with the new material, of peculiar hardness, as yet unsurpassed, and, as far as I have seen, unequalled, by anything of the kind—the Val de Travers asphalte—will be more than one-half of that power, and consequently a saving of more than half the dirt and dung in the streets, and that this pavement will nearly equal the tramways in this respect for public vehicles, whilst it will exceed tramways in general convenience, especially for all sorts of private carriages. Sir Joseph Whitworth, who has studied street economy and the means of street cleansing, and who is much struck with the new material, tells me that he anticipates that when extensively adopted, it will make way for the hot-air engine, with indiarubber tyres. A colleague of mine, of the Institute of France, who for the last ten years has ridden over a street paved with the Val de Travers asphalte in Paris, speaks of the great comfort in riding over it. The horses, on becoming accustomed to the tread, he says, do not certainly slip more, or so much, and when they fall do not tear their knees as on the old pavements.

One advantage of gravel soils is the rapid discharge of surface water, and immediate dryness after rainfalls. This advantage is possessed in a high degree by the impervious and even asphalte surface.

There is one peculiar evil attendant on the old systems, which is the noise, the rattle, and the vibration of the traffic over them, to which strong people become accustomed, and do not mind, but from which weakly and ailing people suffer very much, being sometimes obliged to leave town to avoid it. The removal of the sick over these paved roads is often attended with considerable danger from the rolling and shaking. At our General Board of Health, it was strongly represented that great injury, often fatal, was inflicted by the removal of some large classes of sick in common cabs, or in other common conveyances, over paved roads. Exhortations were prepared for popular circulation, that, on the occurrence of accidents in the streets, attended by the fracture of limbs, it is of the greatest importance that the patients should not be put into any common conveyance for their removal, but should be allowed to remain where they fall until a surgeon can be brought to direct special and safe means of removal by stretchers. In relation to the action of granite pavements on healthy persons, a professional friend declares that the loss of what he calls "brain force," from the vibration and disturbance of the nervous system in much riding over the old carriage pavements, is far greater than would be imagined. We know that for ladies of the well-to-do class, it is found necessary at times to spread straw over the street, to prevent the vibration, and deaden the sound of carriages. With a pavement of this very remarkable new substance, which gives, with great tenacity, a sort of elastic surface—hard and inodorous alike in summer and winter—it is very much as if tan were always laid down before all the houses of a whole line of street. Tradesmen in Cheapside testify, as one characteristic of it, that, without shutting their shop doors, they can now hear their customers, and can make themselves heard by them without shouting, as heretofore, to overcome the noise of the carriages over the granite pavement. Those living in such streets can now keep their windows open with little annoyance, either from noise or dust.

The macadam roads, in cities of great traffic, may be said to be huge stone mills for grinding granite dust. Some notion of the extent of the work done in this way in the metropolis may be formed from the fact that there are annually imported, and used there, six hundred and fifty thousand tons of granite, of which it is estimated that about one hundred tons are imported in cubes, and that the rest is used as macadam. In addition to this material, large quantities of flint, and also other stones imported as ballast, are used. In Birmingham, fifty thousand tons of granite are put on the roads every year. Every year, therefore, so many tons of granite is ground, in dry weather, into dust with dung, which the winds carry about, and in wet weather into mud. The wear of the macadam roads is from one inch to four inches or more of granite annually. Westminster-bridge, it is stated, requires annually a coating of at least five inches and a-half of the very best granite that can be got. The wear of any smooth road, by reason of the very smoothness, is comparatively inconsiderable, an example of which, I am informed, may be given, though of a street of secondary traffic, compared with our chief thoroughfares, the Rue Bergere, in Paris, where the result was observed. The street was laid with two inches of Val de Travers asphalte in 1854, which was lifted in 1869, when it was found to be reduced to one inch three-eighths, but chiefly by compression, for it had, during the fifteen years, lost only five per cent. in weight. I am informed that similar results have been obtained in Threadneedle-street, for the time the new pavement has been down there.

We found that these granite pavements very injuriously affected the working of the sewers. When the granite-dust is washed by rain into the sewers, it often forms an indurated surface, only to be loosened by the pick, and to be removed at much trouble and expense. This sometimes occurred, even with tubular glazed pipe sewers. To obviate this evil, we had traps carefully constructed at the mouths of the gulley shoots to arrest the granite detritus, for which, however, in times of storm or heavy rain, they proved to be insufficient.

When the new granite or flint material for macadam is first laid down, it is a cruelty to horses, and a barbarism as respects carriages and carts, to impose upon them the labour of crushing it. The steam-roller is a relief to them, and an economy in getting a somewhat better surface, though still, to some extent, a permeable one for dung. But this implement, it is now found, aggravates waste and evil of another sort, produced by the vibration from heavy traffic. One great inconvenience in those streets is the frequent breaking up of the pavement for the repair of gas and water pipes. I found from my own inquiries that the leakage of those pipes was very much proportioned to the heaviness of traffic, and was inconsiderable in the bye-streets and districts of little traffic, the vibration of the heavy traffic perpetually shaking the lines of pipes and loosening their joints. The escape of gas, besides being a waste—which in some districts was stated to amount to as much as thirty per cent.—was attended by sanitary evil in the pollution of the air, and even in some cases of the drinking water. So great in some districts was the saturation of the subsoil with gas, that, where the water supply is on the intermittent system, and the pipes are alternately full and empty, the water-pipes were often filled with gas sucked in from the substratum through the loosened joints when the water was drawn out of the pipes. Mr. Milne, the engineer of the New River Company, to demonstrate this condition to me, and show that to the water were frequently ascribed impurities which did not belong to its original and proper quality, took me early in the morning to the new road, and applied a match to the tops of water-plugs, and lighted the gas that escaped from them. Instances were stated of people, on going with candles to the taps in houses to draw water, being surprised by a blaze of gas from them. The operation of the new steam-rollers, whilst it relieves horses, carriages, and ordinary vehicles from the labour of crushing and forcing down granite, and is in other respects economical for the macadam roads, is productive of injury and waste by a yet more powerful vibrating action than the ordinary traffic, and by a greater disturbance and rupture of the system of pipes beneath the surface. Some of these rollers weigh as much as thirty tons each. I am informed that the gas and water companies in London and in the provincial cities have had serious cause to complain of the use of these rollers, which bring to bear the weight of some twenty or thirty one-horse loads upon one fulcrum, and have fractured large pipes deeply laid, and have also injured the house connections.

In proposing the system of combined back drainage, that is, of carrying water-pipes as well as drains and branch sewers at the backs of lines of houses, instead of in the streets along the fronts, I calculated that, besides saving the expense and inconvenience of carrying drains and pipes under the lower floors of houses, the measure would reduce the evil of the loosening and breaking of house service-pipes, as well as the mains, by removing a large proportion of them from the direct action of the heavy traffic over the granite pavements in the streets.

There can, I think, be no doubt that the indirect economies will be greater than the direct economies from the new principle of covering the streets with even and yet hard surfaces.* One indirect economy will be the reduction of the weight of the vehicles necessary for the paved roads, and thence a reduction of the wear of the roads.

Amidst these economies are to be regarded the reduction of pain as well as the economy of horse-power. I have received from my esteemed correspondent, Dr. Edward Jervis, of Massachussetts, a paper entitled "Our Dumb Animals," published by a new society started there, on the principle of our Society for the Prevention of Cruelty to Animals. They say, "We want to show the people of this country the abuses to which animals are now subjected, and that those abuses affect not only the well-being of the animals and of the public health, but also the tone of public morals, inasmuch as cruelty to dumb creatures begets cruelty to creatures that are not dumb. Our aim is to educate all, and particularly children, to a higher humanity, and to inspire a reverence for the Great Creator of all these wonderful forms of animal life, and a more profound consciousness of our duty in regard to them." In this elevated spirit they advert to the Nicholson pavement as against cobble stones. I have seen no account of the construction of this Nicholson pavement. I am assured, however, that as at Paris, on a close comparison with other long tried means, the Val de Travers pavement is now being actively taken up in New York. But I cite the account as corroborative of the principle of a smooth as compared with a rough pavement, and for the society's discrimination of the elements of humanity with those of economy involved in the application of the principle by whatsoever means. They state that by the new smooth pavement—

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* In respect to the interior of the metropolis, Sir Christopher Wren's admirable plan for the rebuilding of the City, which is still good as a study, provided for direct lines, and for level street surfaces. He would have prevented Holborn-hill and Ludgate-hill. I got Mr. Butler Williams, when principal engineer of the College of Civil Engineers, to ascertain by survey how much had been lost by deviations from Sir Christopher's plan—lost by increased gradients, as well as by increased distances; when it was proved that the loss of horse-power, and of time, on those two hills alone, would almost pay for the reconstruction of the streets, and the restoration of the plan of the architect of St. Paul's.

"Streets which once had but little else but light pleasure carriages coursing through them, are now filled from morning to evening with heavily-loaded drays, and carts and carriages of all kinds. The explanation is that the teamsters and cabmen have found out that they can drag their heavy loads over the smooth Nicholson pavement with half the wear and tear of team and cart that is expended on the cobble-stone pavement; and so, very naturally and reasonably select those streets which have the smoothest wheel-ways.

"And why should they not? The life of a first-class coach in Boston streets, for example, is diminishing nearly 50 per cent. by the rough cobble over which it is banged from day to day. And the life of all sorts of carriages, carts, and waggons is probably diminished proportionately. The wear of horses, too, is, no doubt, somewhat in the same proportion. The sprung knees and unsound hoofs of our city horses are a continual protest against cobble stone. How can a poor horse be expected to do half his appropriate work, or live out half his appointed days, who is rarely allowed a chance to put his foot down flat on the road he is travelling, but must step and pull over a series of round stones, which afford no firm footing, and which jerk and wrench the carriage in every direction, every motion of which is an unnatural and unreasonable and injuring strain on the faithful animal who is tugging along his heavy load?

"A first-class livery coach, which costs the stablekeeper sixteen or eighteen hundred dollars, will last as such about half-a-dozen years only in Boston streets. It is then sold for about what has been expended on it in repairs during the time it has been in service; and so the coach is in fact sunk and lost in the course of about five or six years. And it is very much so with every sort of carriage which is used in our city. Not that they wear out equally quick, but that their life, if we may so speak, is proportionally shortened, and so it is, too, with the poor horses.

"Now let those who have the making and paving of our streets bear these facts in mind, and they will see that true economy, as well as comfort, demands that our streets should be made just as smooth as is compatible with durability, and that cobble-stone pavements should be banished as fast as possible from our city limits."

It is confidently anticipated that the improvement of the road surfaces will lead to the improvement of the shoeing of horses.

The Corporation of the City of London have rendered a public service by the trial of the new material in streets of such tremendous traffic as those where they have had it laid down, but they would render the example more complete by having the surface washed, in certain weathers, by the jet. The municipal authorities of the cities where they have command of a constant supply of water at high-pressure who did this would have the most complete sanitary street surface yet known. From some trials I got made at the first consolidated Commission of Sewers, it appeared that the cost of cleansing the roadway of the Strand by the jet daily would not be more than threepence per house per week. One of the methods then brought forward, of a hose with a movable carrier, for cleansing the streets by jet, has been adopted in Paris, with great success, on the asphalte pavement. If a suitable pavement were provided, we estimated that the streets of the whole of the metropolis might be kept as clean as a gentleman's courtyard at a rate of a halfpenny per week per head of the population—a rate that would effect a great economy of clothes, and of washing, and of merchandise. I deem the conditions that require sweepers of street crossings to be a mere barbarism, being clear evidence of the excessive dirtiness of the general surface.

For these reasons chiefly I have taken a personal interest in this Val de Travers pavement, as realising more than we expected in the amendment of town pavement. It were to be wished that the material were more abundant, that it might be obtained cheaper. As it is, however, although there appears to be no economy in the first construction, as compared with granite, there are evidently very large economies in its use—economies in cleanliness and health, in the preservation of clothes and furniture, in goods, in horse-power, and carriages.

The lower districts occupied by the many—the wage-classes—require a special attention and consideration which they have not yet received. In some of these districts, in the manufacturing towns, a missionary visitor may observe in a dirty lane or unpaved alley, the steps of one house nicely cleaned and pipeclayed. That is a house occupied by new comers, a young married couple, who have been brought there from the rural districts by the inducement of high wages at the manufactory, and they could get no other house near the work. On repeating his visit some time after, the visitor will find that the distinction of the clean steps, and also of the clean floor, has disappeared. The housewife has given up the contest with the surrounding filth from the muddy, unpaved place, and the children, in their rural home once cleanly, have become almost as dirty as the house floor. She bewails the fact that the labour of trying to keep them clean is in vain; they will go out to play, and roll themselves in the mud. Then, being always so dirty, she is ashamed to send them to school. To withstand the depressing influence of the damp and the filth of the place drink comes in, and so all are lowered to the surrounding filth, and, with higher wages, they sink into a lower physical and moral condition.

Now, it is to be maintained, as a duty of the local authorities to provide such paving and cleanly surface conditions in the poorer districts, that there will be no mud for the children to roll in, or to make "mud pies" of, if they would. It is for the local authorities, and in their default—the default, commonly, of low landlords—it is for the central authority so far to make the population clean—as may be done by cleanly surrounding surface pavement. Of course, a special economy is to be consulted for such work, and is available for those districts where there is little quick carriage or horse traffic, and where the same peculiarly hard road-surface is therefore not needed. It is to be hoped that a smooth, non-absorbent, and washable surface, may be got at cheap rates by the use of General Scott's "celenite," or some of the concretes, at least for foot-paths and for court-yards. I had intended to propose that these concretes, Portland and others, should be tested. I myself have a fancy for one form of tile with a rabetted joint for foot pavements, which I wish to see tried. The cheaper gas-tar asphaltes have some merits, but unless they are very well made they soften and smell offensively under summer heats. I am informed of examples in Germany of the use of a good smooth tar concrete for paving of play-grounds of childrens' institutions. Indeed, I know of one institution in the metropolis where a saving of one-half the shoe-leather was experienced after an improvement of the surface, and the cost of shoes is a very large proportion of the cost of clothing to the working classes. A general economy of shoe-leather to the bulk of the population is to be taken into account as attendant upon an improved surface pavement. The sanitary economy in childhood from the prevention of noxious subsoil emanations, as well as surface emanations from damp, and filth, and dust, will be of itself very considerable.

The economies specified are, however, much frustrated by carrying out the Val de Travers pavement in isolated patches; nor is justice done to the material in respect to cleanliness, while it is subjected to the dirt of side streets and old pavements; nor indeed are the horses fairly dealt with in being suddenly pulled up and made to change their action for short distances. It is obvious that, if the concert of different jurisdictions be impracticable, unity of administration will have to be sought, for the attainment of the benefits available to the public from the improvement.

Unfortunately for the population of the metropolis, and of some others of our cities, the local administration itself is yet retained very much in patches. Even for one line through the metropolis, the action of seven vestries would be needed. In some places we found that streets were divided longitudinally,—one longitudinal half being paved and repaired by one parish at one time, and the other half by another parish at another time. The longitudinal halves, too, were cleansed by halves, often by the scavengers sweeping the dirt from one parish into the other. We proposed, to remedy this state of things, a provision that the paving should go with the drainage jurisdiction, and should comprehend the entire metropolitan area, including the suburbs. It is only on the complete scale of a city and suburbs that the recited economy of horse-power can be achieved. The horse-traction may be reduced by more than one-half on a particular line, but beyond it, and for the unimproved suburbs, the double horse-power will still be needed. As it is, however, the shopkeepers of Cheapside and other streets declare that they are satisfied even with the partial improvement, and better cleansing surface for themselves. It is stated that some of the vestries amongst whom the main thoroughfares are divided, whilst admitting the demonstrations of improvement which are not to be withstood, state they will wait until their present granite pavements are worn out, or until their contracts for the maintenance and renewals of the objectionable conditions are expired. Meanwhile, by this apparent saving real waste is maintained, excessive filth is being maintained, shop goods being spoiled, discomforts inflicted, and health deteriorated.

With the new available materials, the professors of sanitary science and economical science may put these questions to urban populations:—

Will you obey the command, "Wash and be clean?"

Will you pave so as to enable you to do so?

Will you pay for good paving and cleansing, to save the direct expense of filth in clothes and extra costs of washing?

Will you pay for good paving, to save more than half the expenses of horses and carriages and the costs of transit?

Will you pay, in good paving and cleansing, to reduce the greater expense of the filth diseases?

I will only add that, in the investigations to which I have referred, one large sanitary policy was kept in view, that by the measures we proposed for facilitating and cheapening intercommunication, which we were prepared to recommend should be done to the extremities of the suburban relations, the evils of internal overcrowding would be reduced. For the removal of the well-to-do classes to suburban residences extends and cheapens house accommodation to the urban population. If it were possible to drive back the suburban population upon the city, where they have their daily business, or upon the interior of the metropolis, and pile story upon story for their reception, the effect would probably be, in the existing conditions, a double death-rate. In the interests of the interior population, we were prepared to recommend the radiation of public tramways to the extreme of the civic external daily relations. But tramways provide chiefly for one class of society, not for another, the higher class of villa residents, including medical men, to whom it were desirable to provide means of doing with one horse what they must now do with two, as also for much goods' traffic and retail distribution. Unfortunately, these economies and any complete civic administrative policy must wait for the advance of superior legislative principles. Time will vindicate them.

The time will come when a local administration will be tested, especially in the lower districts, by the smell of a place and by the look of the people inhabiting it.

ANNUAL INTERNATIONAL EXHIBITIONS.

The first of the series of Annual International Exhibitions closes to-morrow, September 30th, having been visited by considerably over a million persons.

EDUCATIONAL COLLECTION.

MECHANICAL DRAWING EXHIBITED AS SPECIMENS OF SCHOOL-WORK.

The report on this section is by F. Alf. Bradley, Esq., Instructor in Geometrical Drawing, R.M. Academy, Woolwich. He is glad to find in the present Exhibition so much satisfactory evidence of the attention that is being paid in this country to the subject, as well as to the cognate science of descriptive geometry, as branches of education. Pointing out the importance of instruction in the art, he says:—

"When it is remembered that the architect, the engineer, the naval constructor, the designer of military works, &c., all require carefully-prepared drawings as a basis on which to found their labours, and when we consider how very many of those about us are connected with one or other of the arts or professions referred to, the necessity for careful and systematic instruction in mechanical drawing, or, at all events, for some sound elementary teaching, will, I think, render itself apparent. Let us put on one side for a moment the mere question of practical utility in considering this branch of instruction, and look at it with regard to the influence it exerts upon the training and upon the habits of the pupil in other branches. If he has been taught, amongst his earliest exercises, to use the common instruments carefully and exactly in the execution of no matter how simple drawings—if he has been shown how to draw a straight line straight, and a circle so as to resemble the curve known by that name (in both cases so far as the means at his disposal will admit of)—if he has been taught that where three inches of measurement are required, three inches *plus* a tenth, or three inches *minus* a tenth will not do—then I submit that the habits of neatness and accuracy acquired will produce a beneficial effect upon his mind-training in other branches of his early education, and that that effect will be apparent in more methodical treatment of his work, and greater honesty in the execution of it. How much the difficulty that a beginner meets with in the study of pure geometry is increased by the badness of the diagrams necessary for his reference, I will not stop to inquire, nor will I do more than hint at the shortcomings of our best mathematicians in this matter of diagram drawing.

"But we must not stop short at the consideration of mere plane geometry as applied to mechanical drawing. We must also give our attention to the representation of solids, or geometrical figures having three dimensions, and so, combining the two branches, we arrive at the study of that science now pretty generally known as 'descriptive geometry.' At the time of our first International Exhibition there were very few educational establishments at which this science was even dipped into; and I think I may safely say, only two were generally known in which a systematic course of scientific instruction was pursued—namely, the Royal Military Academy at Woolwich, and King's College, London. Now, thanks to the State aid offered to encourage education, and the exertions of the Science and Art Department of the Council on Education in applying that aid since the year 1852, the candidates who annually present themselves for examination in this and kindred subjects may be numbered by thousands.

"Continental nations have the start of us by half a century, as respects instruction in this science. It was at the end of the last century that the great engineer, Monge, for the first time reduced it to a system, and drew up a text-book for the use of the students in the then new Ecole Polytechnique. Since that time descriptive geometry has ever held its place, not only as a study in the school itself, but as a subject that must be taken up for examination by candidates for admission. This is also true of other schools in France, notably in the case of the Imperial School of Mines, where the entrance examination in this subject is very stiff. Monge's system rapidly spread throughout Europe, and for many years there has scarcely been a school in France, Belgium, Germany, Russia, &c., under the direction of government, in which it has not formed an important portion of the student's course. The well-filled portfolios displayed by Belgian schools in the present Exhibition speak for themselves. One school provides us with a syllabus of the course of study in various departments—and it will be found that no department (save that of fine arts), and no year of study, is without its fixed amount of instruction in geometry—perspective, or "*coupe des pierres*."

Mr. Bradley expresses regret that the specimens of work sent up by a great number of the English schools evince a want of *system* and of purpose; but at the same time he "reminds those who compare the results contained in the English and Continental portfolios of the very different circumstances under which those results were produced. To most of the English students who exhibit, learning must be a secondary consideration to the necessity of earning daily bread, and the time devoted to it must be stolen from that otherwise devoted to rest and recreation. The student comes into his class-room (which is, perhaps, crowded and ill-lighted), fatigued in body and mind, and with hand shaking from manual labour, to get instruction as best he may, and to work with perhaps very limited means and appliances; while in the case of the Belgian schools, the results are produced by students whose whole time is devoted to 'learning,' the object of whose early years is education, and to whom every facility is given for attaining that object."

Needlework included in the Results of Schools Teaching.

The report in this section is by Mrs. Le Neve Foster. It appears that one hundred and eighty-three schools sent specimens for admission:—

	Number of Schools.
Elementary of Great Britain	101
Elementary of Ireland	72
Army schools	6
Private schools, &c.	4

The committee of selection, after a careful examination of all the specimens, arrived at the following conclusions:—

	Approved.	Rejected.
Elementary schools of Great Britain	53	48
Elementary schools of Ireland	27	45
Army schools	2	4
Private schools, &c.	1	3

Mrs. Foster speaks highly of the British work exhibited, which "presents highly-satisfactory specimens of our school-work, and is certainly superior to that of any other country. The most critical observation of the various specimens approved by the committee cannot fail to elicit admiration, as there is scarcely one which does not show great marks of excellence. If, however, we take into consideration the amount and character of the work which was rejected, the result does not show that the condition of this branch of instruction in our schools is so satisfactory as could be wished." Needlework from foreign countries, however, is very inadequately represented, as only three of the countries in Europe have sent anything at all.

"It appears that the National Education Board in Ireland gives great encouragement to the teaching of needlework. The Commissioners have published a manual of needlework, for the use of national schools; it seems very practical and easy to understand. At the annual examinations all female teachers are liable to be examined in this manual. During the year 1870, there were 2,993 national schools submitted to special examination in needlework by the inspector, and the pupils present at the examinations numbered 76,951. The tabulated results of proficiency show that of this number:—

36,270	passed satisfactorily in sewing.
26,609	" " " knitting.
5,240	" " " cutting-out.

"As the promotion of teachers depends on the results of the annual examinations, and as needlework forms a most important part of them, a strong inducement is thus presented for skill in this particular subject, and the number of marks attainable in it at the examination, and upon which the character of the school is estimated by the inspector, is large. This also is an important stimulus to proficiency in needlework in the schools throughout the country. The Commissioners keep on hand supplies of various materials required for the use of schools, which they grant at reduced cost on application. Any neglect in teaching needlework, or any omission to provide for the use of the pupils the necessary materials for regular practice, is punished by the issue of a reprimand, or the infliction of a fine on the teacher. There are 6,707 schools in operation in Ireland; about 1,650 are attended exclusively by girls, and are under female teachers. There are also about 100 infant school conducted by females. In all these schools needlework is regularly taught as a part of the ordinary school routine. In the industrial schools, where lace-making and embroidery are taught, as has been before noticed, the attendance is not necessarily limited to the young, but may include adults of the humbler classes, who desire to avail themselves of the opportunities presented for acquiring knowledge of the various kinds of needlework, or for improving that already imperfectly possessed. Young girls and women find in them not only opportunities for acquiring such habits of order, neatness, and cleanliness as will accompany them through life, either in their homes or in their places of service, but they also receive careful instruction in the other subjects of the board's programme."

In conclusion, Mrs. Foster points out the need of greater encouragement being given to needlework in schools:—"In Great Britain it appears that no special money-grant is made by her Majesty's government for proficiency in needlework; surely, if this were otherwise, there would be a greater stimulus to both mistress and scholars. The only notice which government takes is of a negative character—namely, if the school inspector reports that needlework is not satisfactorily taught, then no grant is made to the school, and no proficiency, however great in other studies, can earn a special grant for the school. There is, however, no individual stimulus which makes it the interest of either pupil or mistress to strive for excellence. If the omission of this subject be made on the ground that the inspectors, being gentlemen, would have a difficulty in appreciating the quality of this class of school-work, means might be found to overcome it, especially now that we have school boards and ladies upon them. Indeed, as the case now stands, some amount of judgment has to be exercised by the inspectors. The difficulty does not seem insuperable; and it may be observed that some of the inspectors at the present time, judging by their reports, are thoroughly capable of expressing a right judgment of needlework. Its importance cannot be over-rated; but as the work of considerably more than half the schools applying for exhibition was rejected (and it must be remembered in the majority of instances they were selected schools), then the inference must be drawn that, as a general rule, it is not thoroughly or satisfactorily taught. It may be the fault is not entirely with the school or the teaching, but it may arise from the difficuly of keeping the scholars at the school a sufficient length of time. Needlework, however, should not be taught to the exclusion of intellectual training, and there is no need of antagonism between the two; there is surely time enough for both if it be judiciously divided.

"Several specimens of wool, flowers, and fancy beadwork were sent in, and were only admitted for exhibition on the strength of their being accompanied by work of more useful character; but their presence is a proof that time, in some schools, is thoroughly wasted on work which is neither useful, profitable, nor ornamental. Crochet and tatting should not be allowed, as they are not essentially useful, until the scholars have attained a skilful use of their needles. Knitting is second to plain needlework in utility, and it is desirable it should be taught. The German plan of knitting being so much more simple than the English method, it is strange that it is not more generally adopted. Cutting-out, a very necessary part of instruction to the elder pupils, is beginning to excite some attention, as may be seen from the paper models sent in for exhibition, cut out by children from eleven to fourteen years of age, and made up by them into different garments, but sufficient attention does not seem to be given to it in schools generally. Patching should be regularly taught; it is a very necessary part of the education of the poor, who, from their very circumstances, are obliged to wear their clothes often as long as the fabric will hold together. All scholars should be made to practise darning—that thrifty art—till quite expert at it. A great proportion of domestic servants, many of whom have been taught in National, British, and other schools, are bad needlewomen; few of them can darn properly, and it is a universal complaint in the middle classes that a servant can rarely be found to do this work satisfactorily. A person not knowing anything about needlework might suppose there must be some great mystery involved in darning, whereas it only requires care and patience, and is a very simple operation; but it seems hitherto not to have been much attended to in school-work. The majority of the poorer classes can neither cut out their own clothes, make, nor mend them. The slovenly way in which many use their needle is lamentable. One cannot expect to effect much, if any, improvement with the adults; their habits are confirmed and past altering. The aim must be to teach the children, in the hope that the next generation may be improved.

"There is, at the present time, a great difficulty in finding good plain needlewomen; hundreds of women profess to be able to work, but cannot in a satisfactory way. Plain workers are said to be badly paid. No doubt those who cannot work neatly get very small pay, but a good plain worker is always sure of employment, and can always earn good wages. All this tends to show that much greater improvement could and ought to be effected in imparting the knowledge of needlework; and, while on the one hand those schools may be cordially applauded and congratulated which have furnished commendable specimens, and given practical proofs of the results attainable by careful teaching; on the other hand, the attention of those who have hitherto treated the subject too lightly must be called to reconsider its importance."

Among the objects exhibited in the Education Department of the International Exhibition is a large and handsome diagram, with the following inscription:—

"Improvements in Teaching.—The Spelling Difficulty."

There are above 3,000 words in the English language of doubtful spelling, as *honor*, honour; *drest*, dressed; *draft*, draught; *realise*, realize; *center*, centre; with many others of a similar kind.

Examiners generally accept either mode of spelling words like these as correct.

It is proposed to ask the Committee of Council on Education to extend this option to simpler forms of spelling used:—

1. By standard writers of the present day, as the *Times* newspaper, Tennyson, Disraeli, and others. The following forms are often met with, *ake*, ache; *program*, programme; *checkered*, chequered; *tho*, though; *Gloster*, Gloucester, &c.

2. By older writers, as Milton, Spenser, Shakespeare, Tyndal, Chaucer, and others. The following simpler spellings are common in the earlier editions of the above and other old authors. It is said that in many cases the modern and more difficult spelling was introduced through "printer's error":—*Plow*, plough; *beleve*, believe; *deceve*, deceive; *enuf*, enough; *delite*, delight; *sovren*, sovereign; *foren*, foreign, &c.

It will be seen that the older and simpler spelling is more in accordance with the derivation than the current spelling.

About 1,000 words simplified in this way, by reverting to the old spelling, would be a great relief in teaching reading and spelling in schools, and it is estimated that half the time now spent upon these subjects might be saved and devoted to other subjects of instruction. Professor Max Müller, Sir Walter Trevelyan, Mr. Edwin Chadwick, C.B., with many other friends of education and teachers are favourable to a simplification of the orthography on this principle.

Persons interested in this subject are invited to communicate with Mr. E. Jones, Hibernian Schools, Liverpool.

EXHIBITIONS.

INTERNATIONAL EXHIBITION AT VIENNA.

The Emperor of Austria has appointed an Imperial Commission to carry out the project of an International Exhibition, to be held in Vienna in 1873. The members of the Commission held their inaugural meeting in the hall of the Imperial Academy of Sciences at Vienna, on Sunday, the 17th of September, under the presidency of the Archduke Rainer. His Imperial Highness, in his speech, congratulated the members of the Commission upon the auspicious event which they were met to bring about. He said that two decades of years had elapsed since Prince Albert, to whom civilisation is so much indebted, first suggested those peaceable contests of nations in arts and industry which are designated by the expression "International Exhibitions," and which may not be inappropriately compared to the Olympiads of the ancients. He rejoiced in the recollection that Austria had always taken an honourable part in the Exhibitions of London and of Paris, and that her productions gained for her the exclamation of their august Emperor, "I am proud of my Austria." He pointed out the advantages to be derived from this great social gathering, the stimulus it would give to the various industries of the monarchy, and the elevating character it would have in cementing the nations of the world, and making the centre of Europe the battle-field of a rivalry in the peace productions of the earth.

The Exhibition is intended to be opened on the 1st of May, 1873, under the special patronage of the Emperor and his brother, the Archduke Charles Louis. The Commission, which is composed after the models of the English and French Commissions, consists of his Imperial Highness the Archduke Rainer, president; his Highness the Lord Steward of the Imperial Household, Prince zu Hohenlohe-Schillingsfürst; his Excellency the Imperial Chancellor, Minister of the Imperial House and for Foreign Affairs, Count Von Beust; Prince zu Liechtenstein, Prince Schwarzenberg, Count Frestetitz, and Count Potocki, vice-presidents; and the Lord High Chamberlain, Count Folliot de Crenneville, and other high courtiers, the Ministers and heads of departments, the Presidents of both Houses of the Reichsrath, the presidents of the chief artistic, commercial, and scientific societies, and a number of gentlemen who have distinguished themselves in the various branches of science, art, and industry.

The entire arrangements have been entrusted to the Austrian Consul-General at Paris, Privy Councillor Baron de Schwarz-Senborn, who has been nominated Director-General of the Exhibition, and who has the advantage of great experience, combined with superior abilities. Local committees are about to be formed in the various provinces of Austria and Hungary, and a special Royal Commission is to be appointed at Pesth. The objects to be exhibited will be classified into 26 different groups, as detailed in the subjoined programme.

One great feature of the Exhibition will be an arrangement for the classification of the productions of all countries in groups corresponding with their geographical position, and great pains will be taken to render the Oriental department in every way worthy of the almost inexhaustible resources of the Indian Empire. The position of Vienna is admirably adapted for this, having, besides the waters of the Danube, a direct communication with all the important harbours of the Levant *viâ* Trieste. The arrangement of the Eastern department will be confided to the Austrian Consul at Constantinople, Dr. de Schwegel, who has already acquired a great reputation for his knowledge of Oriental habits and productions.

A new feature of the Exhibition will be an arrangement by which the treasured collections of the various museums of London, Paris, Berlin, Moscow, Lyons, Munich, Stuttgard, &c., will appear in simultaneous position, and it is further intended to represent a history of inventions, a history of prices, a history of industry, and a history of natural productions, so that the world's progress in arts, science, industry, and natural products will thus be brought into contrast. The Emperor of Austria has granted the use of the "Prater" for the site of the Exhibition, which is described by Mr. Scott Russell, who is at present in Vienna consulting with Baron von Schwarz as to the design for the building, the "Windsor-park of Vienna." Chevalier de Schaeffer, Director of the Austrian Consulate-General in London, who gained great experience at the London and Paris Exhibitions, and who is justly esteemed for his indefatigable zeal and ability, has been entrusted with the preliminary arrangements respecting the contributions to be sent to the Exhibition from Great Britain.

PROGRAMME.

I. Under the august patronage of his Imperial and Royal Apostolic Majesty, an international Exhibition will be held at Vienna in the year 1873, which is intended to represent the state of culture at the present time, and the entire sphere of national economy, and to promote its further progress.

The same will be arranged in the buildings to be erected for the purpose in the "Prater;" it will be opened on the 1st of May, 1873, and closed on the 31st of October of the same year.

II. The objects to be exhibited will be classified in the following 26 groups:—

1st Group—Mining and metallurgy.
2nd Group—Agriculture and forestry.
3rd Group—Chemical industry.
4th Group—Articles of food as industrial products.
5th Group—Textile industry and clothing.
6th Group—Leather and india-rubber industry.
7th Group—Metal industry.
8th Group—Wood industry.
9th Group—Stone, earthenware, and glass industry.
10th Group—Hardware industry.
11th Group—Paper industry.
12th Group—Graphical arts and industrial drawing.
13th Group—Machinery and means of transport.
14th Group—Scientific instruments.
15th Group—Nautical instruments.

16th Group—Military accoutrements. This group embraces all objects and contrivances for the equipment of the army and the tendance of the sick and wounded.

17th Group—Maritime objects. This group will consist of objects applicable to sea and river navigation, shipbuilding, the fitting-out of ships, the construction of harbours and coast-lights, of safety appliances, &c.

18th Group—Architectural and engineering objects. In this group will be represented executed or projected works for the construction of roads and railways, aqueducts, drainage works, works for the regulation of streams, canals, the construction of dwelling-houses and public buildings (as Houses of Parliament, theatres, hospitals, prisons, bathing establishments, public wash-houses, &c.), and also contrivances for ventilation, firing, &c.

19th Group—Cottage houses, their interior arrangements and decorations.

20th Group—Peasant houses, with their implements and arrangements. In these two groups it is intended to exhibit, by completely furnished dwelling-rooms, the manner in which the various peoples regard the object of habitation.

21st Group—National domestic industry. This department is designed to illustrate the abundance of valuable sources of which the productions of national domestic industry, such as objects of ornament, fineries, vessels, textures, &c., are the result.

22nd Group—Representation of the operation of museums of art and industry.—The object of this department is to bring into view the means by the aid of which the museums of art and industry of our time endeavour to influence the improvement of artistic taste and artistic culture in general.

23rd Group—Ecclesiastical art. This group will combine all that is produced by art and industry for religious purposes.

24th Group—Objects of art and industry of former times, exhibited by amateurs and collectors. (*Exposition des Amateurs.*)

An attempt will be made, by arranging this group, to bring together the treasures of private collections of works of art, which are usually accessible only to a limited few, thus giving students and others engaged in artistic and industrial pursuits an opportunity to enrich the domain of artistic industry by new ideas.

25th Group—Plastic art of the present time. Only such objects of art will be admitted in this group which have been produced since the first great International Exhibition in London in 1851.

26th Group.—Objects of education, training, and mental cultivation. This group will contain—(*a*) A representation of all such objects as are used for the support and rearing of the child in its infancy—its physical and psychical development from the first days of its life to the time of its being placed in a school. (*b.*) Educational and school matters, from the elementary schools upwards to technical colleges and universities. (*c*) The entire system of instruction and culture, so far as it can be brought into view by the productions of literature, the public press, societies, libraries, and statistical records.

III. By the juxtaposition of machines, apparatus, and the *modus operandi* of workmanship of different eras, the gradual improvement and perfection of certain inventions—for instance, that of the sewing machine, the loom, of telegraphy, photography, &c., are to be brought under notice as an attempt for the collective representation of the "history of inventions." In addition to this an attempt will be made to place side by side the productions of machines and handwork, and to show the supplanting of the latter by machine work.

IV. By the exhibition of similar objects, but manufactured at different epochs (and, if possible, with the prices attached), as well as of patterns and models, the increase and development of special industries, their dependence on the changes in taste, and their influence on the same, will be illustrated, as well as their economic importance in the different epochs. In this manner a collection will be brought together to illustrate the "history of trades and industry."

V. In order to give a retrospect of the influence of science on the progress and development of trades and industry, it is proposed to exhibit the application of waste, or the increase in the employment of the latter, by comparing the so-called waste with the articles manufactured therefrom, and also the intermediate products so far as such production of new commodities has been promoted by discoveries and inventions, since the first great International Exhibition in London in 1851.

VI. A further object of the Exhibition will be the "history of prices." It is intended to bring together, from the chief and largest manufacturing districts, the prices of the more important articles, dating as far back as possible, and placed side by side in average periods of five to five years, and illustrated by patterns and samples.

VII. In order to bring under view the international exchange of products, an attempt will be made at a representation of the commerce and trade of the world. For this purpose, samples and patterns of the articles of trade and commerce of all important harbours and ports are to be exhibited, with information as to the sources of supply and the respective markets for them, the quantity of import and export, the prices, &c., as also by statistical details and graphic representations of the extent of the navigation and commerce of the respective seaports during the last ten years.

VIII. It is, moreover, intended to realise the idea expressed in the preceding paragraph—viz., to facilitate the study of the Exhibition by figures and graphical representations in all the departments of the Exhibition, in such a manner that the economic progress which the several States have made since the first great International Exhibition in London in 1851, shall be illustrated by official data.

For instance, the statements showing the area of arable land, and land under cultivation, the quantity of the annual produce of the soil, its price, the value of the land, the rate of interest, railways, number of population, &c., as they were at each time of the successive International Exhibitions (1855, 1862, and 1867), shall be placed side by side, so that in this manner the power of material production of the several States may be made visible in a tabulated form in those portions of the Exhibition building which will be assigned to that purpose.

On the other hand, all particulars relating to the single subjects exhibited, such as the names of the exhibitors, description of the articles, their price, &c., (the specification of which is, however, quite optional), are to be attached to the respective articles.

In the same manner other details, the publication of which is desired by the exhibitors, and instructive to the public (for example, the history, extent, and gradual growth of an establishment, the amount of annual production, and all such other details as are usually contained only in catalogues), shall be multiplied by printing or in writing and attached to the objects exhibited, and so brought under the notice of the visitors.

IX. In order to make the Exhibition lastingly profitable, trials shall be made with new or little known modes of manufacture, and experiments with such objects the value of which can only be demonstrated by such a process, as, for instance, trials as regards the management of cellars (heating of wines, application of the hydro-extractor, &c.), trials with working machines of all kinds, application of the electric light, utilising of aerostation, experiments in blasting, trials with steam-ploughs, locomotion by the application of wire ropes, street locomotives, steam fire-engines, &c. In this respect lectures will be held in the Exhibition building, and international prize problems issued (as, for instance, the best appliances for the cultivation of beet-root).

X. Arrangements will be made for temporary exhibitions of such articles which by their nature do not admit of an exposition of long duration. They will comprise living animals (horses, cattle, sheep, pigs, dogs, fowls, game, fish, &c.); dead fowls, game, deer, meat, fatty substances, &c.; produce of the dairy; fresh fruit, vegetables, flowers, live plants injurious to agriculture and forests. Trials will also be made to test the strength, &c., of useful animals. International races will be arranged for horses sent to be exhibited, at which prizes will be awarded. Representations of all other kinds of sport, and the performance of popular games and plays are likewise included in the plan. With the temporary exhibitions practical attempts will be combined to discuss and solve questions connected therewith—as, for example, practical trials will be made with the produce of the dairy, as to the best modes of churning and of making cheese. In order to enable the visitors to test the quality of the articles of food exhibited, testing halls will be erected, in which the exhibitors may allow visitors to taste their articles in a prepared state upon payment.

XI. During the time the Exhibition is held, international congresses are contemplated for the discussion of important questions, to which either the Exhibition itself may give rise, or which may be specially suggested as themes suitable for international consideration. More especially is it intended to hold international congresses of learned men and artists, of gentlemen of the scholastic and medical professions, of representatives of museums of art and industry, of teachers of drawing, engineers, architects, representatives of chambers of commerce, of members of banking and insurance companies, of agricultural and forestry societies, as well as of mining and metallurgical companies. Subjects for discussion will be the following:—

The question of literary property; the improvement of taste; extension and development of the instruction in drawing; the perfection of all modes of transport; the question of obtaining the highest attainable profitable working of machines; cultivation of foreign statics; reduction of the price of articles of food (by increased productions, improvement of marketing affairs, reform in the kitchen, new modes of preserving, &c.); the nourishment and first training of children; the exertions made in our age in regard to therapeutics; the education of women, and extension of their sphere of employment, &c.

XII. The arrangement of the Exhibition will be geographical, that is to say, according to countries, but in such a manner that the different territories of production shall appear as nearly as possible in the same order as they are situated naturally in the direction from the west to the east.

XIII. With reference to such objects which admit of a classification in several of the groups specified in Paragraph II., it is left to the option of the exhibitor to name the group in which he desires his articles to be placed.

XIV. An international jury will be nominated to pass judgment on the merits of the articles exhibited. Each exhibitor has to signify whether he wishes his productions to be submitted to the decision of the jury or not. In the latter case, his exhibition will be marked "*Hors concours.*" The distinctions awarded by the jury will consist of the following categories:—(*A*), for works of plastic art, the distinction will be in the form of an "artistic medal;" (*B*), for all other objects exhibited, the distinctions awarded will be as follows:—(*a*), to exhibitors who have already taken part in previous exhibitions, for the progress which distinguishes their production since the last International Exhibition at which they were exhibitors, a "medal of progress;" (*b*), to exhibitors who contributed to an International Exhibition for the first time, as an acknowledgment of the merits which they are in a position to show, either in a national, economical or a technical point of view, the "medal of merit;" (*c*,) all exhibitors whose productions satisfy, either in respect of colour, shape, or external embellishment, the requirements of refined taste, are, moreover, entitled to the medal "for refined taste;" finally (*d*,) corresponding to the "honourable mentions" of former Exhibitions, diplomas of merit will be awarded; (*C*,) workmen who, according to the statements of exhibitors, have had an essential share in the excellence of the productions exhibited, shall be awarded in recognition thereof the "medal for fellow-workers," (*D*,) the merit which single persons or corporations have gained in the promotion of popular education; the advancement of national economy, or by their special care for the intellectual, moral, and material welfare of the working classes, shall be presented in acknowledgment with "honorary diplomas."

XV. The details respecting the execution of the Exhibition, the composition and mode of procedure of the jury, as well as the compilation and issue of catalogues, the drawing up of reports, &c., will be embodied in the general and respective special regulations.

Art-Exhibition at Constantinople.—A scheme is on foot for holding a native exhibition at Constantinople next autumn. It is said to be favourably entertained by the Grand Vizier.

Exhibition at Vicenza.—An exhibition is announced to be held at Vicenza in the course of the autumn, which, besides agricultural and industrial products, will embrace works of art. The products of the Austro-Hungarian empire will also be admitted, and will be allowed to enter Italy free of duty.

International Exhibition at Turin.—A meeting was lately held at Turin, by the promoters of the international exhibition that was intended to have taken place in that city on the occasion of the opening of the Mont Cenis Tunnel, but which was indefinitely postponed on account of the Franco-Germanic war. After a long discussion as to whether this exhibition shall be held or not, and whether it shall be international or merely an exhibition of national produce, a commission was formed to decide on the merits of the various proposals.

Exhibition at Monza.—In this age of exhibitions the little town of Monza, with the laudable desire of keeping pace with her neighbours, is now holding an exhibition, which, however, is confined to the products of the agriculture and industry of the district of which it is the centre. This exhibition was opened on the 3rd of September, under the patronage of the Minister of Foreign Affairs, Signor Visconti-Venosta, who, in the absence of the Minister of Agriculture, presided at the ceremony of inauguration. The fruit, flowers, and vegetables, which the principal gardens of the Brianza have largely contributed, make a very good show. The cotton industry of the district is also well represented, and the prize in that section has been awarded to the firm of Funiagalli and Pizovano, of Monza. In the section allotted to agriculture, implements, and machinery, the gold medal has been carried off by the well-known firm of Baner and Co., of Milan, who have contributed a large collection of implements and machinery used in Northern Lombardy. The agricultural section makes a good show of cereals, amongst which may be mentioned some fine samples of wheat, exhibited by Professor Galanti, of Milan. The products of sericulture are also worthy of note. Amongst the others represented in the exhibition may be mentioned the furniture, upholstery, leather, gilt picture-frames, stuffed birds, and articles of female work. The show of cattle is, however, very poor.

THE MONT CENIS TUNNEL.

The Mont Cenis Tunnel was opened formally on September 17th. In addition to the various accounts of the progress of the work that have, from time to time, appeared in the *Journal*, the following statistics, supplied by the correspondent of the *Standard*, will be found interesting. The facts and figures are all taken from official sources:—

"In the calculations made when the perforation of the Alps through the Col de Tréfus was first seriously contemplated, the length of the tunnel was set down at 12,220 metres—a metre is to a yard as 99 is to 90, so that they have only to add a tenth to any computation I may give in metres, and then multiply by three, to arrive at the result stated in feet. The mouth of the tunnel at Bardonnecchia was calculated to be 1,335·38 metres above the level of the sea; at Fourneaux, 1,202·82; and the culminating point between the two, 1,338·45. The maximum height of mountain strata overhead was stated at 1,610 metres, or nearly an English mile. Experience has verified these calculations, the facts since ascertained with rigid accuracy differing but imperceptibly from the anticipation. In one sense, however, and that, perhaps, the more correct one, the tunnel is 13,446·32 metres in length, as I will explain in a few words. In order that the workmen at both ends should meet in the middle, it was neccessary that the tunnel should be rectilinear; but this straight line does not commence immediately at either end. In order to leave the two extremities open for ventilation and the various exigencies of the service, two curved galleries were made, one at the southern end, 757·07 metres long; one at the northern end, 453·70 metres. Thus, when one looks at the ornamental archways of which I have spoken in my former letters, one is not looking straight into the rectilinear tunnel. That view is to be obtained at some little distance away. The geological strata that had to be pierced, proceeding from Modane to Bardonnecchia, may be stated in the following order:—A sandy mica and schist mixed up together, quartzite, chalky dolomite, and, finally, calcareous crystalline schist, alternating with argillaceous schist. Of the means of piercing these various strata I have already given you the outline. It may be well to ask how the body of water required to compress the air, which was ultimately the motive power of the perforating machines, was obtained at Bardonnecchia from the torrent known as the Melezet, and at Modane from the Arc, which I have had occasion so many times to mention. I fear I should be considered to be trespassing upon the tasks more suited to scientific journals than to a daily newspaper, were I to enter into a detailed description of the methods by which the water was made to keep up a constant supply of compressed air, the compressed air made to move the piercing, scooping, and perforating tools, and then last, again, to do their important work. But it ought not to pass unmentioned, that when in the winter months the water at the Fourneax end was insufficient for the purpose, the ever-active mind of the lamented Sommeiller came to the rescue, and saved almost incalculable expenditure and delay by the invention of a tubular hydro-pneumatic compressor.

It will interest many to see the extraordinary rate at which the yearly progress made in the tunnel increased from 1857 to 1870, and I therefore transcribe the following official figures:—

	Metres.
1857	38·08
1858	459·52
1859	369·10
1860	343·30
1861	193·00
1862	243·00
1863	802·00
1864	1,087·85
1865	1,223·70
1866	1,024·99
1867	1,512·11
1868	1,320·15
1869	1,431·45
1870	1,635·30

Here we have almost a steady increase of progress, varied only by stubbornness of the matter to be got rid of. The expense, as may be imagined, was considerable; yet, looking to the vastness and novelty of the undertaking, it seems less than might have been expected. By the bill dated August 15th, 1867, and passed by the Sub-Alpine Parliament, the government was to contribute 41,400,000 lire, and the Victor Emmanuel Railway 20,000,000. After the session of Savoy and Nice, France had to undertake the payment of 19,000,000 francs, on condition that the work was completed in twenty-five years; but a further contribution was to be made by the French exchequer of 500,000 francs for every year less than twenty-five that the work should occupy, and of 600,000 for every year less than fifteen. By the energy and expedition with which the task has been completed, the Italian treasury has been considerably lightened of its financial obligations in the matter. The whole expense of the undertaking is calculated at 75,000,000 lire, or £3,000,000 sterling."

THE WOOLLEN TRADE IN FRANCE.

The following letter, published in the money article of the *Times* of 27th September, relates to the revival in the woollen manufacture of France and its probable influence on the Australian trade:—

"Sir,—An autumn tour through the north-eastern districts of France may be made with a two-fold object. There is much to interest those who desire to follow the course of the recent war, upon which abundant materials yet exist to show its marvellous character, and to illustrate the rapid manner in which a country can recover from misery and devastation. There is, however, a series of facts of peculiar importance to the wool-grower, for it is from these parts that new life has been given to that industry, the Australian staple having been in unusual demand; it has consequently, largely increased in marketable value, which must have important effects on English commerce.

"At Sedan and in its neighbourhood there are large woollen manufactories, but it is at Roubaix and Rheims that the Australian wools are mostly required. These towns are now in the utmost activity, the looms in full employment, and the workpeople in almost happy forgetfulness of their recent troubles. I stood, at their hour for dinner, in one of the most central positions of Sedan, and the squares and streets which, twelve months since, were crowded with soldiers, were now occupied by moving masses of men, women, and boys, emerging from every factory, rejoicing in their labour and their rest, getting their daily bread by honest industry; and I was told they are rapidly paying off the debts incurred during the period of wasteful idleness. The same result is found in the other towns where the industry of the people is being again developed.

"The inquiries into this great activity led to the following points of information:—

"1. There has been, on the part of the French manufacturer, a great scarcity of wool, necessarily because purchases ceased during the war, and the looms were out of occupation.

"2. The return of peace has led to the almost immediate resumption of trade, and the consequent restocking of factories and warehouses.

"3. There has, since the war, been a considerable change in the fabrics used for apparel. The ladies have, to a large extent, instead of wearing silk, taken to woollen dresses or mixed materials in which wool is largely used; and I dare say, if the subject were closely followed, other changes in dress, in material, and in fashion would be found to exist.

"4. The French Government, in their financial requirements, have given some excitement to the trade. It was expected that the new tariff would impose an *ad valorem* duty as high as 20 per cent. on the import of 'raw wool;' hence the dealer laid in heavily of stock. He has since found that the impost will not exceed 3 per cent.; but although there may be more cautious buying than was the case two or three months since, the wants of the trade are still heavy, as well for home purposes as for the distant markets for fine French cloths, which include Cashmeres and almost all materials, except silks and cottons in ladies' dresses.

"These are important present advantages to wool growers and importers. The great question to the Australian colonies, however, at their distance from the seats of consumption is, will these results be continuous? After recent experiences, both political and commercial, it would be most unwise to reckon confidently on anything, still less on prices, which are proverbially as 'unstable as the waters.' There are, however, some features known in France which may guide to sound conclusions. Remembering that the argument is as to wools of long staple, and suitable to 'long combing' purposes, it is asserted that the Australian article is, even at the recent prices, cheaper than the best German wool, the latter having declined, while the former has increased in value—the Australian wool being at all times preferred on account of its peculiarly valuable qualities. Even for mixing purposes it is found infinitely better, and has properties in which the German article is almost entirely deficient.

"The resumption of peace has developed another peculiarity of this industry. Without asserting that the French have lost the art of manufacture, it is well understood that fine woollen goods are being largely made in Sweden, in Russia, and in Austria. These countries now compete for the Australian wools, those from Victoria being most in favour for ladies' materials, those for South Australia and Queensland for fabrics employed in men's garments, flannels, and the heavier articles of manufacture. The great depôt is Belgium, and the station at Verviers is often crowded with wool for the countries in the north of Europe.

"The general conclusions I have made are, that the increase of price is sound, derived from a legitimate trade, and arising from an improved manufacture; that other countries than France are now alive, not only to the value, but the making of first-class woollen goods, and that at present no country can distance the Australian colonies in the production of the raw material now in demand, not only in Europe but in America, where it is known that the manufacturers are keenly alive to the competition going forward in the wool markets of the world. The results of my observations are at your service, and they may, perhaps, have an interest not only in England but in Australia, where the wool growers have long had a checkered career from bad seasons and low prices.

"I am, Sir, your obedient servant,

"W. P.

"Mayence, September 21."

CORRESPONDENCE.

RESOURCES OF INDIA.

Sir,—The following agricultural statistics of the Madras Presidency, showing the acreage under each kind of crop, for the revenue year from 1st July, 1869, to 1st July, 1870, are taken from the "Adungal," or cultivation account of each district:—

The entire area of the Presidency comprises 143,380 square miles, or 91,750,000 acres, about one-fourth of which, or 37,780 square miles, are zemindary, from which no agricultural returns can be obtained, leaving 105,600 square miles, or 67,500,000 acres under ryotwarry settlement (including Inam land and villages) to be accounted for.

Of these 67,500,000 acres, 23,882,000 were under the following crops—2,500,000 acres lying fallow; the remaining 41¼ millions is mountain and hill tract, swamp, sand-hill, unenclosed pasture-land, and unappropriated culturable waste:—

	Acres.
Food-grains, &c.	20,088,000
Oil-seeds of various kinds	1,018,000
Green and garden crops	336,000
Topes and orchards	397,000
Cotton and indigo, &c. (special crops)	2,043,000
Total	23,882,000

Showing that by far the larger area was under food-grains, viz., twenty million acres against less than four million acres under all the other products.

Food-Grains.—The 20,088,000 acres of food-grains were under the following crops, viz.:—

	Acres.
Cholam	4,855,000
Raggy	1,611,000
Wheat	23,000
Varagu	1,605,000
Cumbu	3,197,000
Corralu	1,018,000
Millet (of various kinds)	614,000
Pulses, grains, &c. (for cattle)	2,023,000
Total	15,365,000

The remaining four millions consisted of rice.

Oil Seeds.—Of the 1,018,000 acres under this description of seeds, the following acreage was under crop of the various kinds; and the value of the exports of this class of product in 1869-70 was upwards of £5,000,000:—

	Acres.
Rape (all grown in Tinnevelly)	50,000
Castor oil (chiefly in Coimbatore)	67,000
Gingelly, &c. (chiefly in Godavery)	870,000
Coriander (most in Kistna)	31,000
Total	1,018,000

Green and Garden Crops, yielding a total 336,000 acres, consisted of:—

	Acres.
Sugar cane (largest quantity grown in Bellary, next in Ganjam and Cuddapah	29,000
Potatoes (chiefly in Coimbatore and Neilgherries)	4,000
Chillies (largest crop in Kistna)	70,000
Mulberry (for silk cultivation at Coimbatore)	3,000
Tobacco (chiefly in Kistna and Coimbatore)	75,000
Other vegetables, &c. (in most districts)	112,000
Cheyroot and other dyes (Bellary and Tanjore)	10,000
Betel leaf (throughout most districts)	16,000
Plantain gardens (largest in Tinnevelly)	17,000
Total	336,000

Topes and Orchards, consisting of 397,000 acres of the following fruits, &c.:—

	Acres.
Cocoanut plantations (chiefly in Malabar)	218,000
Areca ,, ,, ,,	43,000
Palmyra ,, ,, Bellary)	10,000
Tamarind (chiefly in Bellary and Chingleput)	29,000
Mango (chiefly in Ganjam)	27,000
Jack and other trees (chiefly in Malabar)	70,000
Total	397,000

Special Crops.

	Acres.
Cotton	1,714,000
Indigo	267,000
Hemp and flax	23,000
Coffee, tea (Neilgherries and Malabar)	39,000
Total	2,043,000

Bellary grew the largest crop of cotton, Cuddapah of indigo, and Godavery of hemp, &c.

N.B.—No land is laid down for pasture; the cattle are grazed on fallows and unenclosed waste land.

I am, &c.,
A. Romaine Wragge, Lieut.-Col.

Old Charlton, September 18th, 1871.

NEW BOOKS.

The Theory and Practice of the Metric System of Weights and Measures, by Professor Leone Levi, F.S.A., F.S.S., &c. Griffith and Farren, St. Paul's-churchyard. One shilling. The purpose of this little work is to give a complete history of the rise and progress of the metric system, as well as the principle upon which it is based, the advantages accruing from its use, and a complete explanation of the decimal scale, and the enumeration and application of the various measures of length, surface, capacity, and volume, embraced by the system, as also the equivalents of imperial and metric weights and measures. The historical portion of the book informs us that, though the system was definitely fixed and settled in France in 1799, the first manifestation of the want of such a system in England was at the International Exhibition of 1851, when it was found that the vast variety of products collected from all regions of the earth had their values and quantities reckoned by all sorts of different standards. It was not, however, till the close of the International Statistical Congress, held at Paris in 1855, that an International Association was formed for the promotion of one uniform decimal system of weights, measures, and coins. This association, after studying the comparative claims of the different systems in use throughout the world, resolved in favour of the metric, on account of its scientific and international character, and thenceforth it gave itself to the advocacy of the same, in preference to any other of a narrow and local application. The Metric Committee of the British Association for the Advancement of Science was nominated in 1863. Urged both by the defective state of the law at home and by the demands for general uniformity among all countries, a Committee of the House of Commons was appointed in 1862 (on the motion of the late Mr. William Ewart), to consider the practicability of adopting a single and uniform system of weights and measures, with a view not only to the benefit of our international trade, but to facilitate our trade and intercourse with foreign countries. The Committee, in its report, recommended that the use of the metric system should be rendered legal; that the government should sanction its use in the levying of Custom duties and in public contracts; that the gram should be used as a weight for foreign letters and books at the Post-office;

that in the public statistics of the country quantities should be expressed in terms of the metric system; that in private Bills the use of such a system should be allowed, and that the same should be taught in all schools receiving grants of public money. Following this report, Mr. Ewart, in the session of 1863, introduced a Bill in the House of Commons for the establishment of the metric system, which was read a second time by a majority of 110 to 75; but the session being too far advanced to carry it through any further stage, it was withdrawn. The year after, the same Bill was again introduced, and once more the second reading was carried by a majority of 90 to 52. At this stage, however, her Majesty's government, which had hitherto resisted the change, consented to the passing of the Bill, if altered from a compulsory to a permissive measure; and, certain alterations having been introduced by the President of the Board of Trade, the Bill passed into law, providing that, "notwithstanding anything contained in any Act of Parliament to the contrary, no contract or dealing shall be deemed to be invalid or open to objection on the ground that the weights or measures expressed or referred to in such contract or dealing are weights or measures of the metric system, or on the ground that decimal subdivisions of legal weights and measures, whether metric or otherwise, are used in such contract or dealing (27 and 28 Vict. c. 117)." Another Bill was in consequence introduced in 1868, providing for the compulsory use of metric weights and measures after a number of years, which was again read a second time by a majority of 217 against 65. But the impending dissolution of the House and the pressure of the Reform Bill prevented its further progress. And in the session of 1871, the same measure has once more been introduced in the House of Commons, by Mr. J. B. Smith, M.P. In 1870, the Royal Commissioners appointed to inquire into the condition of the standards of weights and measures, after full inquiry, reported "that the time has now arrived when the law should provide, and facilities be afforded by the government, for the introduction and use of metric weights and measures in the United Kingdom." And the Educational Code of 1871 prescribes "that in all schools, the children in Standards V. and VI. in arithmetic should know the principles of the metric system, and be able to explain the advantages to be gained from uniformity in the method of forming multiples and sub-multiples of the unit." There is, therefore, now every prospect that the metric will speedily become the standard weights and measures of the United Kingdom, and any further resistance to what is universally recognised to be a great improvement would be unworthy of a great nation. The following is given by Professor Levi as a list of the countries that have adopted the metric system:—France, Netherlands, Belgium, Greece, Spain, Portugal, Italy, Roumania, North German Confederation, Wurtemburg, Bavaria, Baden, Austria, Switzerland, Norway, Chili, Equador, Uruguay, Brazil, Argentine Confederation, United States of Columbia, Peru, Venezuela, the United States, and British India. The following extract is from the chapter showing the advantages of the metric system:—"*To Education.*—The International Decimal Association sent a circular to schoolmasters asking what time is now spent in teaching arithmetic in schools, and what would be the probable saving of time that would accrue from the introduction of the metric and decimal system. The returns obtained showed that more than half the time now spent would be saved by the introduction of the metric system. And what does that mean? The teaching of arithmetic now absorbs fully a third of the time expended in elementary education, or one year out of three. Supposing the saving of only six months' teaching, calculated on 2,000,000 children under education, it will amount to 1,000,000 years for every generation of children. And consider the saving in money. The sum now spent in the United Kingdom in elementary education, including government grants and school pence, is upwards of £2,200,000 per annum. Allow that only a third of that sum is expended for arithmetic, or about £750,000, a saving of half will amount to £350,000 a-year. The reason, indeed, is very plain. We have it in the Rev. Mr. Kerr's analysis of educational argument in favour of the reform as follows:—'There is nothing more difficult in elementary education than the thorough commission of our tables to memory, nothing so hopeless as their perfect retention, nothing to be compared with them as sources of error. The metric system dispenses with all that is troublesome in the operation of reduction. To reduce from the highest denomination of length to the lowest, the French arithmetician throws the decimal point seven places to the right. We, for a similar purpose, have to multiply by the set of numbers, 8, 40, 5½, 3, 12, 8, or 10. To see the simplification and shortening of school work thus effected, let any of us recall our earliest experience in the rule of three. The metric system dispenses with all that is peculiar to the operations of compound addition, subtraction, multiplication, and division, as distinguished from the corresponding simple operations; it leaves hardly any place for the operations of practice; it prescribes the method of decimal multiplication in interest, a method which is often the best even in our arithmetic, though at the disadvantage of preliminary and final reductions; in short, it provides for the management of concrete numbers, in all practical questions, by the same principles and forms of operation that apply to abstract decimals. The metric arithmetic is much more easily learnt than ours, for it presents no gratuitous difficulties. The four fundamental rules extended to decimals, a few simple propositions in vulgar fractions and the rule of three; these are sufficient under the metric system for the solution of all questions that occur in common life.' *To Science.*—Great advantage would result to science by the adoption of one uniform system of weights and measures in all countries. Professor Owen, in a speech addressed to the President of the Board of Trade, when on a deputation on the subject, said, 'The majority of the facts in natural history include the elements of weights and measures. An English anatomist and physiologist gives the weight of the brain, lungs, &c., in relation to the weight of the body of some rare animal which he has had the opportunity to examine; the foreign physiologist desires to reduce the English weights to those of his country. If the kind of weights used by the Englishman be not specified, viz., avoirdupois or troy, the description is useless to the foreigner in regard to the important constants of the proportion of parts or organs to the whole body. Similar difficulties are experienced as regards linear measures. And although when the system of weights and measures is noted by the observer, its reduction or the finding the equivalent in another system may be a small demand upon his time, yet the repetition of that act takes a serious amount from the working hours of the individual; and when multiplied by the number of observers, obstructed by conflicting systems of weights and measures, the impediments to the progress of sciences of observation become so great as to render the subject quite worthy of the consideration of the Legislature.' The metric system, when used in science, is specially adapted to express the data of experiences or observations. Men of science already use it exclusively, even in countries where another system prevails. And in the absence of a universal language, the universal adoption of the metric system will go far to render the data of science everywhere intelligible, understood, and applicable. *To Commerce* the metric system produces economy, not only in the number of clerks employed, but in the extent of their aptitude. In countries which have systems of measures of a complicated character, the clerks employed in commercial offices require a special knowledge for calculation. Where the metric system exists, these calculations become easy to a more extended class of persons, and those who are better instructed are reserved for higher and more important duties. Consequently, the simplification of operations produced by the introduction of the metric system practically reduces the expenditure of every ton of merchandise, and effects a decided economy. If we could calculate the enormous mass of merchandise that modern commerce puts in motion, we should see what economy of expense and labour would be thereby obtained. Besides the economy of time, there is the diminution of chances of fraud; for certainly, just in proportion as the means of exchange rest on simple and intelligible bases, so one is enabled easily to protect his just rights and to see for himself if the party with whom he deals gives him the exact quantities of the goods purchased. And, when we come to international trade, how enormous would be the advantages resulting from the avoidance of the necessary conversion of the weights and measures of different countries. Certainly it would bring with it simplification of accounts, diminution of clerks, augmented rapidity and efficiency of work, and diminished chances of error. The merchant, moreover, would be better able to keep himself informed of the current prices in foreign markets, and thus trade and intercourse with the most distant nations would be thereby promoted. *To Agriculture.*—The Chambers of Agriculture and Farmers' Clubs have for a considerable time complained of the extreme difference of practice in the weights and measures used in different markets of the United Kingdom for the sale of grain and other agricultural products and manures, and a committee of the Central Chamber of Agriculture recommended that grain should be sold by the 100 kilograms or by the quintal. The Devon Chamber, in its petition to Parliament, showed that the increasing dependence of the United Kingdom upon foreign countries for the supply of corn, flour, oil-cake, rendered it increasingly desirable for the British agriculturist to be able easily to understand and compare the prices current in the foreign as well as in the home markets. *To Mechanics and Contractors.*—The extended substitution of iron for stone or timber has greatly changed the condition of labour. The old measures and their subdivisions were adapted to the wants of the times when they were established. But now, in metallic or other works, a much greater precision has become necessary; and, since the old measures have no such small divisions, it has been found necessary to create them. In Russia, for example, where the measure does not descend lower than $\frac{1}{4}$ or $\frac{1}{8}$ of a verhook, that is, 0·0055 millimetre, it became necessary to divide the sagene into thousand parts of two millimetres each. In England, the inch is divided into eighths, sixteenths, and thirty-seconds for some purposes, and into tenths for others. It is a great advantage of the metric system in mechanical valuations that, if we know the specific gravity of an article, we may arrrive at its weight by its volume. A cubic metre of water weighs 1 ton or 1,000 kilograms, and is also one kilolitre in capacity; therefore, if it were required to ascertain the weight of a mass of rock, measuring, say, six metres long by three metres wide and two metres deep, the product of these, 36, is at once the weight in tons, and also the contents in kilolitres of a vessel of water of these dimensions. Multiply this again by the specific gravity of the rock, and it will give at once the weight of the mass of that rock. How different in the imperial system. The inch has no simple decimal relation to the pound weight. In ship-building, it is a special advantage to have an unit which bears an exact proportion to a ton of water. Neither the inch nor the foot gives any convenient fact in relation to it, for a ton of water consists of 35·955 cubic feet, and the long decimal fraction is so inconvenient, that Mr. Scott Russell said he had been led to get rid of it, by adding so much salt to the water as should make 35 cubic feet weigh exactly the ton. Another important advantage of the metric system is, that it leaves less chance of error from the misreading of figures. Mr. Robinson, of the Atlas Works, gave an illustration of this. Take the dimension of 1325 milimetres, whether the decimal point is inserted after the figure or not, no mistake can arise in the operation of the workman, because 1325 are the same as 1m. 325mm. Suppose even that by accident the decimal point should be inserted after the 3, the difference between 13m. 250mm. and 1 m. 325 mm. would be so great that the mistake would be immediately manifest. But if, on the contrary, in the present system a careless draughtsman inserts the figure 12 instead of 1 foot 2, the difference of 2 inches is so small that probably no error would be detected; and every one using an English rule of 2 feet in length must have experienced the liability to mistake 1·7 for 17 inches, or 1·5 for 15 inches, the combination of the figures 1 and 7 and 1 and 5 causing confusion, when dimensions are hastily or carelessly taken. It is well known that in making engineering or mechanical drawings, plan-scales, being reductions of the natural sizes, are employed for the purpose of saving space and promoting convenience of transmission. At present these scales vary, according to the whim or convenience of mechanical draughtsmen, between $\frac{1}{8}$ in., $\frac{1}{2}$ in., 1 in., $1\frac{1}{2}$ in., and 3 inches to the foot; so that, in measuring off the full size, a considerable diversity of multiples must be used. If, on the other hand, the decimal system proposed were adopted, nothing would be easier than the reading of the full-size from the scale-drawing—1·50 representing either the full size of 1m. 50c., or 1 decim. 50mm., or 1c. 5mm., according to the scale of the drawing expressed upon it, the mere alteration of the position of the decimal point giving the desired full size on the scale dimension. *To Chemistry and Pharmacy.*—Chemists and pharmacists accustomed to deal with the minutest quantities find in the decimal notation, especially in the gram and its decimal multiples and submultiples, an invaluable auxiliary, and they use them to a large extent. The British Pharmaceutical Conference memorialised the General Council of Medical Education and Registration, praying that the metric equivalents of the English weights and measures be given in every formula of future editions of the 'British Pharmacopœia.' The council were restrained from the use of two systems, lest it should lead to error, but gave instruction for making test solutions for volumetric estimations in metric weights and measures, as well as in the imperial. *To the Postal Service.*—Certain branches of the public administration which have special relations with foreign countries, such as the Post-office, would greatly benefit by the adoption of the metric system. In the Post-office, the price of transporting letters and despatches bears a proportion to the weight, and each country has therefore a tariff fixing a series of weights side by side with a corresponding series of prices of transport. Now the scales of two nations which have not the same system of weights and measures are necessarily different. They may approach very near to each other, but they cannot correspond altogether, because each of them includes only the usual and practical subdivisions of the systems in use, which do not coincide with those of the neighbouring nations. Consequently, letters, the weight of which is found to be between the two degrees of the same order in each scale, are in an uncertain position, and are generally subjected to one or other of these tariffs, according to the place where the payment is made, or according as the letter goes from one country to the other, or according as the letter is pre-paid or not. A postal convention was recently concluded between Great Britain and France, which fixed the minimum charge for a letter of the weight of ten grams addressed from France to England, and the same for the weight of one-third of an ounce from England to France. But this new weight is equivalent to nine and a half grams of metric weight (exactly 9·44985); and ten grams, the assumed equivalent in France of one-third of an ounce are equal to 0·35274 oz., being eight and a-half grains (8·49015) in excess of one-third of an ounce. The metric postal weight is, in fact, heavier than its nearest imperial equivalent by five and a-half per cent. Much better would it be to adopt the metric weight of ten grams as an international arrangement, than to introduce a new weight, which, though nearly equivalent, is not really identical."

GENERAL NOTES.

Hill Settlements.—In extension of the application of the hill resources in India, European volunteer corps are being established at Mansee and Nynee Tal.

The Decimal System in Austria.—The Austro-Hungarian government have at last resolved to adopt the decimal system throughout that empire, and that measure is to become legal after the 1st January, 1873.

Engineering Schools in Italy.—The number of engineering schools (or as they are termed, schools of application for engineers) in Italy are three. During the scholastic year 1868-69 the number of diplomas granted was 656, being 395 at Milan, 79 at Naples, and 182 at Turin. At the University of Padua there is also a course of engineering, but only two diplomas were granted during the above-mentioned years. The total number of students entered on the books of these schools during the scholastic year 1869-70 was 567, of whom 190 were registered at Turin, 135 at Naples, and 242 at Milan.

Commerce of the United States.—The returns of the foreign commerce of the United States for the past fiscal year have been completed, from an advanced slip of which, furnished by the Bureau of Statistics, we make the following analysis. The figures represent gold values:—Imports, 1869-70, 462,377,587 dollars; exports, 1869-70, 451,162,417 dollars. Imports, 1870-71, 541,493,774 dollars; exports, 1870-71, 541,504,172 dollars. Of the total trade for the fiscal year ended June 30, 1871, it will be seen that the exports exceeded the imports by 10,398 dollars, while for the fiscal year ended June 30, 1870, the imports exceeded the exports to the amount of 11,415,170 dollars. The following table shows the relative amounts of the foregoing, which consisted of merchandise, and specie, and bullion, respectively:—1870-71. Merchandise—Imports, 519,593,750 dollars; domestic exports, 428,529,017 dollars; foreign exports, 14,401,270 dollars. Specie and bullion—Imports, 21,900,024 dollars; domestic exports, 84,505,256 dollars; foreign exports, 14,038,629 dollars. The value of foreign commodities remaining in the warehouses of the United States, June 30, 1871, was 68,324,855 dollars, against 56,930,841 dollars, June 30, 1870. In consideration of the fact that the imports into the United States during the past fiscal year exceeded those of the preceding year by 79,016,187 dollars, it is not surprising that the value of foreign goods remaining in bond at the close of the year should have shown an increase of 11,394,014 dollars. That the country has had the ability to consume over 520,000,000 dollars, in addition to the immense amount of its own products, speaks well for the financial condition of the great mass of consumers. The comparative amounts of the total trade for the fiscal year June 30, 1871, carried in American and foreign vessels respectively, compared with the previous year, were, in mixed values, as follows:—American vessels, 1869-70, 352,969,401 dollars; ditto, 1870-71, 353,304,172 dollars; foreign vessels, 1869-70, 638,927,488 dollars; ditto, 1870-71, 755,822,645 dollars. It will be seen that while the American flag barely held its own in 1871, foreign flags increased their per-centage of traffic heavily. The foregoing figures show a substantial increase of the foreign commerce of the country, which is largely due to the increase of production, and the consequent improvement of the financial condition of the masses, but there is no increase in the carrying trade by American bottoms.

Trade in Skins at Bari.—From returns published by the Chamber of Commerce at Bari, we learn that the number of skins sold in that city, in 1870, was as follows:—600,000 lamb, 250,000 kid, 16,000 horse, 8,000 wild cat, and 3,500 martin's skins.

New Safety Poison Bottle.—The object of the inventors of this bottle is to render it at once distinguishable to the hand, so that if taken up in the dark no mistake could arise. The invention is a very simple one. It consists of a number of conical projections from the surface of the phial, so arranged that it is impossible to grasp it without being reminded of the nature of the contents. A poison bottle of this kind may be alike usefully employed in dispensing and in the sick chamber. The inventors are Messrs. Lynch and Co., 171A, Aldersgate-street, E.C.

A Census of Factory Hands.—Some idea of the magnitude of the interests involved in the textile industry of the United Kingdom may be gathered from the fact that the number of persons actually employed in the mills, factories, and works, now falls little short of 1,000,000. Including printing, bleaching, and dye works, with other auxiliary processes, the exact number of persons in the 7,545 establishments of Great Britain and Ireland, according to a recent publication of Messrs. Redgrave and Baker, the Factory Inspectors, was, last year, 973,267, the larger half being females, namely, 563,077, the males amounting to 410,190. They were thus distributed through the various branches of employment:—

Factories in 1870.	No.	Number of Hands employed.		
		Males.	Females.	Total.
For spinning and weaving—				
Cotton	2,483	178,397	271,690	450,087[*]
Wool	1,829	63,143	61,987	125,130
Shoddy	120	1,906	1,910	3,816
Worsted	630	43,094	66,463	109,557
Flax	500	38,096	86,676	124,772
Hemp	35	1,442	1,708	3,150[*]
Jute	63	4,372	13,198	17,570
Silk	696	13,987	34,137	48,124
Hair	37	745	1,594	2,339
Lace	224	5,998	2,372	8,370
Hosiery	129	4,594	5,098	9,692
Elastic web	61	2,759	1,864	4,623
For embellishing the fabrics, &c—				
Calico printing	96	20,051	5,475	25,526
Other print works	53	4,144	638	4,782
Bleaching and dying	439	23,904	7,523	31,427
Calendering, &c.	150	3,558	744	4,302
Total	7,545	410,190	563,077	973,267

The return issued for 1868, gave only 401,064 persons as engaged in the cotton mills. Their prosperity is shown by the addition of 49,000 hands in the course of two short years. Indeed, within a trifle, King Cotton gives as much employment as he did immediately before the American war, when 451,569 toiling subjects owned his sway. This was in 1861. In wool there has been a slight diminution of briskness as compared with 1868; about 2,000 fewer hands being engaged. In worsted, however, the falling-of is more serious; 22,000 hands less than in 1868. But the woollen trade between 1861 and 1868 was enormously stimulated by the cotton famine, and the complete revival of Lancashire's staple has naturally depressed it somewhat. The silk mills are doing better, having work for 7,000 more hands than they could use two years ago. The flax mills are employing 5,000 more persons than they did in 1868, and 37,000 more hands than in 1861. Putting gains against losses, and striking the balance, we ought to be well content. The total of the hands engaged in all kinds of spinning and weaving in 1868, was 858,000; the corresponding return for 1870 was 907,000.

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[*] In the official return there is an error of 1,000 in the total under cotton, as well as in the total under silk. The figures above are corrected accordingly.

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FRIDAY, OCTOBER 6, 1871.

All communications for the Society should be addressed to the Secretary, John-street, Adelphi, London.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.

By Dr. Crace Calvert, F.R.S.

Lecture I.—Delivered Tuesday, February 7th.

Red Colouring Substances.—Madder.

This well-known tinctorial substance may still be considered as the most important of all the dye-stuffs employed by calico printers, owing to the brilliancy of the colours, and their permanence under the action of light and soap, and the wear and tear which fabrics so died can sustain, as well as on account of the variety of shade and colour that can be obtained; one dyeing operation being sufficient to produce pinks, reds, purples, violets, puce, and black; and, notwithstanding the competition that madder colours have met with of late years from aniline dyes, I believe the quantity of madder consumed in England is quite as great at the present day as ever it was.

The employment of madder-root as a dye dates from the most ancient times, as is proved by the Egyptians using madder-dyed fabrics to wrap round their mummies. The Greeks and Romans were acquainted with it under the names of *Erythrodanon* and *Rubia*, and their modes of fixing it on cotton fabrics were the same as those now employed, namely, aluminous salts for producing reds, and salts of iron for purples and blacks.

The plant which produces madder is an herbaceous one, and is called *Rubia tinctorium.* It bears a yellow flower, and a dark red berry fruit. The red colouring matter exists almost entirely in the cortical part of the root, little or no colour being found either in the epidermis or in the ligneous or centre part of the root. M. Decaisne and M. Edouard Koechlin have shown that the colouring matter in the fresh root is yellow, and becomes red under the oxidising influence of the atmosphere. The same process goes on, to a certain extent, in the roots of the plant when they are allowed to remain several years in the ground, especially in chalk formations. In France, the roots are allowed to remain in the ground two or three years; in Turkey and the East, from five to seven. In the latter countries and in Naples, they are dried in the open air, but in Holland and France stoves are employed for this purpose. Naples and Turkey madders are imported in the root, and are known in commerce as Naples and Turkey roots, while those from France and Holland are ground, and sold under the name of French and Dutch madder.

One hundred parts of fresh root yield on perfect desiccation twenty parts of dried substance. The roots as imported always contain sixteen or eighteen per cent. of water; the fresh roots, therefore, give 24 or 25 per cent. of commercial madder. Dutch and Alsacian madder, after being ground, is stored in large casks, and kept for two or three years, when the colouring matter is developed, and its tinctorial power is much increased; if, however, it is kept five or six years, further changes ensue, and its value seriously decreases. French Avignon madder can be employed at once, although the quality is much improved by keeping it one or two years. The best Avignon madders are grown on lime formations. The roots that have a red colour are called *palus*, and those that are pink *rosées;* the former being considered the finest. The value of these madders is in ratio to the fineness of their powder, the finer powder containing the most colouring matter.

The nature of the chemical changes occurring in madder during the time it is stored, and which so much improves its commercial value, was entirely unknown until the elaborate and interesting researches of Dr. Ed. Schunck, F.R.S., published in the year 1851. He succeeded in isolating a peculiar ferment called *Erythrozym*, which possesses the property of decomposing a substance called by him *Rubian.* Rubian may be considered as a glucoside (this name being given by chemists to compounds of sugar with other organic principles), and is decomposed by erythrozym into a peculiar sugar and *Alizarine.* Whether there are in the rubia-root several glucosides which unfold themselves respectively into sugar and one of the colour-giving principles, or there is only one glucoside, and its colour-giving principle as it is liberated gets successively oxidised into alizarine, purpurine, &c., is not yet satisfactorily determined. Still, this valuable discovery of Dr. Schunck has thrown much light on the subject, and has led to several important commercial improvements, to which I shall call your attention as I proceed. One hundred parts of dried madder-root consist of—

Soluble in cold water	55 parts.
Soluble in boiling water, and which contains the greater part of the colour-giving principles..................................	3 ,,
Soluble in alcohol	1·5 ,,
Fibrous matter	40·85 ,,

I shall make no remark on the gum, mucilage, pectine, pectic acid, and pectates which the rubia-root contains, but state that the water extract contains also the yellow colouring-matter discovered by Kuhlmann in 1824, and called by him *Xanthine;* but this colour has never received any commercial application, from its want of brilliancy. Water also dissolves another colouring principle called *Chlorogenine,* which is decomposed by weak acids into sugar and a brownish green matter. Both these colouring substances are sources of annoyance to the calico printer, as they render very difficult the obtaining of pure whites in printed goods, and they dim the brilliancy of the shades produced by the combination of alizarine and purpurine with the mordants. Further, the cold water dissolves the sugar contained in the root, and on the Continent it is transformed into alcohol. The yield of alcohol varies with the nature of the root, and ranges between 7 and 10 lbs. per cwt. of root. This fact shows that there is from 10 to 15 per cent. of sugar in the root.

Messrs. Julian and Roquet have based on the above facts a commercial process for preparing a purified madder, which they call *fleurs de garance,* of which several million pounds are now manufactured in France per annum. It not only yields brighter colours than the original madder, but, as it does not soil the white parts of prints, its use saves the printer much soap and labour. To prepare the fleurs de garance, the madder is mixed with eight or ten parts of water, and left for three or four days at a temperature of 75 to 80° Fahr., when fermentation ensues, transforming the sugar of the root into alcohol, which is collected. The madder, deprived of all soluble substances, is dried, and ready for use. A hundred parts of madder yield from 55 to 60 per cent. of fleurs de garance. I may state, *en passant*, that the injury which Dutch and Alsace madders sustain when kept too long in casks is doubtless owing to the fact that, after the erythrozymic fermentation is completed, an alcoholic and lactic one sets in, which acts injuriously on the colour-giving principles.

I now proceed to lay before you the outlines of two interesting processes for extracting commercially the two useful colour-giving principles, *Alizarine* and *Purpurine.*

The first is due to M. Leitenberger, and is based on the fact that pupurine is soluble in water at 130°F., whilst alizarine only dissolves at 170°F. He mixes madder with water, and heats the whole gradually, by means of a jet of steam, at 130°, at which temperature it is maintained for some time. The liquor is then run off and filtered. To the clear solution, lime, or, still better, baryta, is added, when a lake precipitates. This is washed and mixed with hydrochloric acid. The purpurine thus liberated is thrown on a filter, washed, and is ready for use. The madder remaining from the above operation is dried and heated in close vessels with wood spirit, which dissolves the alizarine. This extract, thus obtained, after being concentrated by distillation, is ready for use. A hundred parts of root yield from two to three per cent. of purpurine, and four or four and a half per cent. of alizarine.

The second process, that of Professor Emile Kopp, is based on another discovery of Dr. Schunck, namely, that weak acids acts upon rubian in the same manner as erythrozym, unfolding it into sugar and alizarine. M. Kopp found, some years since, that sulphurous acid dissolved the glucosides of purpurine and alizarine, and applied this observation as follows: — 600 lbs. of Alsace madder are macerated for 12 or 15 hours with 800 gallons of a weak solution of sulphurous acid, to which is added one-thousandth part of hydrochloric acid, to neutralise the earthy carbonates existing in the root. This operation is repeated three times. To the liquors, three per cent. of sulphuric acid are added, and the whole heated to a temperature not exceeding 140° Fahr., when red-coloured flakes separate and gradually deposit, which, when washed and dried, are commercial purpurine. The liquor is then carried to the boil for a couple of hours, and allowed to cool, when a dark green powder is found deposited in the vessels, which, when washed and dried, is commercial alizarine.

This process has been carried out by Messrs. Schaaffer and Lauth for many years, and no doubt yields a larger amount of colour-giving principle than M. Leitenberger's method, the glucosides being doubtless more completely decomposed by the acids than by water alone. It has the further advantage of obtaining the colouring matters free at once, which have only to be washed to be ready for use.

The dyeing power of the alizarine thus obtained is equal to 40 times its weight of madder, or 10 times that of garancine. These colouring substances, except green alizarine, are not substituted for madder in the dyebeck, but are printed on the cloth and steamed, as will be described further on.

M. Kopp found that his green alizarine is a mixture of alizarine with chlorogenine; and that this latter body can be separated by treating the mixture with a light oil of tar, having a boiling point of 300° which dissolves the chlorogenine. Alizarine is employed in the production of rich purples, whilst purpurine is used for reds and pinks.

Before describing pure alizarine and purpurine, I may state as a fact very interesting, although of no commercial value, that if superheated steam be passed over a preparation of madder known as garancine, pure alizarine is volatilised, and may be easily collected.

Pure crystallised alizarine was discovered, in 1824, by MM. Robiquet and Colin, by treating madder with strong sulphuric acid, when they produced a black mass, which they called "charbon de garance," and which, on being heated at a moderate temperature, yielded crystals of alizarine.

In 1851, Dr. Schunck succeeded in isolating from madder a substance to which he gave the name of *rubian.* This he effected by filtering a hot decoction of madder on pure animal black, which is washed with cold water to remove chlorogenine. The washed charcoal is boiled repeatedly with alcohol, and the alcohol solution evaporated to dryness. The dry mass is dissolved in water, and acetate of lead added, which gives rise to a precipitate. This precipitate, when acted on by sulphuretted hydrogen, gives pure rubian in solution. When rubian is acted on, either by erythrozym or weak acids, it is decomposed, yielding, according to Dr. Schunck's paper, alizarine and water; according to M. Schützenberger, alizarine and glucose, or grape sugar.

Pure alizarine sublimes, at a temperature of 460° Fahr., into pale orange prismatic crystals. When slowly crystallised from an ethereal solution, it forms a hydrate, containing two equivalents of water, which crystallises in lustrous scales. Cold water dissolves a mere trace of alizarine, but its solvent power increases as the temperature is raised, as may be seen from the following figures:

At 212°	100 parts of water dissolve	·034
At 400°	,, ,, ,, ...	·820
At 480°	,, ,, ,, ...	3·160

Alizarine is freely soluble in alcohol, ether, wood spirit, benzole, turpentine, sulphuret of carbon, and glycerine. It is soluble without decomposition in sulphuric acid, even at a temperature of 400° Fahr., and is thrown down unchanged when large quantities of water are added. It is soluble in a warm solution of alum, but insoluble in a cold one. It has been assigned different formula by different chemists, the two most generally adopted being that of Dr. Schunck, $C_{14} H_{10} O_4$, and that of Wolf and Strecker, $C_{20} H_{12} O_6$. Alizarine gives a purple colour with a weak solution of caustic alkali, which undergoes no change by the action of air. It yields, with alumina fixed in fabrics, a variety of red and pink shades; with oxide of iron it gives purples and blacks; and, with a mixture of these two oxides, chocolates.

I shall now call your attention to one of the most interesting and important discoveries of chemistry, as applied to manufactures, which have been made of late years, namely, the artificial production of this most important colour-giving principle, alizarine, or of a substance which, if not identical, has great similarity to it. Messrs. Graebe and Liebermann, and Mr. Perkins, believe in the identity of the artificial product with the natural one. But this is denied by M. Alfraise, on the grounds, first, that the formula given by Messrs. Graebe and Liebermann does not agree with that given by Dr. Schunck, as is shown by the following figures:—

Schunck.	Graebe and Liebermann.
$C_{14} H_{10} O_4$	$C_{14} H_8 O_4$

Secondly, that the artificial alizarine does not give the same coloured sublimate as the natural alizarine; and thirdly, that if both these substances are acted on by nitric acid, natural alizarine is converted into phtalic acid, whilst the artificial alizarine, which he calls alizapurine, yields a large quantity of a nitro-compound having an intensely bitter taste, mixed with only a mere trace of phtalic acid. These observations of M. Alfraise have been confirmed by M. Kopp. That the commercial artificial alizarine is not identical with a natural alizarine is rendered still more certain by the researches of

Dr. Schunck, who, on examining a sample obtained from Mr. Perkins, found it to contain a large quantity of a compound crystallising in yellow, silky needles, anthraflavic acid, and which he obtained by treating Mr. Perkins's product with alcohol. On treating the acid with fuming nitric acid he obtained a nitro-compound, the potash salt of which he describes as resembling picrate of potash. This is doubtless the bitter principle which Alfraise obtained, but did not study. Dr. Schunck gives the formula of anthraflavic acid as $C_{15}H_{12}O_4$ and considers it homologous to alizarine, one equivalent of its hydrogen being replaced by methyl. Messrs. Graebe and Liebermann, and Mr. Perkins, found their opinion as to the identity of the two alizarines, on the fact that they give the same absorption bands on being submitted to Professor Stoke's spectrum test.

Artificial alizarine was first made in 1869, by Messrs. Graebe and Liebermann. The substance from which they obtain it is *Anthracene*, a body discovered by Professor Anderson, of Glasgow. Anthracene is one of the last products passing over in the dry distillation of coal-tar, and is found most abundantly in the 10 or 15 per cent. which comes over from the temperature where soft-pitch is formed, and that where hard pitch is produced. The quantity of anthracene in coal-tar varies greatly; it is most abundant in the tars obtained from those coals which yield most naphtha. The South Staffordshire coals give the largest quantity, whilst the Newcastle coals give very little. Its extraction can only be carried on with advantage in cold weather, as it becomes very soluble on a slight rise of temperature in the oily homologues which accompany it. At a temperature of about 40°, the distillate above described is semi-fluid; it is placed in a hydro-extractor, and the oily fluid separates from the solid matter, which is then submitted to cold and hot pressure. The cake thus formed is pulverised and carefully washed with petroleum spirit, having a boiling point of about 180°, which leaves anthracene moderately pure. This powder dissolved in alcohol and crystallized, yields anthracene in nearly white scaly crystals, or in a fit state for the manufacture of artificial alizarine.

Messrs. Graebe and Liebermann oxidised the anthracene ($C_{14} H_{10}$), by nitric acid, into anthrachinon ($C_{14} H_8O_2$), this being again converted into bibrom anthrachinon ($C_{14} H_6 Br_2 O_2$), which, by fusion with potash, is changed into alizarine ($C_{14} H_8 O_4$.) There are three patents published, and a process, the details of which are kept secret. It is curious to notice that the patent taken out by the above-named gentlemen and Mr. Caro is dated the 25th of June, 1870, while Mr. Perkins entered his on the day following, in which nearly the same processes are described, merely employing different oxidising agents.

The following is an outline of one of the processes detailed in the specification of Messrs. Caro, Graebe, and Liebermann:—One part of anthracene is heated with four of sulphuric acid, of sp. gr. 1·845, for three or four hours, to a temperature of 212° Fahr., and then for an hour at 300°. The mixture is allowed to cool, and to it is added water equal to three times the weight of anthracene taken, and manganese equal to four times that weight. The whole is boiled for three hours, and a milk of lime is then added, which gives rise to a deposit, consisting of the excess of lime and manganese used, and protoxide of manganese, while there remains in solution a double sulphate of anthrachinon and lime. This solution is now acted on by carbonate of soda in slight excess, carbonate of lime separates, and the salt of soda thus produced is evaporated to dryness. To this solid mass is then added two or three parts of caustic potash or soda and a small quantity of water, and the whole heated under pressure, in suitable vessels, at a temperature of 350° to 500° for one hour, when the anthrachinon is further oxidised, and converted into alizarine. This anthracene, $C_{14} H_{10}$, gives anthrachinon, $C_{14} H_8 O_2$, and this alizarine, $C_{14} H_8 O_4$. The alkaline mass, on cooling, is dissolved in water, and sulphuric or acetic acid added in slight excess, when an orange-yellow flocculent substance precipitates, which, when properly washed and dried, is artificial alizarine.

The second colour-giving principle of madder, to which I have referred several times already, is called purpurine, and was also discovered by MM. Robiquet and Colin, in 1828. Although in commerce it is sold as a red powder, as has been mentioned above, still, by heating at a temperature of 480° Fahr., it can be obtained in the form of feathery crystals, of an orange-red colour. It is more soluble in water than alizarine, especially at a temperature of 140° Fahr., and is also soluble in the menstrua already mentioned under alizarine. Further, it gives a red colour with caustic alkali, instead of purple as alizarine, It is soluble in a cold solution of alum, while alizarine is not. When fixed on fabrics, its colours do not stand exposure to light as well as those of alizarine.

Professor Stokes, of Cambridge, has found a most elegant method of discovering and characterising mere traces of these colouring principles. So delicate is the test, that the colouring matter on one square inch of dyed fabric is sufficient to obtain the results. He treats the fabric with a solution of carbonate of soda, which dissolves the colouring matter. The solution is then introduced into a small tube, which is placed before a slit in the shutter of a dark room. The light which passes through is decomposed by a prism, when a spectrum is produced. The operator will observe that, when purpurine is taken, there are principally two black bands formed by the absorption of light in the green part of the spectrum, having between them a band of green light, whilst alizarine exhibits, on analysis, a band of absorption in the yellow, and another narrower one between the red and the orange.

Professor Schützenberger, by treating commercial purpurine successively with alcohol and benzine, unfolded it into four different substances, to which he assigns the following formulæ:—

Alizarine ...... $C_{20} H_{12} O_6$
1 Purpuroxanthine $C_{20} H_{12} O_6$ or $C_{20} H_{14}O_6$.
2 Purpurine .... $C_{20} H_{12} O_7$ or oxy-alizarine.
3 Orange matter.. $C_{20} H_{16} O_9$ or hydrate of purpurine.
4 Pseudopurpurine $C_{20} H_{12} O_9$ or oxy-purpurine.

I shall now call your attention to a very remarkable discovery, recently made by the late Professor Bolley, viz., the conversion of purpurine into alizarine. If purpurine is heated in the atmosphere, as stated above, it is nearly all sublimed, leaving only a small amount of carbonaceous residue, but if heated in sealed tubes, at a temperature of 400°, it forms a carbonaceous mass from which water extracts alizarine. Under the influence of the high temperature, the purpurine loses an equivalent of oxygen, and is converted into alizarine. This reaction appears to confirm the opinion of M. Decaisne, that the madder plant contains only one colour-giving principle, which under the oxidising influence of the atmosphere becomes converted, first, into alizarine, then purpurine, and afterwards into the still more highly oxidised compounds.

The difficulty and expense experienced by calico-printers in brightening their colours, and obtaining pure whites in madder-dyed goods, attracted many years ago the attention of scientific and practical men, and any process by which these difficulties might be overcome was anxiously looked for. The discovery of MM. Robiquet and Collins, that the colour-giving principle was not destroyed by sulphuric acid, was the step in that direction, and led M. E. Schwartz to observe that the carbonaceous mass of Robiquet, if carefully washed and neutralised, could be used as a dye-stuff. MM. Lagier and Thomas improved upon this, and introduced, in 1839, an article which is now extensively used by calico printers and named garancine, and now is prepared as follows: — Madder, either unwashed, or, better still, washed with cold water, is mixed with one-third of its weight of sulphuric acid, which has been previously diluted with water till it marks 10° Twaddle; it is then boiled for four or five hours, and the mixture run on to woollen filters, and washed till only a mere trace of acid remains. It is then either removed or washed once with a very weak solution of carbonate of soda, submitted to hydraulic pressure, and then introduced into drying stoves. One hundred parts of madder yield from 34 to 37 of garancine. Garancine is a fine powder of a light brown colour, and has a dyeing power four times as great as the original madder. It does not give as good blacks as madder, nor are its purple, red, and pink so fast, but its purple is brighter, and the whites are obtained pure without soaping, it being only necessary to substitute a slight clearing liquor, composed of an alkaline, hypochlorite of soda, to which is added a small portion of sulphate of zinc.

In 1852, Messrs. Pinckoff and Schunck effected an improvement in the manufacture of garancine, their product being known in England under the name of commercial alizarine; but on the Continent it is better known as *Pincoffine*. Their process consists in submitting ordinary garancine to the action of high pressure steam of a temperature of 300° F., which, whilst it does not act on the alizarine contained in the garancine, destroys two other colouring matters which are present. These Dr. Schunck has isolated and examined, and named *Rubertine* and *Rerantine.* They are of a peculiar resinous nature, and spoil both the whites and the purples, which are fixed along with alizarine in the dyeing process. The employment of commercial alizarine is especially advantageous in the production of purples, which are faster and more brilliant than those produced by ordinary garancine. The cloth also does not require either soaping or cleansing.

M. Pernod has, within the last two or three years, introduced a madder extract, which is at the present time extensively used in Lancashire as a topical colour. This term is applied to a colour which is printed on a fabric, and afterwards fixed by steaming. By this method bright and fast colours are introduced in printed goods, producing much more effective designs than could be effected if the goods had to pass through a dye-beck and afterwards be washed with large quantities of water. Some splendid specimens of this class of printing were to be seen at the last Universal Exhition, 1867.

To prepare the extract, garancine is lixiviated till completely exhausted, with a nearly boiling solution of sulphuric acid, containing five parts of acid to a thousand of water. On cooling, an orange red precipitate falls to the bottom of the vessel, which, when collected and thoroughly washed, constitutes an extract ready for use. The products of M. Leitenberger and Messrs. Schaaffer and Lauth may be substituted for this extract.

As the employment of these extracts is the most important improvement recently introduced into calico printing, I will give the three following recipes for their application:—To produce dark red, take 8 lbs. of extract of madder, 4 lbs. acetic acid, and 1¼ lbs. starch. Boil these in an earthenware vessel, and when cold add to six measures of the above one of acetate of alumina and a very small quantity of Gallipoli oil, say 1 per cent. For a pale red, take 4 lbs. of extract of madder, 2 lbs. of acetic acid, 10 quarts of gum Senegal water, and 1 pint of acetate of alumina. To obtain a purple, take 1 pint of extract of madder, half pint of acetic acid, half pint of water, and 3 ozs. starch; boil, and when the mixture is cool, 5 ozs. measure of acetate of iron of 24° Twaddle, and 5 ozs. of water. To produce a chocolate, proceed as in the last recipe, substituting acetate of chrome for the acetate of iron.

The above mixtures are printed on cloth by means of engraved copper rollers, and are then dried and submitted to dry high-pressure steam for one or two hours, when the colours have become fixed on the fabric. After being slightly soaped, to remove all excess of colour, the prints are stiffened, and ready for the market.

Although I have now concluded my lecture on madder as a dye-stuff, and have already exceeded the time allotted to me, I hope you will allow me a few minutes more, to enable me to give an outline of the processes by which madder styles are produced, the more so as there may be some persons present who are not aware how madder and garancine prints, now manufactured in such enormous quantities and in such general use, are produced.

To effect this, the ordinary white calico, as sold in shops, is not sufficiently deprived of its impurities to be employed in madder or garancine styles; it has therefore to undergo further bleaching operations. The calico so extra bleached is then printed by means of copper rollers, on which the pattern to be produced is engraved. This roller leaves on the calico a red, purple, or chocolate mordant; that is, for red, a sulpho-acetate of alumina, or red mordant; for purples, violets, and blacks, an impure acetate of protoxide of iron, known in the trade as pyrolignite of iron, or black liquor; and for chocolates a mixture of these two mordants.

After this operation the pieces undergo a process technically termed ageing. This was formerly effected by spreading out the pieces, and hanging them in a room for three or four days, so that the acetate of alumina might lose part of its acetic acid, and the iron mordant nearly the whole of it, thus liberating the oxide of iron and enabling it to undergo partial oxidation.

Some few years ago, Mr. David Thom introduced a process by which this is effected in twenty minutes; it consists in passing the printed mordanted cloth over rollers fixed in a machine placed in a chamber about twenty feet long, in which a current of air and steam is thrown. The temperature of this chamber must not be below 100° nor above 108°, and the quantity of steam present must be such that fifty yards of calico will take up one ounce of moisture during the twenty minutes it takes to pass through the chamber. The printer is able to test the state of the chamber by means of wet and dry bulb thermometers. The next operation to which the cloth is submitted is dunging. The process received this name because formerly the calico was passed through a mixture of cow-dung with water. Now, however, silicates or arseniates of soda, mixed with a little chlorate of potash, are substituted. After passing through either of these solutions they are washed, and ready to be passed through the dye-beck. This beck contains water, and from five to seven pounds of madder, or one to two and a half pounds of garancine, or commercial alizarine, for each piece of calico to be dyed. The heat of the bath is then gradually raised, by means of a jet of steam, to 180° for garancines, or 212° for madders. This operation takes from one and a-half to two hours, according to class of goods, style, &c. The fabrics are then washed and passed through a cleansing liquor for garancine or commercial alizarine styles, or soaped twice at 180° when they are dyed with madder.

The most permanent and brilliant colour produced from the rubia plant on cotton fabrics is Turkey red. The details so essential to success in dyeing this colour are kept by each dyer a secret, but I will attempt, as briefly as possible, to give the main features of the process. After the bleaching of the fabric is completed, they are passed through Gallipoli oil, and then exposed to the atmosphere in heated chambers. This operation is repeated several times. The next one consists in passing the cloth through a weak alkaline solution. After this they go through a solution of acetate of alumina, and then through a bath of a tannin substance. By these processes, no doubt, the fatty acids of the oil combine with the alumina, as does the tannic acid of the tannin matter, helping to fix the mordant in the fibre of the fabric. On being dyed, the goods assume a rich, dark red tone, to which brilliancy is imparted by passing the dye fabric through heated soap solutions.

I should occupy too much of your time were I to attempt to enter into the details of the methods by which chemists determine the relative tinctorial powers of roots, madders, and garancines, but I may give you a very simple method of detecting ordinary adulterations of garancine by dye woods and tannin matters. Pieces of blotting paper are dipped into a weak solution of chloride of tin and sulphate of protoxide of iron, and on each of these sheets is sprinkled a little of the suspected garancine. If a dye wood be present, the chloride of tin paper will assume a red colour, and if tannin matter be present, the iron paper will be blackened.

ANNUAL INTERNATIONAL EXHIBITIONS.

The first exhibition of the series inagurated this year closed on Saturday last, September 30th. The closing was marked by no greater ceremony than the performance of God save the Queen, performed at six o'clock, by the London Madrigal and Glee Union and the band of the Royal Artillery Company, in the Albert-hall, which was filled, everywhere but in the private boxes, with an attentive audience, and who, at the conclusion of the National Anthem, volunteered some hearty cheers.

The *Times*, in chronicling the close, says:—"The course of the International Exhibition has been such as fairly to entitle its secretary, and all other persons concerned in its management, to congratulate themselves upon a positive success. Although it has never attracted the crowds of visitors that flocked to the Great Exhibitions of former years, yet its galleries have always been filled in a manner that indicated much quiet and genuine appreciation of their contents. The total number of visitors by payment has been more than a million (1,039,186), and 102,968 visits by holders of season tickets raise the gross total to 1,142,154. The greatest number of visitors on any shilling day was on Whit-Monday, when the tale reached 21,946; and the least number was on Friday, the 18th of August, when it fell to 5,198. The week ending on the 19th of August shows a smaller total than any other, amounting to only 35,843; and during the last week the number rose to its highest point, 80,429. The crowd of Whit-Monday and the falling-off of visitors at the close of the London season may surely be conjointly accepted as evidence that the display has been popular with classes widely remote from each other in social station, and every day's experience would serve to confirm such a conclusion. The skilled artisan of London has been only scantily represented; but there have been numerous arrivals from the provinces of people in the humbler walks of life, and the lower middle class of the metropolis has furnished visitors by thousands. At the same time, the Exhibition on Wednesdays was fairly entitled to take rank as a place of fashionable resort; and even on the shilling days rows of coronetted carriages might be seen in waiting at its entrances.

"In all matters of arrangement, the success attained has been very remarkable, and has been due, in great measure, to the military administration. The Exhibition has, in fact, been constructed, organised, and governed by the corps of Royal Engineers. The sappers, under the command of their officers, have done all but the mere masonry, from fixing the gas-jets of the Albert-hall to feeding and attending on the wool-producing animals. The whole work of receiving, exhibiting, and guarding the contents of the building has been carried out by them, or under their immediate direction and control; and they are now about to undertake the removal of the several exhibits. Their work, although felt only remotely by the public, in the order and harmony which it produced has really been extremely arduous, and it was not at all unusual for all hands to be on duty for from 12 to 15 working hours in the day. The new and varied experience gained by the soldiers cannot fail to render them more efficient in their own calling; and the cheapness of military labour has been an important element in the calculations of the Commissioners.

"The money-takers at the entrances were all pensioned ex-members of the Metropolitan Police, and the effect of their presence was to turn back the known thieves and bad characters who were attracted to the Exhibition by the hope of plunder. During the whole six months not one case has occurred to call for the intervention of a magistrate, and no charge of any kind has been made against a visitor.

"The financial success has long been declared, and it has enabled the Royal Commissioners to devote a sum of £2,000 to the purchase of selected articles for the nation.

"The following return shows the number of articles rejected in each class, and the per-centage of rejections to the numbers submitted:—

"Division 1.—Class 1—Number rejected, 939; per-centage on number submitted, 33 (paintings, &c.,). Class 2—Number rejected, 450; per-centage on number submitted, 40 (sculptures, &c.,). Class 3—Number rejected, 352; per-centage on number submitted, 46 (engravings, lithographs, &c.,). Class 4—Number rejected, 232; per-centage on number submitted, 57 (architectural designs). Class 5—Number rejected, 111; per-centage on number submitted, 39 (carpets, tapestries, &c.,). Class 6—Number rejected, 116; per-centage on number submitted, 40 (designs, decorative manufactures). Class 7—Number rejected, nil; per-centage on number submitted, nil (copies of pictures, mosaics, &c., reproductions). Division 2.—Class 8—Number rejected, 217; per-centage on number submitted, 2 (pottery). Class 9—Number rejected, 368; per-centage on number submitted, 21 (woollen and worsted). Class 10—Number rejected, 530; per-centage on number submitted, 14 (educational works and appliances). Division 3—Number rejected, 126; per-centage on number submitted, 22 (scientific inventions and new discoveries). Unclassed—Number rejected, 11. Total number rejected, 3,452; total per-centage on number submitted, 15.

"The experience of 1871 will, doubtless, be rendered useful by the officials in many ways, and will enable them, on future occasions, to anticipate occurrences that have been sources of trouble during the present year. On the part of the public, we may ask for a more careful discharge of the editorial duties of the management. It is essential to the comfort of visitors that the catalogues and official reports should be issued in time to serve as guides, and that they should be framed upon some uniform model. The reporters of 1871 had manifestly no concerted plan of operations, and no agreement as to the limits of their various departments, or as to whether they should discuss principles or details. On another occasion, the reporters should hold a preliminary meeting, under the presidency of their editors, and should arrive at a definite understanding upon such points as these. Their labours would thereby be greatly lightened, and their reports would be much more profitable to those for whose benefit they are intended.

"A concession which would be greatly valued would be the abolition of the extra payment for admission into the Horticultural Gardens. The conduct of the public has this year been so exemplary, and the omnipresent turnstile and toll-taker have been such nuisances to everybody, that this small boon may be sought from the Commissioners with some hope of its being favourably considered.

"As regards the actual closing, there is but little to record. The galleries were well filled, but not so well so as on former days; and at half-past four, a charming performance by the London Glee and Madrigal Union, attracted large numbers of people to the Albert-hall. At five minutes before six, the military bands commenced the National Anthem, and the clear notes of Miss Jane Wells, as she sang its last solo, formed the *finale* to the first London International Exhibition. The curtain had fallen, and the audience dispersed."

EDUCATIONAL COLLECTION.

Miscellaneous Work Done in Prisons, Industrial Schools, and Reformatories.

The report on this section is by Captain E. F. Du Cane, R.E., Surveyor-General of Prisons, who begins by pointing out wherein the interest of this collection consists:—

"There are still found many who doubt of the precise advantages that are conferred on the poorer classes, by offering to them—or forcing upon them—a higher literary or intellectual education; but nobody doubts that they ought to be able to earn their own livelihood by work, and it is quite clear that those who cannot do so must either starve or steal, or by some means live upon the industry of others. The objects, then, here exhibited as the products of industrial instruction in reformatories, industrial schools, and convict prisons, are such as have been either executed by children who have been arrested on their way before having to make a choice so fatal both to themselves and to society, or by children or adults who, having fallen, from one cause or another, into the ways of crime, have been afforded (while in prison for the expiation of their offences) the opportunity of acquiring or practising such skill and habits of industry as may, at all events, give them a fair opportunity, when they come out of prison, of living legitimately by their own industry, instead of by preying upon that of other people.

"It is obvious that much of the work which may be, and actually is, taught in the various establishments which carry out these objects, is not such as can well be brought up to London for exhibition, and this especially applies to the operations of farming, building, and public works, with the many industries connected with large engineering operations, which are the most important and most lucrative of the works carried on in these establishments, and which afford such complete means of carrying out the ideas above referred to, as well as to such useful work as that done in training ships, where boys learn to fit themselves for following a seafaring life; but it is to be regretted that the industries carried on in prisons and reformatories abroad are not included in this Exhibition, for considerable attention is paid to this subject in most foreign countries, not always, it is to be feared, with any view to beneficial action on the inmates of those institutions, but solely, in too many cases, for the purpose of reducing the expenses of maintaining them, the other and higher objects being often almost entirely neglected.

"There are three classes of institutions which, in Great Britain and Ireland, are wholly or partially devoted to the attempt to prevent the development of the criminal classes, by subjecting to industrial training those who might be tempted to join them, or by the same means to reclaim those who, having joined them, have subjected themselves to the penalties of the law. These are—1. Reformatories, Industrial Schools, and Refuges, which are not aided by the State; 2. Certified Reformatories and Industrial Schools; 3. Prisons.*

"The first of these are maintained entirely by private efforts, and they work only by persuasion, or by consent, or by desire of the parents and guardians. The number of the institutions in the United Kingdom, under various names, not certified, connected with the Reformatory and Refuge Union (including penitentiaries) is 165, with accommodation for 8,915.

"The certified reformatory and industrial schools are equally carried on under private management, but they undertake certain duties for the State in regard to young people who are, or are likely to become, offenders against the law. They are subject to government inspection, both as regards the buildings and establishments, and also as regards the rules by which they are governed. They are also assisted by the State, which contributes in this year (1871-72) the sum of £243,830.

"The Industrial Schools Act, passed in 1866, provides that a child under fourteen, who is, from certain specified causes, apparently likely to develop into a criminal, may be sent to, and forcibly detained in, a certified industrial school; and a child under twelve, if charged with a punishable offence, may also be sent to one; moreover, parents or guardians who cannot manage their own refractory children, may also dispose of them in a similar manner by consent of the justices, and the Treasury will contribute 2s. a-week each for their maintenance. The reformatory schools, carried on under an Act also passed in 1866, are similar in character to the industrial schools, but they take an older class of offenders (those under sixteen years of age), and such as have actually been convicted of crime rendering them liable to imprisonment or penal servitude."

The total number of certified reformatories in Great Britain and Ireland, and their cost, appears, by the reports of the inspectors for 1869, to have been 72, with 6,315 inmates, the total cost being £136,135. Of certified industrial schools there were 82, with 7,345 inmates, maintained at a cost of £138,407; altogether, 154 certified institutions, containing, on 31st December, 1869, 13,660 inmates, and costing £274,542 per annum. To show the increase in these establishments, it may be added that, on 31st December, 1857, there were in Great Britain, in the certified reformatories, only 2,323 inmates.

"There can be no doubt of the extreme usefulness of these institutions, whether maintained by public or wholly by private resources, or of their high influence in checking the growth of crime. Removal from the bad influences by which such children are surrounded, is alone a great step towards the attainment of the desired object. Instruction and training in the arts which enable them to take their place among productive labourers is a further step, and the good work is, as far as possible, completed by putting them out in life in such position as will favour the development and proper utilisation of the training they have received. This last step is, perhaps, the most difficult of all. In this crowded country the struggle for existence is sometimes very keen, and it requires not only ability to work, but good principle to resist the temptations which sometimes seem to offer an easier manner of attaining the desired end.

"The most perfect solution of this difficulty, and that which gives the best security that the efforts for reclaiming the young offenders will not be thrown away, is the transplanting of them by emigration to other countries where there is less keen competition, and where temptations to crime are less effective because steady industry is sure to find an ample reward, and, in fact, for the most part, pays better than a life of crime.

"At the present time, when we have been deprived of the great resource for the disposal of our adult convict prisoners which transportation offered, and are obliged to absorb them on discharge among the community, to encounter again all the difficulties, dangers, and temptations which in so many cases may lead them back to their former courses, and so to develop a criminal class at compound interest, it may be well to direct some attention to the subject before the evil has taken too deep root.

"The present course of legislation and of public policy is directed principally to the hunting down of the criminal. It would be fair, and also politic, to combine with this the offer to the incipient criminal of such opportunities as emigration would afford of escaping entirely from the difficulties by which he is likely to be surrounded.

"The two classes of institutions I have described are represented in the Exhibition principally by the objects collected by the Reformatory and Refuge Union—a society which has been established for the purpose of undertaking the very useful duty of combining and assisting to direct the efforts of all who are engaged in work of this nature. Eighteen out of a total of 319 such institutions show specimens of the work carried on in them. Seven of the remaining ten institutions which exhibit, but are not affiliated to the Reformatory and Refuge Union, carry on their operations in Ireland. There is considerable similarity in the class of work exhibited by all—tailoring, shoemaking, and brushmaking for the boys; knitting, needlework, and basketmaking for the girls."

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* To these should be added the industrial homes attached to prisons, such as those connected with the Wakefield House of Correction, where every discharged prisoner, male and female, is received and taken charge of.—*Ed. of the Reports.*

It appears that the prisons are represented by the work which was executed in the government prisons. No county or borough prisons have sent any specimens of the manufactures they carry on. Upon this subject, Captain Du Cane says:—

"Considerable difficulty attends the selection of suitable employment for a large number of our prisoners, both male and female, on account of the conditions with which it must be carried on. 1. In all county and borough prisons, and in those government prisons in which the early part of a sentence of penal servitude is carried out, the requirements of punishment and discipline necessitate that each prisoner should be kept in isolation in a cell. This condition at once excludes all those employments in which the workers act in concert with one another. 2. The work must not require any considerable amount of skill, as the time which a prisoner passes under sentence of this nature is not generally sufficient to allow of the practice necessary to enable such skill to be acquired. 3. It should be sufficiently healthy, and the articles made should be such as can be readily disposed of. In the government prisons, so far as possible, the inmates are employed in doing work required for the supply of the various departments of the government service, and specimens of such work are exhibited."

All the mats required for public offices are made at Pentonville or Millbank. The clothing for the prisoners themselves is made and repaired in the prisons, and so are the shoes and boots, shirts, &c. A good deal of weaving is carried on. They make now the uniforms of the prison officers. There is shown a specimen of boots made by convicts at Parkhurst for the Metropolitan Police, who are also supplied with gaiters made in convict prisons. [The saving of cost by making these articles in convict prisons has supplied funds which have been used for increasing in various ways the efficiency of the police.] Our soldiers also are furnished with socks knitted by the female convicts in Woking Prison, and this kind of employment is also found most suitable for aged and infirm male prisoners, of whom the number is not inconsiderable.

Some blocks of mosaic pavement, made by female convicts at Woking, are somewhat remarkable as samples of a successful revival of an ancient art, possessing great artistic merit, and to it the name *opus criminale* has been applied at South Kensington. It is composed of fragments of refuse marble, such as is thrown aside in marble work. The mode of manufacture is as follows:—"The pattern which it is intended to produce is traced on a board, or on paper placed on a table, and enclosed within a frame. The fragments of marble are then chipped into pieces of a suitable size and shape, and are laid close to one another on the pattern which has been prepared, the various colours or shades of the pattern being followed by marble of corresponding colour or shade. A layer of cement is then placed over the layer of marble, and of course penetrates the interstices between the fragments of marble; and this cement may, if necessary, be strengthened by a tile laid in the middle of its thickness. The mosaic tile, thus formed, is then taken to dry; and when this process is completed, it is returned to the workshop to be faced. Until this part of the process, the tile has been laid on its face, but now it is laid on its back, as it will appear when in position as a pavement, and the worker, with a piece of York stone, proceeds to rub it down, until the whole surface has been brought to a level, and is sufficiently smooth. Any inequalities which may have arisen from too great irregularity in the marble fragments are now corrected by removing the imperfect pieces and replacing them."

Captain Du Cane mentions the remarkable fact that the greater part of the skilled mechanics employed in the convict prisons have learnt their trade since their conviction. "Out of 2,245 convicts employed at trades in May, 1871, 1,650 had learnt theirs in prison; and out of 89 mechanics among the men discharged last year from one of our convict prisons, 75 had acquired some degree of skill in trades of which they had previously no knowledge."

In conclusion, the writer gives a statement of the cost and earnings of these various institutions—prisons, reformatories, and industrial schools—so far as can be ascertained.

"In 1870, the convict prisons cost £299,796. The value of the work done by the prisoners amounted to £184,852. This amount was not equally distributed, for the three prisons at Portland, Portsmouth, and Chatham, which cost £128,904, earned £143,841, or £15,927 more than they cost. The prisons in which constant separation is enforced, and the prisons which are appropriated to aged, infirm, and invalids, or mentally incapables, earn only a portion of their cost. The two latter classes are so numerous in convict prisons as to lead to the inference that many of them must be led to crime from inability to earn an honest living, or want of power to appreciate the difference between right and wrong; or, in other words, that criminal habits are often the result of mental disease. Out of 8,362 men under sentence of penal servitude in May, 1871, 252 were lunatics, or weak-minded; 308 were subject to bodily infirmities, disabling them from earning a living; and out of 1,300 women, 36 were lunatic or weak-minded, and 79 subject to infirmities.

"The county and borough prisons in England and Wales are returned as having cost, in 1869, for ordinary expenses, £498,809, and their industrial labour was valued at £40,099. The Scotch prisons in the same period cost £60,231, and earned £4,388, making the total cost of county and borough prisons in Great Britain, in 1869, £559,040, and the earnings, £44,487. The certified reformatory and industrial schools in Great Britain cost £256,733, and their labour earned £19,881."

Upon the whole, this report is a most valuable one, and well worthy of the attentive perusal of all interested in the difficult problem of the treatment of our criminal population.

Methods and Results of Teaching in Schools for the Blind, and the Deaf and Dumb.

The report on this section is by Edmund C. Johnson, Esq. In reference to the blind, he observes that, whilst England and Scotland have contributed a very fair share of useful appliances and well executed work, the Continent, owing probably to its unsettled state, is but feebly represented. Bath, Birmingham, Leicester, Worcester, York, and Edinburgh have each sent large contributions, as well as the London schools and institutions.

"The educational appliances for the blind consist of—1. Machines for enabling the blind to correspond. 2. Books, maps, and globes used in their education. The blind are enabled to write, emboss, and print by various contrivances. These are divided into—(*a*). Apparatus for the use of those who have lost their sight at a late period of life, and who know the form of the various letters, being, in fact, *guide-mains*. (*b*). Embossing frames, by which letters can be produced in relief, to be read by the seeing and felt by the blind. (*c*). Printing machines, in which a common page of printed matter can be produced by means of type.

"Printing in an embossed type for the use of the blind has, both in this and other countries, been effected with considerable, but by no means complete, success. The ordinary systems of embossed printing displayed in the

Exhibition may be divided into two classes ; one in which arbitrary characters are used to denote letters, sounds, or words, and a second, in which the ordinary Roman letters —capitals and lower case—are used, all alike presenting a raised surface to the touch of the 'reading finger.' There are various modifications of these two great classes."

The reporter describes most of the "arbitrary" systems, but upon the whole he prefers those in which ordinary letters are employed. He quotes from the Chaplain of the School for the Indigent Blind, who says :—"Whatever claims these arbitrary systems may have on the blind boy's notice, one fatal defect runs through them all, viz., that they tend to cut him off more than ever from the rest of the world, and especially from those who are able to read and to help him when he comes to a hard word. The task of learning Moon, Frere, Lucas, or Braille is to him like learning a new language, with this difference, that when he has learned it, and hard work in the course of years has deadened his sense of touch, not a single friend or companion at home will understand it, or be able to read with the eye the mysterious symbols which the reading finger can no longer discern. Common sense ought long ago to have stepped in and settled the question, but she has had the door shut in her face by prejudice, and the strife still goes on. Meanwhile, the old Roman letter, in spite of all patent inventions, manages to hold her own."

The late Mr. Alston, the chief patron of this system in the United Kingdom, thus wrote in his last report :—"I had long been convinced that arbitrary characters, however ingeniously constructed, threw unnecessary obstacles in the way of the blind, and that an assimilation of the alphabet of the blind to that of the seeing would, from its great simplicity, not only be free from all objections, but in the case of those who had lost their sight after they were familiar with the Roman alphabet, it would be attended with manifest and peculiar advantages, whilst its similarity to the common printing would enable blind children, at a distance from any institution, to attend an ordinary school, without giving more trouble or inconvenience to the teacher than any of his other pupils. Having this further advantage—being common to the seeing and the blind—the former can not only judge of the correctness of the latter's reading, but are qualified to assist them in the process, wherever they are. The advantages of a literature for the blind, so simple, practicable, and so easily taught, are obvious to every one."

Passing to the apparatus for teaching the blind mathematics, he quotes Mr. Guillié, who says :—"The privation of sight may be considered an advantage in the study of mathematics. The blind have a natural disposition for this study, which they follow with a decided taste." The reporter then describes the appliances in general use for imparting arithmetical knowledge, as well as some embossed figures of Euclid for teaching geometry. Embossed globes, maps, &c., for teaching geography are then referred to, and the reporter passes to the subject of musical notation for the blind :—"Since M. Braille has successfully arranged a system of writing by means of raised points (first conceived by M. Barbier), and has brought musical notation to the same degree of perfection as that of typography, the various institutions of France have almost unanimously adopted his mode of instruction. Those blind persons who have given attention to the system of pointed musical notation are loud in its praise, and prefer it to any other as yet invented. Having become familiar with the pointed system, as applied to the ordinary letters of the alphabet, the blind man has but little difficulty in understanding the same arrangement of points as applied to musical notation.

"It appears that many French blind children possess large and well-assorted collections of the finest *morceaux* of the best masters. They point their own scores, and carry about with them, in a small compass, masses, overtures, and concerted pieces, which they study in private, whilst they take a pride in being their own embossers and instructors. Many also compose in writing, without the aid of the professors, and thus another amusement is afforded them. The British and Foreign Blind Association are doing their best to secure the success of this system in music as well as in the ordinary literature for the blind. There are, however, but few persons in England who understand how properly to teach it, and up to the present time but few schools have entirely adopted it. It is, however, quite a living work, and must in time supersede the clumsy reproductions in relief of the ordinary music of the seeing."

In concluding this division of the subject, Mr. Johnson mentions the efforts which are now being made to establish a college for the blind sons of gentlemen at Worcester, under the presidency of the Lord Bishop of Worcester, Lord Lyttelton, Sir John Pakington, and other influential persons :—"It appears that, two years since, the Rev. Robert Hugh Blair, rector of St. Michael's, Worcester, opened an establishment on a small scale for the reception of blind pupils of the wealthier classes. The success of the college under Mr. Blair's management had been such that it was thought advisable that the present establishment should be enlarged, and that a proprietary association, upon the principle of limited liability, should be formed, in the first place to increase the accommodation in the present college, which has already thirteen pupils, so as to make it suitable for at least twenty-five pupils, and, as necessity arose, to provide further accommodation by erecting a larger building on freehold land in or near the city of Worcester, or in London. The charge for the education of pupils, including the necessary masters and board, is £110 per annum."

The examples of manufacture by the blind consist of contributions from ten of the most important institutions in London, Edinburgh, and the provinces. These are very varied in their character. At the Edinburgh Asylum, articles amounting to no less than £12,745 in value were produced and sold last year.

The School for the Indigent Blind, St. George's-fields, Southwark, has contributed "by far the largest and most important collection of works by the blind, including some splendid specimens of carpet and rug work, and various forms of basket, brush, and knitting hair work. It is the largest institution of the kind in the United Kingdom, containing 180 pupils."

Sweden and Belgium are the only foreign countries that have contributed results of school teaching for the blind and deaf and dumb.

Passing to the deaf and dumb, the reporter says :—"The discovery of methods for instructing the deaf and dumb in the use of spoken and written language is comparatively of recent date—a fact which indicates how little their affliction was heeded in former times. However, the period arrived when their condition was to be ameliorated, and they were to enjoy the blessings of religious, moral, and intellectual culture. But the rich only among this afflicted class obtained, at first, the benefits of the discovery that the deaf and dumb could be taught to read and write, to think in words, and to convey their sentiments in language, either written or spoken. No sooner had this important truth been established by the successful education given to a few of these unfortunates in the upper classes of society, than an effort was made to form a school for the education of the poor. This benevolent attempt was commenced by two worthy men, who simultaneously strove to outvie each other in obtaining support to their novel and truly charitable undertaking. These individuals were the Rev. John Townsend and the Rev. Henry Cox Mason, M.A., Rector of Bermondsey, Surrey, in which parish the first public school for the gratuitous education of the deaf and dumb in Great Britain was opened in the year 1792. This philanthropic movement steadily and rapidly progressed, until institutions for the deaf and dumb were scattered over England and nearly every great town in Europe and America. The Abbé Daras tells us that 'there are as many as 455 schools, public and private, in Europe and America, whilst France alone possesses upwards of thirty thousand deaf and dumb people. According to the census of 1861, one in every 1,640 of the population in England and Wales is dumb; one in every 1,300 in Scotland; and one in every 1,026 in Ireland; whilst it is now ascertained that the proportion of deaf and dumb persons on the Continent is about the same as in England. Mr. Buxton, the principal of the deaf and dumb school at Liverpool, has contributed some valuable statistics as to the causes of this misfortune. It appears that in a large number of cases which came under his notice, one out of every ten, who were deaf and dumb, was the offspring of the marriage of cousins. He also found that the children of 310 deaf and dumb persons, who had married those who were not deaf and dumb, gave as a result, that one out of every thirty-five of their children suffered from the calamity. Still more remarkable, of the children of 303 deaf and dumb men who had married deaf and dumb women, one in every twenty was afflicted with the parents' misfortune.' M. Morrell has also given us some valuable statistics, gleaned from 112 cases:—52 were dumb from birth, 37 so from the following causes:—Convulsions after teething, cerebral fevers, scarlatina, measles, worms, and scrofula. These facts prove that this malady may be the result of accidental disease as well as congenital malformation; and also, that any disease affecting the delicate structure of the ear may become a fruitful source of the misfortune. The method by which education is imparted to the deaf and dumb consists of the employment of signs, pictures, manual alphabet, and articulation. All philanthropists do not, however, quite agree as to the best mode of employing these different agencies; some are for the entire employment of signs, and others for labial articulation. At the great London school these two processes are in daily use, and with immense success, but the whole system of signing is there considered to be bad in principle."

Mr. George C. T. Bartley, in his work on the "Schools for the people," describes very fully and clearly the instruction given at the London asylum, which may be taken as the best example of training, and to his book those who are specially interested in the subject are invited to refer.

EXHIBITIONS.

Norwich Industrial Exhibition.—The Earl of Kimberley presided on Tuesday afternoon, at the closing ceremonial of the Norwich Industrial Exhibition. In addressing the meeting, the noble earl observed that when exhibitions of this kind were first commenced there were undue expectations about them, while now there was a kind of reaction and a desire to depreciate their utility. International exhibitions and smaller exhibitions, such as the present, were of very great use. It could not be otherwise than most useful to have an opportunity of comparing the products and manufactures of other countries with those which we were most accustomed to see, and of disabusing ourselves of any notions which we might entertain of fancied superiority over others, and which were not based upon a correct knowledge of the actual facts. Industrial exhibitions had also encouraged considerable improvement in some of the most important manufactures of this country. For instance, no one who had seen the series of exhibitions which had taken place in London, and especially that which had just closed at Kensington, could deny that an enormous advance had been established in the art of pottery in this country. The remark also applied to glass manufactures. This improvement in the manufactory of pottery and glass showed that we might also, by education and industry, obtain greater excellence in other branches of industry in which we did not now excel. There were some who lamented over an alleged decline of skill on the part of this country in competing with other countries, but for his part he did not believe in this alleged decline. At the same time he thought there was ample evidence that the artizans of the present day were able to hold their own in many of the productions which had made this country so great. It was well, however, that we should not shut our eyes to the fact that in other nations a great advance was taking place, and that unless we advanced also we should lose the superiority which we possessed in some branches of manufacturing industry. We must not only have the wealth of the capitalist and the skill of the master, but it was also absolutely necessary that there should be skill on the part of the workman; and it was this skill and knowledge which those present were met to promote.

THE TUNNEL BETWEEN DOVER AND CALAIS.

Mont Cenis pierced, says the *Daily News*, successfully, and Africa converted into an island by the Suez Canal, make it fair to ask how long "the wet ditch," known as the English Channel, is to continue to be a nuisance or a terror to the continental traveller. The numberless projects which have been started, the schemes which have been discussed, the commissioners and reports, the interviews with exalted personages, the flattering announcements from time to time of the only infallible remedy for sea-sickness on the journey between Dover and Calais having been discovered—have none of them helped the people who have gone abroad this year. The waves have been as productive of unpleasant consequences, the boats as wretched, the passengers as limp and miserable as ever; and with the triumphs of French and Italian engineers freshly before the world, it seems natural to ask whether the countrymen of Stephenson, Brunel, and Telford are content to be defeated by the "silver streak of sea." The answer is easy. The Franco-German war has interfered with the projects for joining Great Britain with the Continent, and delayed their fruition, as it has many another scheme of progress. At this moment it is chiefly the formal grant of a concession from the French Government which the advocates of a tunnel between the two countries are waiting for. This granted, the public will assuredly hear more of the Channel tunnel. In Lord Clarendon's lifetime the French authorities were about to grant the concession, and wrote to the English Foreign-office to ask if our Government had any objection to offer. There was an interview between Lord Clarendon and Lord Richard Grosvenor, M.P., the chairman of the International Committee for considering and reporting on the practicability of constructing a tunnel between England and France, after which an official letter affirming the high respectability of the members of the committee was despached from the Foreign Office, and then the matter hung fire for the time. The Continent was convulsed soon afterwards, and the French Government has scarcely been in a position to grant concessions for the easier occupation of the country. The delay has been employed by those interested in promoting a Channel tunnel in strengthening their hands, and in confirming the convictions they had formed.

It was at the suggestion of the Emperor Napoleon that an International Committee was formed in 1867, to organise plans for a tunnel between England and France. In June, 1868, this Committee, together with its engineers, had an interview with the then Emperor, in the course of which copies of the reports and plans, together with an address in favour of the project, signed by many peers, members of Parliament, and other representative men, were laid before his Majesty, who referred the matter to the favourable consideration of the Minister of Public Works, who in his turn appointed a Special Commission to inquire into the subject in all its bearings. This Commission made its report in March, 1869, and the opinion of the General Council of Mines and Bridges pronounced upon it in the same month, while that of the General Council of Mines was laid before the Emperor a few weeks later. It was subsequent to these repeated investigations and reports that the French Government applied formally to that of England to know if there were any reason why a concession should not be granted for carrying out the works. The following general conclusions were submitted to the International Committee, in a report, dated June, 1868, and signed by the following eminent English and French engineers:—John Hawkshaw, James Brunlees, William Lowe, Paulin Talabot, Michel Chevalier, and Thome de Gamond:—

"1. That there is a reasonable prospect that the work can be accomplished, but that it would be improper to deny that it is attended with a certain amount of risk.

"2. That this risk is limited to one contingency—viz., the possibility of sea-water finding its way by some unforeseen fissure into the workings in quantities too great to be overcome. Apart from this risk, tunnelling in chalk is easy and rapid, and the execution of a tunnel of the length of the one under consideration is only a question of time and expense.

"3. There seems to be no reason to assume that the tunnel would cost more than ten millions sterling, or that it could not be completed in nine or ten years.

"4. The question of risk would be fully solved by sinking land shafts on each coast, and driving the preliminary driftways. This portion of the work being safely accomplished, the remainder would be of an ordinary character.

"5. The possible loss would be measured by the cost of this preliminary work, which we estimate at one million and a-half, and which could not exceed two millions, or say one-fifth of the whole cost of the tunnel.

"6. That this risk should be undertaken by the governments of France and England, if after consideration they deem the importance of the work and the probability of its completion sufficient to justify them in doing so."

The French Commission, in a report dated March, 1869, and signed "Ch. Combes (President of the Commission), Kleitz, A. Coupvent des Bois, De la Poncié, E. de Hennezel, L. Lalanne, and A. de Lapparent (secre- and reporter), "are of opinion that driving a submarine tunnel in the lower part of this chalk is an undertaking which presents reasonable chances of success. Nevertheless, they would not hide from themselves the fact that its execution is subject to contingencies which may render success impossible. These contingencies may be included under two heads:—Either in meeting with ground particularly treacherous—a circumstance which the known character of the grey chalk renders improbable, or in an influx of water in a quantity too great to be mastered, and which might find its way in, either by infiltration along the plane of the beds, or through cracks crossing the body of the chalk. Apart from these contingencies, the work of excavation in a soft rock like grey chalk appears to be relatively easy and rapid; and the execution of a tunnel, under the conditions of the project, is but a matter of time and money."

The following extract from the engineers' report has special significance, now that travelling between Switzerland and Italy occupies no more time than from Waterloo to Wimbledon, or from the City to the West-end:—"It is evident that at some sufficient depth below the bottom of the Channel a tunnel could be constructed, so that as regards superincumbent pressure only, it would be analogous to constructing a tunnel of similar length through a mountain so high as to prohibit intermediate shafts; and it is evident that any possible irruption of sea water may be avoided by going deep enough below the bottom of the Channel. On the other hand, there is a limit to the depth at which the tunnel can be carried, from the necessity of approaching it from the shore, and obtaining gradients for those approaches suitable for railway traffic.

About a month ago, another communication from the French authorities was replied to by the English government; and the formal concession is now expected, with exclusive rights and privileges to those who construct the tunnel. It is pleasant to remember in this connection, that Mr. John Hawkshaw is the English engineer who pledged himself years ago to the success of the Suez Canal, and upon whose report the late Viceroy, Said Pasha, permitted the work to proceed. Mr. John Fowler and others came in towards the conclusion of the fight, when there was little else to do than to cheer the victors; but Mr. Hawkshaw spoke out boldly, and pinned his professional reputation to specific predictions, when to talk in England of the possible success of the Suez Canal was to run some risk of being branded as a traitor or a visionary. When, therefore, Mr. Hawkshaw's name is the first name appended to the proposals for boring a tunnel between Dover and Calais, the Egyptian precedent has considerable weight; and the soundness of his views as to piercing through the desert gives credit to his opinion as to burrowing under the sea. But in truth the weight of testimony as to the practicability of a tunnel under the Straits of Dover is exceptionably strong. The mining engineers point to Whitehaven and Northumberland, where galleries are worked under the sea, which occupy in their manifold turnings many times the distance between England and France. The theories as to the difficulty of ventilating a tunnel of twenty miles are disposed of easily. The towers or air-shafts, standing like light-houses in mid-ocean, are no longer thought to be necessary. The difference in temperature between the two ends of a tunnel is the greatest security for its ventilation; and many authorities insist that, so far from air-shafts being essentials, they defeat the ends for which they are designed. The Mont Cenis Tunnel, and the perfect current of air maintained there, are striking examples of what may be done without them.

It must not be supposed that the International Committee have been idle during their twenty months of waiting, or that those members of it who will be directly or indirectly interested in the company which will be formed when the the French concession is received have been contented to fold their hands. The reports quoted and other evidence cause them to regard the perfect practicability of the Channel Tunnel as a foregone conclusion. It is on the details by which the scheme shall be carried out rapidly and cheaply, that attention has been concentrated lately. There are eight hundred feet in depth of chalk under the sea between Dover and Calais. Chalk can be worked as easily as a Dutch cheese, of which, or of good pipe clay, its consistency reminds the investigator. The well at Harwich, at Dover, and at Calais are said to prove this geologically, and a new tunneling machine which was exhibited at the meeting of the British Association last year, and which the International Committee have seen at work for months upon the chalk at Snodland, near Rochester, testifies to the rest. This machine will, and does make a hole seven feet in diameter, and eighteen yards forward in the chalk strata in every twenty-four hours. This being so, what are called the driftways of the proposed tunnel can, it is maintained, be driven in one year instead of five, as was calculated, and the enlargement and completion will follow in two or three years more. One of the favourite proposals is that there shall be two driftways and two separate tunnels, so that the trains shall always travel the same way in the same tunnel. This would not be more expensive, for the difference in cost through reduced size would fully compensate for the duplicate tunnel; and while a very short time ago ten millions was put down as the probable cost, the statistics and success of the Mont Cenis Tunnel cause many competent people to reduce that figure considerably.

CORRESPONDENCE.

COLLIERY EXPLOSIONS.

Sir,—In view of the constantly recurring colliery explosions, and the terrible loss of life occasioned, the fact of there being something radically wrong in the present method of lighting coal mines forces itself on the mind of any one closely reasoning on the practice as it now exists. It unfortunately happens in most cases that it is easier to find fault with existing evils than to suggest a remedy; but as so little has been done in this direction, and bearing in mind the recent calamity at Wigan, I beg to submit a plan which I believe will remove one of the great causes of coal-mine explosions, hoping it will come more immediately before those interested and able to form an opinion of its merits, and possibly be the means of saving life.

What I have to suggest is, that the air to supply the lights to illuminate a mine should not be drawn from the atmosphere of the mine itself, containing, as it often must, mixtures of explosive gases; and although the Davy lamp does, by means of its wire gauze, burn in a dangerous mixture of coal gas and atmospheric air without exploding the surrounding atmosphere, a jerk of the hand, or an incautious act on the part of the miner, may cause the flame to come through the gauze, when an explosion at once ensues. I would propose that instead of the usual lamp carried by each miner, and deriving its supply of oxygen from the mixed gases of the pit, that the pit should be lighted by lamps made perfectly air-tight, so that the inner atmosphere of the lamp should be wholly isolated from the surrounding atmosphere of the pit. A supply of atmospheric air could then, by means of pipes of sufficient size, be brought from the surface of the ground above to all the lamps in the pit, entering at the bottom, and passing to the flame through a finely perforated plate, to become diffused, and so keep the light steady. A similar arrangement of pipes to carry off the products of combustion passing from the top of the lamps, would communicate with the outer atmosphere, and a fan or other exhausting apparatus in the main pipe leading from the lamps would be all that is necessary to set up a circulation in the entire arrangement, which would, on a small scale, closely represent the present method of circulating air through a pit. The main supply pipe from the outer atmosphere to the lamps would represent the down cast, and the main pipe from the lamps, with the exhausting apparatus, the up-cast, while the smaller pipes would represent the circulation of air through the workings; but the atmosphere in the pipes and lamps, and the atmosphere in the mine would be separated; and at no great cost, a coal-pit could be as well and safely lighted as a street, as glass lamps of sufficient size and strength could be used, and gas laid on and burnt in them. Most of the lamps might be fixed, and others could be supplied by means of flexible tubes securely placed. A ready way of lighting them could be easily arranged, without exposing the flame to the atmosphere of the pit; but, as the lamps would be kept constantly burning, this would not often require to be done.

The proposed method admits of combustion being supported without using the dangerous mixture of gases in the atmosphere of the pit itself for the purpose, and the necessity for doing which, by the present system of using the Davy lamp, I believe to be the great cause of coal-mine explosions. This necessity would no longer exist if the light was isolated, in which case it would be as little affected by a sudden influx of gas to the pit (now the chief source of danger) as if it were on the surface of the ground above.

In the limits of a letter little more than the outline of such a plan can be given, but enough has been said to indicate the principle of the suggestion, should any of your readers interested in the safer working of coal-mines care to try it.—I am, &c., John C. Martin.

Barnes, S.W., September, 29, 1871.

GENERAL NOTES.

Indian Hill Settlements.—Darjeeling, which was a barren waste when Dr. Archibald Campbell first undertook the government, now produces £70,000 worth of tea, and pays £10,000 revenue to the government of India. In the Shevaroy hills, Major Hunter has produced the first crop of tea, which is of good quality.

Public Libraries in Italy.—The following statistics respecting public libraries in Italy, during 1870, appear in a report lately published by the Minister of Public Instruction. The total number of readers during the year was 723,359, of which the greater number were at the library of Turin, being 115,489. The total number of books given out was 1,057,230, and 12,859 works were given to be read out of the library. The number of works purchased during the year was 11,706.

Iron Shipbuilding in Italy.—At the Industrial Conference (Inchiesta Industriale) now being held at Naples, Signor Luigi Orlando, the eminent shipbuilder of Leghorn, on being questioned on shipbuilding in general in Italy, stated that he could undertake to build iron ships at his establishment at Leghorn, and to compete in price with those built in English ship-yards, and that he could build them precisely under the same conditions as those in England, provided that the orders were frequent and regular. He also urges that the government, besides building their own ships, should give orders to private shipbuilders, and that the exemption of duty upon foreign iron for shipbuilding purposes should also be extended to iron required for repairs.

The New Postal Arrangements came into operation yesterday. The half-ounce weight disappears from the postal scales, and the halfpenny stamp comes into use for letters above an ounce weight. The letter postage will still be a penny, but the penny stamp will cover all letters not exceeding an ounce; while only an additional halfpenny stamp will be required for letters above one ounce and under two. The following are the details of the new tariff:—For a letter not exceeding 1 ounce, 1d.; exceeding 1 ounce, but not exceeding 2 ounces, 1½d.; exceeding 2 ounces, but not exceeding 4 ounces, 2d.; exceeding 4 ounces, but not exceeding 6 ounces, 2½d.; exceeding 6 ounces, but not exceeding 8 ounces, 3d.; exceeding 8 ounces, but not exceeding 10 ounces, 3½d.; exceeding 10 ounces, but not exceeding 12 ounces, 4d. This tariff is limited to twelve ounces, and letters above that weight will be charged at the rate of a penny an ounce. The *Daily News* says:—"All the difficulties about the pattern and sample post will be met by this great reduction in the letter postage, which, taken together with the post-cards and book-post, renders our postal service the cheapest, as it is the most efficient, in the world. Only two more reductions are needed, and one of those is at least promised. We must have sixpenny telegrams, and probably shall have them as soon as the machinery of the post-office telegraphs is sufficiently perfect to bear the sudden expansion of business the reduction would cause. The other reform needed to make our postal system complete is a cheaper and more efficient system of registering letters. Letters ought to be registered on the payment of double postage; and the registering ought to make the department responsible for them up to their declared value. When this concession to public convenience has been made, the public will really have nothing more to ask from the Post-office."

The Largest Diamond Found.—A correspondent of a Cape paper, writing from Peniel on July 21st, says:—"I went out to Du Toit's on Monday, and returned on Wednesday. Just as I got there, the largest South African diamond on record—124 carats—was found by Stevens and Raath,—the first day they worked in the claim! Dr. Atherstone was present when it was found. He is still out there." On this the journal in question has the following:—"This is good news, and there can be no question about its truth. The stone is about twenty carats larger than any known to have been found as yet on our fields. Our correspondent says nothing about its colour and quality. Its value, therefore, remains unknown to us, and imagination may spread its wing and soar away into regions of unlimited exaggeration. Shall we put it down at a hundred thousand—the estimated cost of the East London Harbour, or twice the amount necessary for the positively last time of opening the Kowie? We are bold enough to say that those lucky fellows, Messrs. Stevenson and Raath, have a delightful consciousness of fabulous wealth. As they nervously clutch their prize, they feel that they have the world in their hand, if not at their feet. Our correspondent, who has given us but the bare facts, has not told us who Messrs. Stevens and Raath are, what they are, or whence they came. He thought it enough to let the fact of the find blaze out upon us by itself. This was all very well, but human nature, even in Graham's-town, is human nature still, and we confess to a weak curiosity to know all about Messrs. Stevens and Raath. What is the colour of their hair? Are they men who, under a sudden accession of fortune, would be likely to reply favourably to a begging letter? Could they, we wonder, be induced to lecture on behalf of any of our local institutions? Had they, taking them together, one tithe the ability and eloquence of Mr. Tobin, we would ensure them a highly appreciative audience, for who would not listen with undisguised rapture to the voice of a man who had a hundred thousand pounds in his pocket? We suppose nothing would induce Messrs. Stevens and Raath to lend this city a few thousands, on the security of the Town-hall, under the amended Act? Our correspondent should certainly have said something about them. As somebody remarked just now, "It is so annoying not to know, you know, men who have picked up all that." We wonder whether they are married! If they are not, what a nice thing it would be for them and others to come to Graham's-town! It is satisfactory to be told that Dr. Atherstone was present at the finding. It will be something to see the man who saw Stevens and Raath in the very act of picking up their fortune. The doctor will tell us all about it in a bounding article in the *Cape Monthly*. It is a most extraordinary concidence that our best descriptive writer—whose pen is diamond pointed—should have been on the very spot at the lucky moment. The whole colony will know all about the find and the finders when the doctor returns. Of course, he will return. It is true our correspondent says, "He is still out there," and we can easily imagine that it would be some time before so enthusiastic a geologist could tear himself away from the spot where a hundred and twenty-four carat diamond had been turned up beneath his very eye. But fascinating as the sight must have been, we scarcely suppose that the doctor is "still out there." He is now on his way down, no doubt, and the city will have the pleasure of shaking the very hands that, in all probability, were the first to touch the splendid monster after its finders had given it to the light. This finding is a dazzling illustration of the brilliant chances of the fields. Messrs. Stevens and Raath found this unrivalled South African diamond on the first day they worked in their claim. A stroke or two of the pick, a few shovelfuls of rotten green stones, a shake of the sieve, and suddenly up flashed the gem! One moment Messrs. Stevens and Raath were simply two diggers, giving a first trial to a new claim. The next moment they clutched a fortune, and became the heroes of the fields, and the objects of unlimited envy to all South Africa. Undoubtedly, this princely find will add to the romance and interest of diamond digging. Coming upon the heels of the discovery that Du Toit's Pan is, as Mr. Tobin says, the birth-place of the diamond, this unearthing of the largest diamond yet found will stir men's thoughts and send them with a fresh current towards the Vaal. It has been evident to all who have given any attention to the subject, that the diamond finds have been lately on the increase. Much fuss has not been made about the weekly returns, because the colony has grown familiar with the new source of wealth. Such, however, is the fact—our diamond-fields are proving themselves to be as rich as men of reasonable expectations at any time anticipated. They have yet to play their chief part in promoting the general prosperity of South Africa."

Railways and Telegraphs in Belgium.—The receipts from railways in Belgium, in 1870, amounted to 41,833,346 frs. 25 cents.; and from the telegraphs, 1,561,171 frs. 70 cents., showing an increase over those of the preceding year of 2,008,686 frs. 53 cents. from the railways, and 236,578 frs. 63 cents. from the telegraphs, throughout the kingdom.

Rock Boring.—The invention of Mr. F. Villepigue, Autun, France, consists, first, of a standard, formed either of a metal tube of any suitable section (which is the kind preferred), or of bars fastened together, or of a solid piece with a longitudinal groove in the same, or of a wheel trolly, carriage, or frame. This standard carries at one extremity thereof an oscillating claw working on an axis, by which it is connected with the standard, and at the other extremity thereof is a screw nut of which is fixed on the said standard, and which screw is provided with a guide washer, which fits inside the tube and steadies the screws. The screw last described is terminated by a head having holes or faces to enable it to be easily turned in the nut, and is surmounted by a steel or iron point, which penetrates the surface it is in contact with; or for the said steel or iron point the inventor substitutes in some cases a revolving claw in connexion with the screw, and permitting the same to turn, or else a claw forming a part of the head of the screw, the nut in the latter case turning in the standard.

New Lamp.—Dr. Bachhoffner has produced a lamp for burning mineral oils, for which he claims that it combines absolute security with great simplicity of construction. It is called "The Domestic Safety Paraffin Lamp;" for in whatever position the lamp may be placed, even should it be inverted either by accident or design, the oil is prevented from flowing out. The principle of construction admits of great variety of shape, size, and ornamentation, suitable either for the drawing-room, or as a night light for the bed-chamber; white glass, porcelain, and other fragile materials being carefully excluded, and neither plaster of Paris, nor any other kind of cement for attaching the several parts, being necessary. The advantages said to be obtained are:—The air admitted to the lamp never comes in contact with that portion of the oil in which the wick is immersed; consequently no opening in the burner, except for the passage of the wick, is required. The very small quantity of oil necessary for the supply of the wick is retained in a chamber separted from the reservoir. The oil in the reservoir never becomes over-heated, however long the lamp may be kept burning. Should the lamp be overturned, placed on its side, or even inverted, the oil cannot flow from the reservoir. Should the lamp be overturned, the flame is instantly extinguished. The lamp cannot get out of order by ordinary use, and, being made of metal, is secure from those accidents to which glass and porcelain are liable.

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All communications for the Society should be addressed to the Secretary, John-street, Adelphi, London, W.C.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.

By Dr. Crace Calvert, F.R.S.

LECTURE II.—DELIVERED TUESDAY, FEBRUARY 14TH.

Red Colouring Substances (continued).—Munjeet; Campechy, Peach, Sapan, Cane, and Bar Woods; Alkanet root; Safflower; Cochineal, Lac Dye; Murexide.

Munjeet.—It is to the researches of Dr. John Stenhouse, one of the most eminent and learned of English chemists, that we are indebted for our knowledge of the true composition of many of the dye-stuffs, and it is to him that we are indebted for the whole of the information we possess in the colouring matters of munjeet, or *Rubia munjista.*

This peculiar variety of the genus rubia is cultivated exclusively in Asia, and especially in India, where it has been used as a dye-stuff for a long period of time, either alone or mixed with other dyes, to produce a variety of red shades. It is imported into this country from time to time, but has never been extensively used, as the colours produced from it are neither so fast nor so bright as those obtained with *Rubia tinctorum.*

Whilst the colouring principles of madder are purpurine and alizarine, those of munjeet are purpurine and a yellow colouring matter, named by Dr. Stenhouse munjistine. He has assigned to this latter body the formula $C_{16} H_8 O_6$. When crystallized from an alcoholic solution, it forms large, beautiful, golden-coloured flakes, which sublimed, give prismatic crystals of an orange-red colour. It is only slightly soluble in cold water, but freely soluble in hot water. Its best solvent is bisulphuret of carbon, which was employed with success by Dr. Stenhouse in separating the purpurine and munjistine from the other substances existing in munjeet. He states that the munjeet root contains as much colouring matter as the *Rubia tinctorum*, and, according to Mr. Higgins, of Manchester, it yields from 52 to 55 per cent. of a garancine; but as it has only half the dyeing power of ordinary garancine, it cannot be employed with advantage for this purpose. The inferiority of munjeet arises from its containing only the comparatively feeble colouring matters, purpurine and munjistine. Munjeet is not much used by calico printers, as the munjistine gives a brownish-purple with salts of iron, which prevents it being employed with that mordant. It is used for special shades of Turkey red, the munjistine giving, with salts of alumina, an orange-yellow colour, which is in some instances employed by the dyers.

I have now the pleasure of calling your attention to an important class of dyeing substances, "the dye-woods."

Campechy or Logwood.—This wood, obtained from a large tree of the leguminous family, called by the botanist *Hematoxylum campechianum*, grows abundantly in the West Indies, Mexico, and other states of South America. The best quality is imported from the Bay of Campechy, in the Gulf of Mexico. Large quantities are also obtained from Jamaica and St. Domingo. The qualities obtained from Honduras, Martinique, and Guadaloupe are inferior.

Campechy was introduced into Europe by the Spaniards, but it was not till the reign of Elizabeth that it came into use in England, and then only for a short period, after which its employment was forbidden under the severest penalties for upwards of a century.

The discovery of its colouring principle, hematine, was made in 1810, by my learned and venerable master, M. Chevreul (who, although now 85 years old, is still actively engaged in scientific pursuits). Shortly afterwards it was studied by Ermann, who gave it the name of hematoxyline. It was obtained by these eminent chemists as yellowish white prismatic crystals, which become discoloured by contact with the oxygen of the air and the small amount of ammonia which the atmosphere contains. It is only slightly soluble in cold water, but much more so in hot. It is very soluble in alcohol, ether, and bisulphuret of carbon. It combines with three equivalents of water, forming a crystalline hydrate, which at 212° F. retains one equivalent.

Hematine in the presence of oxygen, especially under the influence of alkalies, assumes a beautiful purple colour. This colouring matter can be obtained under the form of purple-black crystals, having a metallic lustre, and has received the name of hematëine. Hematine has the formula $C_{16} H_{14} O_6$, which, on conversion into hematëine, becomes $C_{16} H_{12} O_6, H_2O$. The hydrate is $C_{16} H_{14} O_6, 3 H_2O$, which at 212° F. becomes $C_{16} H_{14} O_6, H_2O$.

The oxydation, and consequent colouration, of hematine under the influence of oxygen and alkalis is so rapid that it may be used as a most delicate test of the presence of carbonate of lime in natural waters; and it is a fact well-known to practical dyers, that waters containing a large quantity of carbonate of lime are well adapted for the production of good log-wood blacks. Hematine gives little or no colouration with salts of protoxide of iron, but hematëine gives a dark purplish blue; the latter also gives dark blue precipitates, with salts of lead and tin. Hematëine is easily reduced to hematine by hydrogen and sulphuretted hydrogen.

In my opinion, the colouring matter in *Hematoxylum campechianum* exists in the state of a glucoside, for when the trees are felled the wood is colourless; but by the time the logs arrive here the outside is of a dark red colour, whilst the inside has only become of a pale yellow colour.

As hematëine is the principle which the dyer requires, the logs are ground into a coarse powder, which is moistened and laid in beds 15 or 20 feet long by 10 or 12 broad, and about three feet thick. A slow fermentation ensues, by which the glucoside is decomposed and the hematine liberated. It is converted into hematëine by stirring the mass, thus exposing it to the oxygen of the air, the action being quickened by the ammonia of the atmosphere as well as by that given off by the decomposition of the azotised principles existing in the wood.

This prepared wood is used by the dyer to produce log-wood blacks, as I shall describe further on, and also by wood extract manufacturers, who prepare an extract which is much used in calico printing. To prepare this extract it is necessary that the wood should not be too highly oxidised, and that the solution obtained from it by successive and repeated lixivation should be slowly concentrated at a comparatively low temperature, that is to say, not exceeding 150° F.; for if a high temperature be employed the hematëine is still further oxidised, and a dark purple resinous principle produced, which spoils the brilliancy of the colour.

This extract is chiefly used in print works, to produce purples in steam styles.* A strong log-wood solution is thickened with starch, and printed on a prepared cloth; that is, a cloth that has been passed through a solution of stannate of soda, then through weak vitriol, by which means the binoxide of tin has been fixed as a mordant in the fibre of the cloth; the fabric, after washing and drying, is ready for the printer. After being printed, the cloth is either rolled on a perforated cylinder or hung in an iron chamber, and submitted to the action of steam, when the hematëine combines with the oxide of tin, producing a beautiful purple.

If blacks are to be produced, an iron mordant is fixed on the fabric, which is then passed through a logwood solution. It is afterwards washed, and the black fully developed by passing it through a hot dilute solution of bichromate of potash.

Log-wood and its extract are much used in Yorkshire for producing cheap blacks on mixed fabrics, which are goods in which the warp is cotton and the weft woollen. The black is produced by dyeing the fabric in a bath composed of logwood, sulphate of soda, and bichromate of potash.

It is often very useful to distinguish logwood blacks from sumach and other fast blacks, and logwood purples from aniline purples. This is easily effected by submitting the piece to the action of weak acids; the logwood colours assume a bright red tint, while the others remain unchanged.

Brazil Wood.—We shall now pass on to a series of woods which are all obtained from the genus *Cesalpinia*, belonging to the natural order *Leguminosæ.*

Although these woods have long been employed as dyes by the natives of the countries where they grow, it is only since the introduction of Brazil wood by the Spaniards that their value as dye stuffs has been known in Europe. The best qualities are all imported from Brazil. The particular wood known as Brazil wood, derived from the *Cesalpinia braziliensis*, has become scarce in the market, from its having been all cut in the districts within easy distance of shipping ports.

The wood most in favour at the present day comes from Pernambuco, and is the *Cesalpinia Christa.* This tree is also found in Jamaica. That obtained from Sierra Nevada is not of such good quality.

Another variety, bearing the name of peach-wood, is chiefly derived from Nicaragua. A third, known as Sapan-wood, comes principally from Siam, the East Indies, and other eastern countries. A rather inferior quality, known as Lima-wood, is imported from Peru.

All these woods appear to contain the same glucoside, and, like the previous ones, are decomposed by peculiar ferments, into a saccharine matter and a colour-giving principle. This is proved by the following experiments. If the decoction obtained by treating the wood from the interior of the sticks be boiled with a solution of double tartrate of potash and copper (the best known test for grape sugar), no precipitate is obtained; while if the glucoside be first decomposed by boiling with a dilute solution of hydrochloric or sulphuric acid, and afterwards treated with the copper salt, an abundant precipitate of suboxide is thrown down. The decoction, which has only a faint yellow colour, gives a most abundant and brilliant precipitate with subacetate of lead. The colour-giving principle was discovered by M. Chevreul, who gave it the name of *braziline.* By oxidation it is converted into *brazilëine.* It also combines with water, to form a hydrate containing two equivalents of water. Professor Bolley gives the formula of braziline as $C_{22}\,H_{20}\,O_7$, and that of the hydrate $C_{22}\,H_{20}\,O_7\,2\,H_2O$. He has also made the curious observation that a comparison of the formulæ of hematine and braziline shows a difference equal to carbolic acid, as may be seen by the following table:—

$$\begin{array}{llll} \text{Braziline} & C_{22} & H_{20} & O_7 \\ \text{Hematine} & C_{16} & H_{14} & O_6 \\ \hline \text{Difference} & C_6 & H_6 & O \quad \text{Carbolic acid.} \end{array}$$

What is still more remarkable is, that by the action of nitric acid upon hematine, he obtained oxalic acid, whilst under similar circumstances braziline yields oxalic acid and picric or trinitrophenic acid, which is the product obtained when carbolic acid is acted upon by nitric acid.

A decoction of any of these woods becomes yellow or orange, (according to the quantity of braziline or brazilëine it contains) on the addition of an acid, and by the addition of an alkali, a beautiful crimson red, the shade of which varies according to the proportion of the two principles. It also becomes red with bichromate of potash, and gives a red precipitate with oxymuriate of tin.

These characters are sufficient to distinguish between a solution of these woods and one of log-wood.

To prepare a good commercial extract from these woods, they must be finely ground, as they yield their colour to water with difficulty; like log-wood, they must be allowed to ferment and oxidise in the air, but not to the same extent. The concentration of the decoctions differs from that of logwood in the fact that they can bear a higher temperature. The more quickly they are evaporated the brighter are the colours which the extract gives. Dr. Dingler has proposed a process which is stated to give very good results. It consists in adding 4lbs. of gelatine, dissolved in water, to every cubic yard of ground-wood, and allowing the whole to ferment for several days. The wood so treated yields a stronger and richer extract than that obtained by the ordinary process; no doubt the gelatine helps the decomposition of the glucoside, and the ammonia produced facilitates the oxidation of the braziline. By the addition of a small quantity of chlorate of potash to the hot extract, Mr. Peak greatly increased its brilliancy, and rendered it more valuable to the printer on account of the brighter colour produced on the fabric.

These extracts are principally used to obtain pinks and reds in steam styles. To effect this, acetate of alumina, chloride of tin, oxalic acid, or acetate of copper is added to the extract, and printed on the prepared cloth already described, which is then submitted to the action of steam.

These woods are also used in conjunction with a little quercitron, or bark, in the production of cheap garancine styles. These inferior garancine prints are easily distinguished from the good ones by means of a hot soap-bath, which only slightly affects the good, while the inferior are almost entirely destroyed. The woods also are sometimes used for the adulteration of garancine.

I may state, before leaving this subject, that the decoction of these woods yield very beautiful pink lakes, which are principally used by paper-stainers.

Common red-ink is also prepared by adding a little alum and acid to an aqueous solution of these woods.

Sandal, Cam, and Bar Woods.—The next class of dyestuffs which we shall have the pleasure of studying together are derived from several varieties of the genus *Pterocarpus*, which are indigenous to the tropical parts of both the new and the old world. It is principally from the East Indies, Ceylon, Madagascar, and the coast of Malabar, that santal, sandal, or red sanders wood is imported, whilst cam and bar woods are procured from Sierra Leone.

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* Calico printers employ the word style or govels when speaking of a class of goods which are denoted by a word characterising the colouring matter used, or the method employed in producing them. Madder goods and garancine styles may be given as examples of the first and steam styles of the second.

The colour-giving principle of this class of plants is only developed with age, the young branches not containing any, whilst it is found in large quantities in the trunk. Professor Bolley proved that it is the same colour-giving principle which exists in each variety, and he gave it the name of santaline. MM. Wagermann and Haeffely consider that it has the formula $C_{15}H_{14}O_5$. It is a bright red crystalline powder, insoluble in water, but soluble in alcohol, ether, and acetic acid. The latter solvent yields the colouring matter to albumen, which is an important fact, and may one day be rendered practically useful. Santaline is freely soluble in alkalies, giving a violet-red solution, from which acids precipitate the colouring matter.

Sandal-wood is chiefly used on the Continent, where it is employed to give a bottom* to cloth which is to be afterwards dyed with indigo. By this process a very fine blue is produced, having a purple hue by reflected light.

Cam-wood, and especially bar-wood, is chiefly used in England for producing on cotton-yarns brilliant orange-red colours, known as mock Turkey-reds. They are, however, neither so fast nor so bright as the real Turkey-red produced from madder, and are easily distinguished from it by yielding their colour to a hot soap solution, or to alkalies.

Alkanet.—The root of the *Anchusa tinctoria* contains a beautiful red resinous principle, to which Professor Bolley assigns the formula $C_{35}H_{40}O_8$, which is insoluble in water but soluble in alcohol, ether, and bi-sulphuret of carbon. To all these solvents it communicates a fine purple colour, which becomes blue on the addition of an alkali. It is not at the present day employed as a dyestuff, its chief uses being in pharmacy to colour medicines; in perfumery, to colour oils and greases; and in domestic life to give a tint to the lime-wash used for the walls of private dwellings.

Safflower.—Although this dye-stuff has lost much of its value since the discovery of the aniline colours it is still extensively used in Lancashire for the production of peculiar shades of pinks for the eastern markets. It is also used for dyeing red tape, and I know no more striking instance of red tapeism than the love which is shown for this particular dye by the users of this article Much cheaper pinks can be produced from aniline, and, notwithstanding that many times the attempt has been made to introduce them, it has in every instance failed, because the exact shade has not been attained.

Safflower is the bloom of a peculiar thistle called *Carthamus tinctorius*, which is cultivated in France, Egypt, Spain, Italy, and India. In France and Spain, the small flowers composing the heads of the thistle are picked off and dried in the shade, whilst in Egypt and India they are squeezed, washed with cold water to remove useless materials, slightly pressed into lumps, and dried in the shade; the latter have about double the value of the former. The safflower so prepared only contains three to six parts per thousand of the colour-giving principle.

This principle has received the name of carthamic acid, and has the formula $C_{14}H_{16}O_{14}$. A solution of this acid, when dried on a polished white surface, leaves a varnish, having a beautiful red colour, by transmitted light, whilst it assumes the the irridescence of cantharides when seen by reflected light. It is insoluble in water and ether, but soluble in alcohol. This solution becomes yellow on the addition of sulphuric, nitric, or hydrochloric acid. It is also turned yellow or orange by weak alkalies, and the colouring matter in this latter solution, undergoes rapid alteration if exposed to the atmosphere. It is owing to the fugitive nature of the colour, and its easy modification by acid and ammoniacal vapours, that the delicate pinks produced from safflower have been so successfully replaced by the pink aniline dyes.

To prepare carthamic acid, safflower is introduced into bags and washed, till a yellow colouring matter which it contains is removed. It is then mixed with water, to which is added 15 per cent. of the weight of safflower taken of crystalised carbonate of soda. After two hours maceration, the liquor is run off, and cotton yarn dipped in; then lemon juice or citric acid is added to liberate the carthamic acid, which fixes itself on the yarn. Up to this point, the process is the same as that adopted in dyeing fabrics, but to obtain the acid, it is necessary to treat the washed cotton a second time with carbonate of soda, which dissolves out the carthamic acid, leaving a second yellow colouring matter fixed on the cloth. The carthamate of soda thus obtained is decomposed by tartaric acid, and the carthamic acid falls as a brilliant red amorphous powder, which, when mixed with a little water, is sold as safflower extract, and when dry and mixed with ground-talc, is employed as *rouge* by ladies.

There is a particular extract extensively used in dyeing, the preparation of which is a secret. Its value depends on the fact that the carthamic acid is rendered soluble in water.

Cochineal, Kermes, Lac-dye, and Murexide.—I shall now call your attention to four colours derived from the animal kingdom, namely, cochineal, kermes, lac-dye, and murexide.

The first three are distinct species of a peculiar tribe of insects called *Coccina*. The females, from which alone the colouring-matter is derived, form a mass nearly destitute of limbs, and remain attached to one spot on the plants infested by them. The males, on the contrary, are very minute and really elegant creatures, furnished with a single pair of filmy wings. The real cochineal is called *Coccus cacti;* kermes, *Coccus illicis;* and lac-dye, *Coccus lacca* or *ficus*. They all contain the same colouring principle. Although the dyes derived from some species of these insects were well-known to the ancients, and were much used in Persia and India, the true cochineal has only been known in Europe since the discovery of America by the Spaniards; and since the year 1830 only has it been propagated in the Canary Islands, the island of Teneriffe, Java, and Algiers. The best qualities are still obtained from the republic of Honduras.

The *Coccus cacti* lives on a species of cactus called the *Cactus nopal* or *Opunta coccinilifera*. This plant is indigenous to Mexico, where it grows in the wild state; and from it large quantities of cochineal are collected. It is also extensively cultivated by the native Indians, who often have plantations containing 60,000 plants. The cochineal obtained from the two sources is of different quality; that from the cultivated plant is much superior, and is called *mestique;* that collected from the wild plant is called *sylvestra*.

I will now explain, in a few words, how cochineal is propagated and prepared for market. In the month of May, in the flat lands, and in November in the mountainous districts, the Indians take the stems of the cactus, which they have preserved from a previous crop, and remove from them the young female insects, which are placed on the growing plants, where they grow and multiply with great rapidity. After a period of about three months, the insects are collected into small tin dishes, so formed as to enclose the bottom part of the plant, and by means of a small brush they are swept from each stem successively into it. They are then destroyed, either by being thrown into hot water and afterwards dried in the sun, or in stoves, which gives the black cochineal, called *zacatilla* or they are placed in a bag and stoved at once, which leaves upon them that peculiar lustrous appearance which characterises the silver white cochineal, called *blanco*. Although one pound of cochineal contains 70,000 insects, there are millions of pounds imported into Europe every year.

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* This term is used in dyeing, to denote that a colour is applied to a fabric with a view of giving a peculiar hue to a dye which is applied after it.

If one of the dried insects be placed in warm water it swells, and takes a hemispheric form, when its structure can be seen. If it is pressed between the fingers, thousands of little red grains are exuded, which, if placed under the microscope, are seen to be minute cochineal insects.

The colouring principle was first isolated in an impure state by Pelletier, who considered it to be an azotised compound. MM. Arppe and Warren de la Rue, however, found that it contained no nitrogen, and that it had the formula $C_{14} H_{14} O_8$. As it had distinctly acid properties, they gave it the name of *carminic acid.* M. Schützenberger proved that carmine is composed of carminic acid and an organic azotised base, called *tyrosine.*

MM. Arppe and Warren de la Rue obtain crystallised carminic acid by the following process. The cochineal is treated with ether, to remove fatty matters, then boiled in water. An acid acetate of lead is added to the solution thus obtained, which precipitates an insoluble carminate. This, after being washed carefully, is decomposed with sulphuric acid, the carminic acid being liberated. The aqueous solution is evaporated to dryness, and the mass treated with alcohol, which, on evaporation and cooling, yields it as a crystalline mass.

As shown by the above process, carminic acid is insoluble in ether, but soluble in water and alcohol. It is dissolved without decomposition by concentrated sulphuric and hydrochloric acids. Carminic acid yields on fabrics, especially on wool, one of the fastest colours known, light and air having no action on it. Chlorine, however, easily destroys it. An aqueous solution of the acid gives the following characteristic reactions. With caustic alkalies, it gives a beautiful crimson-red colour; with oxy-muriate of tin, it gives a red precipitate; and with cream of tartar or oxalate of potash, an orange-red precipitate. Alumina removes the whole of the colouring-matter from an aqueous solution. As cochineal is an expensive dyestuff, it is subject to much fraud and adulteration. One of the most common frauds is practised at Nismes and other places where perfumery is largely prepared. The cochineal in those localities is put into water for a short time, by which a part of its colour is extracted; it is then dried, and either sold as black cochineal, or placed in a sack and shaken with talc or sulphate of lead, and sold as white cochineal. This fraud is easily detected by grinding the cochineal and mixing it with water, when the talc or sulphate of lead falls to the bottom. Good cochineal does not leave above five or six per cent. of ash.

It is often advisable before buying cochineal to determine its tinctorial power. This may be ascertained by two or three methods. In the first, equal weights of the cochineal to be assayed, and of one of known value, are treated with alcohol or a solution of alum. The solutions thus obtained are poured into tubes, and placed in a colorometer. This is an oblong box, which has two apertures at each end and two on the top, in a direct line with the end apertures. The tubes are placed through the openings on the top, and, on looking through the end apertures, any difference in intensity of colour between the two liquids can be observed. If a difference is detected, alcohol or water is added to the stronger liquor until there is perfect uniformity of tint. According to the amount of dilution required is the relative value of the cochineals.

A good process was published by the late Dr. Penny, of Glasgow. It consists in exhausting a gramme of cochineal with 50 grammes of potash solution, and this extract is further diluted with 100 grammes of water. The solution thus obtained is mixed with a graduated solution of ferricyanide of potassium (one gramme of salt to 200 grammes of water) till its colour changes to a dark brown. A solution of bleaching powder of known strength can also be used for the same purpose. The best method consists in dyeing equal surfaces of flannel in a bath composed as follows:—

For Scarlet Tints.

	grammes.
Water	1,250
Cream of tartar	2
Tin composition	2
Cochineal	1

For Crimson Tints.

	grammes.
Water	1,250
Cream of tartar	0·75
Alum	1·50
Cochineal	1

The pieces are then washed and dried, and by a comparison of the relative intensity of shade the value of the cochineal is determined.

The chief employment of cochineal is for dyeing wool, but it is also employed in calico printing to produce pinks and reds in steam styles.

It will no doubt be interesting to you to know how to determine whether a pink has been produced from a dyewood, a cochineal, or from madder. All these colours are destroyed by chlorine or bleaching-powder. A boiling soap solution destroys the wood pinks, communicates a crimson hue to the cochineal dye, and brightens the madder colour. Dipped in a rather dilute solution of hydrochloric or sulphuric acid, fabrics dyed with cochineal are not affected, while those dyed with madder or woods assume a yellow tint, which becomes purple when placed in milk of lime. These cloths, however, if subsequently soaped, will yield their colour if dyed with wood, but not if dyed with madder.

Ammoniacal Cochineal.—When one part of ground cochineal is left in contact with three parts of ammonia for several weeks, a chemical action ensues, by which the ammonia loses one equivalent of hydrogen, which unites with an equivalent of oxygen of the carminic acid, giving rise to water and an amide compound, carminamide. Adopting M. Schützenberger's formula for carminic acid, the change may be thus represented:—

$$\begin{array}{ccccccc} \text{Carminic Acid.} & & \text{Ammonia.} & & \text{Water.} & & \text{Carminamide} \\ C_9 H_8 O_5 & + & NH_3 & = & H_2O & + & C_9 H_9 NO_4. \end{array}$$

This compound is also used for dyeing, but before employing it for this purpose, it is necessary to add 4 per cent. of alumina, in the state of jelly, to the mixture described above. The mass is then slowly evaporated to the consistence of a thick paste. By this means all excess of ammonia is expelled. This preparation is used for dyeing silk, and to produce violet and mauve colours on woollen goods.

Carmine Lakes.—These very beautiful pigments are prepared from a decoction of cochineal, and not from carminic acid, the animal matter which the insect contains, appearing to be necessary to their production. The mode of preparing the finest qualities is kept a secret by the manufacturers; but I will describe two processes, which give very satisfactory results. The first consists in boiling one pound of ground cochineal with two gallons of water, to which has been added one ounce of alum. It is then boiled for three minutes, the liquor is allowed to settle, and, after having been kept for several days, about an ounce of a bright carmine lake is produced. For the alum employed in this process cream of tartar can be substituted. The second process consists in boiling for three hours, two pounds of powdered cochineal in thirty gallons of water. To this is added three ounces of pure saltpetre. The liquor is then boiled again and left to settle. The clear liquor is run off, and after two or three weeks' yields a fine carmine lake.

As these lakes are expensive, they are often adulterated with starch, kaolin, vermillion, &c. The complete solubility of pure carmine lakes in ammonia affords a ready means of detecting these adulterations.

Kermes.—This colouring matter is also derived from a variety of *Coccina*, which lives on the species of oak called *Quercus coccifera.* The young female animal fixes itself under the epidermis of the leaves or young shoots of the oak, in the early part of spring. As the insect grows, it gradually swells out the epidermis, covering the surface of the leaves or branches with a multitude of excrescences. During this period it deposits its eggs.

In Spain and the South of France, during the month of June, or just before the eggs produced would be hatched, the animals are removed, and destroyed by placing them in the steam from heated vinegar.

Although this colouring-matter is seldom used in England, it is extensively employed in the South of France, in Spain, Morocco, and Turkey, to dye morocco leather, and to dye woollen cloth with that particular shade which characterises the cap called "fez," worn by the Asiatics.

If the colour is not so brilliant as that of cochineal, it has the advantage of not being changed by soap or dilute alkalies. It is also employed at Milan, Rome, and Florence to colour a very favourite beverage known as alkermes. The colour-giving principle of this insect is identical with that of cochineal, and has been used as a dye in the East from time immemorial.

Gum-lac.—This is another variety of the *Coccina*, which lives especially on the *Ficus*, or fig tree. They reproduce themselves with such rapidity and in such numbers that they entirely cover the surface of the branches of the trees on which they are deposited. Owing to a resinous fluid which they secrete, they form solid masses, which are often a quarter of an inch thick, all round the branches, and adhere very firmly to them. The natives break off these branches just before the hatching season of the animal, and expose them to the sun to kill the insect. These gum-lac twigs are sold under the name of stick-lac. Those of Siam are considered the best, those of Assam next, and those from Bengal the worst.

There are three kinds of lac in commerce—stick-lac, which has just been described, seed-lac, and shell-lac. The resinous concretion is taken from the twigs, coarsely powdered, and triturated with water in a mortar. The greater part of the coloring principle is thus dissolved.

The granular portion which remains is dried in the sun, and constitutes seed-lac. Shell-lac is obtained by melting seed-lac, and straining whilst hot. It is then dropped upon smooth stems of the banyan tree, and so runs into thin plates, which are known in commerce under the name of shell-lac.

These three lacs have the following composition:—

	Stick-lac.	Seed-lac.	Shell-lac.
Resin	68·0	88·5	90·9
Colouring matter	10·0	2·5	·5
Wax	6·0	4·5	4·0
Gluten	5·5	2·0	2·8
Foreign matters	6·5	..	..
Loss	4·0	2·5	1·8
	100·0	100·0	100·0

The colouring matter of the insect is identical with that of cochineal and kermes, and it has been employed as a scarlet dye-stuff in the East, from time immemorable.

Lac-lake and Lac-dye are preparations imported into this country from India since 1796. They are both prepared by acting on stick-lac by a weak alkaline solution, to which is then added a solution of alum. This produces a precipitate, which, when washed and dried, is ready for use. Although both these lakes are prepared with the same substances, lac-dye is considered much superior in quality. This is due to the greater care bestowed on its preparation. The details of the process are kept secret.

To dye woollen cloths with them, they are dissolved in a weak solution of vitriol, to which is added a little oxy-muriate of tin, and the cloth dipped in when the liquid is near the boil. It only requires washing and finishing to be ready for market.

Some years ago, Messrs. E. Brooke and Co., of Manchester, introduced a lac-dye much superior to that imported from India, which they prepare by treating stick-lac with weak ammonia, and adding chloride of tin to this solution, when a fine red precipitate is formed, which, collected, is ready for use.

Murexide or Roman Purple.—Although this colour has now been superseded by those derived from coal-tar, I call your attention to it as an example of the assistance rendered by the progress of chemistry to the art of calico-printing.

In 1776, the illustrious Swedish chemist, Scheele, discovered *uric acid* in human urine. In 1817, Brugnatelli found that nitric acid transformed uric acid into a substance which he called *erythric acid*, but which was afterwards named by Wöhler and Liebig *alloxan*. In 1818, Dr. Prout found that this latter substance gave, when in contact with ammonia, a beautiful purple red colour, which he named *purpurate of ammonia*—the product known by the name of *murexide* since the researches of Liebig and Wöhler in 1857. These discoveries remained dormant in the field of pure science until the year 1851, when Dr. Saac observed that when alloxan came in contact with the hand it tinged it red. From this he inferred that it might be employed to dye woollen fabrics red, and further experiments showed that if woollen cloth, prepared with a salt of tin, were passed through a solution of alloxan, and then submitted to a gentle heat, a most beautiful and delicate pink colour was obtained.

In 1856, MM. Depouilly, Lauth, Meister, Petersen, and A. Schlumberger, applied it as a dying material to silk and wool, and succeeded in producing red and purple colours, by mixing the murexide with corrosive sublimate, acetate of soda, and acetic acid.

For printing upon cotton, a mixture of murexide with nitrate of lead or acetate of zinc, properly thickened, was printed on the fabric, which was then allowed to dry for a day or two, when the colour was fixed by passing them through a mixture of corrosive sublimate, acetate of soda, and acetic acid.

The uric acid required for the preparation of such large quantities of murexide, was obtained from Peruvian guano. The guano was treated with hydrochloric acid, and washed. The insoluble mass was then treated with nitric acid of specific gravity 1·40. When the action of the acid was completed, the mass was treated with warm water to dissolve out the alloxan. It was then carefully evaporated to such a degree that it became solid on cooling. The solid mass had a brown or violet colour.

PAPER-MAKING IN JAPAN.

The art of paper-making in the country of the Mikado forms the subject of a very interesting Parliamentary document just issued, comprising reports from three of her Majesty's consuls in Japan. Mr. Lowder's report, addressed to Sir H. Parkes, from Kanagawa, was accompanied by numerous coloured illustrations, the work of native artists, and costing only four dollars. These illustrations now accompany the report in the form of engravings, and are highly interesting, being singularly bold and graphic, conveying a very clear idea of the processes referred to.

According to Mr. Lowder, the manufacture of paper from the paper-mulberry (*Broufsonetia papyrifera*) was introduced into Japan about A.D. 610, being mainly brought about by the skill and enterprise of Shôtokn Taishi, a son of the reigning Mikado, who improved on what he had previously learned from Donchô, a priest from the Corea. This Donchô is said to have been a clever man, learned in the Chinese classics, and a skilful artist. But his paper was not all that could be desired. It did not take ink well, and it tore very easily. Taishi had recourse to the paper mulberry, and caused it to be extensively planted all over the country, taking measures at the same time to have the mode of manufacture largely promulgated among the people. From the year 280, paper had been imported into Japan from the Corea, but soon after 610, thanks to the ingenuity of Taishi, the Japanese learned to make their own paper, and even made it of better quality than that of Corea. The art, as practised in the present day, is very rude in its appliances, but is very satisfactory in its results. The mulberry stalks, cut into lengths of three feet or rather less, are steamed, and the skin thus softened is afterwards stripped off by hand. The skins thus peeled off are hung up to dry, a process which occupies from one to three days. They are tied up in bundles, and exposed to the action of running water for twelve hours, or perhaps twenty-four. After this washing, the outer dark skin is stripped off from the inner fibre by means of a knife, the tool being held stationary with the right hand pressing on the material, which lies on a straw padding. The operator then draws the material towards him with the left hand, and as the stuff passes under the edge of the knife the outer fibre is stripped off. The dark outside skin is used for making inferior kinds of paper. After being thoroughly washed in running water, which causes it to open out flat, it is boiled. It is then allowed to rot, and is well beaten, after which paper is made of it, by admixture with the "tororo." In years when the paper-mulberry is scarce, this kind of paper is sometimes made of the common mulberry. The mode of manufacture is the same, and the leaves are occasionally made use of for the purpose.

Reverting to the treatment of the inner fibre, we observe that this is parcelled into lots of about 32lbs. avoirdupois each. It usually takes three days to make this into paper, but adepts can accomplish its manufacture in two. These parcels are taken to the river and thoroughly washed, after which they are steeped in buckets of water. The water is then run off, and heavy stones are placed upon the fibre to squeeze out the remaining liquid. The parcels are next boiled, so as to get rid of all sticky and glutinous matter, and the fibre is then called "sosori." Great care has to be taken that the boiling goes on evenly, and sometimes the boiling has to be assisted by throwing in wax-ash or common lime; but the admixture of either of these will slightly affect the colour of the paper. The boiling, moreover, is not carried on by means of common water, but by the use of water in which the ashes of burnt buckwheat husks have been infused. After this boiling, the sosori undergoes a second washing, in order that the residue of the ash infusion may be thoroughly expelled. For this purpose it is placed in a basket, through which running water is allowed to percolate, after which the basket is lifted up, and the water runs off. The night before the paper is made the sosori is again washed, and the next morning it is pounded "for about as long a time as it takes to boil the rice for breakfast." When paper is made in the winter a little "tororo" is mixed with the sosori before pounding, but in spring rice-paste is used. The totoro is a plant, having a root about the same size as that of the common dock. The sprouts and skin of the root are scraped off, and the root is then beaten. When required for use, the "tororo" roots are boiled into a tolerably thin paste, and strained through a fine hair-sieve into a tub.

In making the paper called "hanshi," the sosori is first formed into a large ball, from which lumps are broken off as required. These lumps are cast into what is called the "boat," and thoroughly mixed with well-strained tororo paste. The necessary pulpy mass is thus formed. In making "hanshi," the boat containing the pulpy material has a length of six feet and a breadth of three. A sort of tray or frame, of the requisite size, has a false bottom of plaited bamboo. This tray is dipped into the pulp, or the pulp may be poured into it. An inner frame is then fitted so as to press down on the false bottom and kep it tightly in its place. A peculiar and dexterous jerk is then given to the apparatus, which has the effect of "setting" the paper. The frame is then placed in a leaning position against an upright rest in the boat, to allow the water to run off, while another frame is prepared. By the time a second frame is ready, the first may be removed, and the entire manipulation is such as can be performed very quickly by experts in the manufacture. Paper made in the winter with "tororo" has the advantage over that made in the spring with rice paste, that it is not likely to become worm-eaten.

In order to dry the paper, the sheet is removed from the frame with a piece of bamboo, the thicker end of the paper being dexterously curled round the stick. By means of a brush the paper is laid on the drying-board, face downward. Five sheets are placed on each side of the board, which is six feet long, and each manipulator requires 40 drying-boards. In fine weather the paper dries quickly; in wet weather it is sometimes dried by the heat of a fire. Cutting is effected by a knife, applied to parcels of 100 sheets. Packing into bundles for the market follows.

Mr. Annesley, writing from Nagasaki, describes the mode of making paper from the bark of the "kaji" tree, and says—"There are no reasons why the "kaji" tree should not flourish in England, more especially if planted in a damp soil; and when it is considered that paper could no doubt be manufactured from this bark at a cheaper rate than it could be made from rags, added to the considerable strength it can attain, and the various useful purposes to which it can be applied, the cultivation of the "kaji" shrub in England is well worthy of a trial." The writer adds—"Some inquiry after this bark has been made by home paper manufacturers from merchants at this port, and samples have been sent to England, where its value will no doubt be appreciated and turned to account." The many forms which paper takes in Japan seem to suggest that we are far behind in the development of this industry. The Japanese will make paper "warranted to wash." They also manufacture oil-paper for rain-coats and other purposes. Some of the common paper is made so tough that it can be torn only with difficulty. Paper is made to have the weight and hardness of heavy wood, or the lightness and elegance of net. Paper hats are made in imitation of straw, the paper being twisted, plaited, shaped, and varnished. Leather is also imitated, and these imitations have excellent qualities to recommend them. Coats, shoes, umbrellas, pocket-handerchiefs, and numberless other articles, are made from paper. As for the raw material, we are told that the Japanese are acquainted with the method of manufacturing paper from rags, but never adopt it, preferring to make their paper from the bark of trees. If the kaji tree can be successfully grown in England, our own papermakers might find it a very useful source for a portion of their raw material. The Japanese seem to luxuriate in an abundance of "sosori;" but in this country the paper-making industry is hemmed in by a comparatively narrow circle. This news comes from Japan very opportunely, and the document before us states that sundry samples of the material have been sent to the South Kensington Museum. The subject is not merely curious, but important. Sir H. Parkes regrets that the information afforded in the consular reports is not more complete, but says:—"It has not been found easy to obtain information from Japanese informants engaged in the trade relative to the production of the raw material or the mode of manipulation." The manufacture appears to be carried on in the interior provinces, and no opportunity of observing the process has been met with at Yeddo.

THE EARL OF DERBY ON EDUCATION.

At the opening of a new School of Art and Science, at Birkenhead, Lord Derby made the following speech, which is interesting as giving a pretty accurate exposition of the system of science and art teaching which now prevails in this country:—

Private wealth is never better employed than in the founding and maintenance of useful local institutions, and when the wealth so used is the result of personal energy and enterprise in business matters, we feel a double satisfaction—first, in seeing that those qualities have brought their appropriate reward, and next, in seeing that what has been liberally gained is freely and worthily expended. I need not tell you that it is to Mr. Laird alone that Birkenhead owes the gift of this building as well as of its sight, and I think that the fact that the sum of £1,100, required for furnishing and as a fund to provide for future repairs, has been raised in a short time, without trouble, indicates a disposition on the part of the inhabitants of this borough to appreciate and to use the advantages which are placed in their hands. With regard to this School of Art I understand that it is now in its 16th year, that it was attended last year by upwards of 160 students, and that in the second grade examination held in 1870, 57 out of 76 candidates succeeded in passing, 22 being classed as excellent, and the rest as good. I have not, I must acknowledge, sufficient experience of the working of these schools elsewhere to judge how, in this respect, the Birkenhead School competes with its rivals, but the facts that 18 prizes were awarded last year to its students, that in the annual national competition Birkenhead gained one Queen's prize, and that payments were made on account of the works of 102 artisans, being an increase of 23 over those of 1869—all statements which I gathered from the last issued report—certainly appear to indicate a healthy state of things. I believe, moreover, that considerable inconvenience has been felt from the want of a suitable building, so that now that that obstacle has been removed, we are entitled to expect a more rapid rate of growth. And let me tell you that this School of Art, and all similar institutions in these parts, will have to grow, if they are to keep pace with the increase of that vast industrial community on both shores of the Mersey, of which Liverpool and Birkenhead are component parts. We have had five years, not exactly of scarcity, and certainly not of idleness, but years in which Lancashire was not as busy as Lancashire usually is. They are passed, and the usual re-action has followed; and in most branches of industry we are doing as well as I suppose we ever did before. Experience teaches us, however, that that also is a condition of things which will pass away; and experience is teaching us another disagreeable truth—that we have more to fear from foreign competition in all occupations for which technical or artistic skill is required than we had fifteen or twenty years ago, or than we are willing to admit at the present day. We have been making a great noise about teaching everybody to read, write, and cypher, and of course that is all as it should be; but book learning is, after all, but a small part of the practical education of life. What is called special or technical training is growing into greater importance every year, and for a very obvious reason. As civilisation goes on, as mechanical skill and scientific knowledge increase in importance, and at the same time become more widely diffused, the tendency in every art, in every branch of production, is to adopt more complex processes, and more labour-saving devices; and these requre more and more men who have been specially and carefully taught to manage them. The fewer human beings you want in order to produce, with such help as you can borrow from nature, a given result, the better as a general rule must be their training to meet the greater difficulty and delicacy of the operations they are engaged in. Now, this training may be got after a fashion by practice only; but it is most perfectly and thoroughly attained by a combination of practice with theoretical instruction; and accordingly in various and very different professions you see the want of a special professional course of teaching recognised. The naval and military colleges about which there is so much talk just now, the establishment which is to train engineers for India, the College of Naval Architecture, the School of Mines in London, the schools under the Science and Art Department, the Agricultural College in the West of England —which I heartily hope will find imitators elsewhere— are all cases in point. They all start from the same leading idea that if a young man is there to learn his business thoroughly, and if that business is one of a complicated or difficult nature, he will understand it best by being instructed more or less, according as his capacity may be, in the theory of what he is doing, instead of being left either to pick it up by chance hints from friends, or to do without it altogether, and work by rule of thumb exclusively. To rely on theory only is like learning to swim on dry land; to rely on practice only is like learning to swim by jumping into the water without anyone to show you what the attitude and motions of a swimmer should be. Now, so far as practice goes, we in England can hold our own fairly with our neighbours; but, if one must trust the reports of those who ought to know best, the other part of English training is very scantily supplied. I was reading the other day an interesting work by Mr. Scott Russell upon this subject two years ago. He may, perhaps, overstate his case—I hope he does—but it is not a pleasant statement for an Englishman to read. When we are told that in the Exhibition of 1867 at Paris, we, as a nation, were beaten "by some nation or other on nearly all the points on which we had prided ourselves;" that we were rivalled if not surpassed even in such articles as steam-engines; that, notwithstanding the greater cost of material abroad, foreign work in iron and steel is imported here because its quality can be more certainly and safely relied on; when one of the jurors at the Exhibition of 1867 tells you that with regard to locomotives and railway works, "our former superiority, whether in material or workmanship, no longer exists;" when Professor Frankland says in the different branches of chemical manufacture, his special subject, "foreign superiority in training is more than counterbalancing the advantages which this country possesses in raw material"—when these things are asserted on what seems to be competent testimony (and I am only picking a few samples, almost at random, out of a mass of evidence of the same kind which is on record), I think it is impossible not to feel that though some of these judgments as to the present and apprehensions for the future may be exaggerated, they are, taken altogether, too serious and too well vouched for to be treated with neglect. In matters of art especially, this superiority of foreign, and especially of French, industry is recognised. One of those skilled witnesses who reported at the Paris Exhibition puts the case so briefly and strongly that I must quote his words: —"The Frenchman's familiarity with art, and his early training in its principles, enable him to outstrip us. You are at a loss to know where they get all the art workmen, but the difficulty would not appear so great if you could read the large placards which are posted up in public places, informing workmen where they can be taught drawing and modelling every evening free of expense. If English workmen are behind in this respect, it is not because art genius is deficient in our nature, but because it is not developed and encouraged sufficiently. It is impossible to estimate the loss which is entailed upon England through the neglect of art culture in every department of our industry, through which we are reduced to mere hewers of wood and drawers of water for other nations." And what this witness says is substantially confirmed, with hardly an exception—indeed, with no exception of importance—by fifty others, similarly reporting on their own branches of business. Now, this is, for us, a very serious matter. Our national prosperity, great as it is, rests on a more artificial basis than that of most countries. We do not even feed our people from our own soil; America has its boundless territory; France has double our area, and a better climate. These are advantages which cannot be lost; but our natural wealth is drawn mainly from trade and manufactures, and we all know by the experience of Holland and the Italian Republics of the Middle Ages—not to go back to more remote dates—how these may pass from one country to another. We can only keep them by successful competition with our neighbours, and it is not enough that we are not falling off, because if we are even advancing, but others at the same time are advancing more rapidly than we, that is to us a relative though not a positive decline. I say then, that the teaching of art, and of science, too, in its practical application—teaching not confined to a few great centres, but so diffused as to reach the whole body of the artisan class, if they chose to avail themselves of it—is one of the requirements of our time. How far that work should be undertaken by the State, and how far by private enterprise, is a question on which I need not enter here. Abroad, the State does everything, but we must bear in mind that abroad large private fortunes are few, and the habit of giving freely out of private means to public objects is not one encouraged by the condition of society. It is a mistake to copy servilely the arrangements of other countries; and I believe that the combination of a central help and a central inspection on the one hand, with local and individual initiative on the other, is for England in general the best. But that is a question which the legislature alone can settle. What I urge upon you now is not that technical education should be pushed on in this way rather than in that, but that it should be pushed on in some fashion. When people really want a thing done they are not likely to quarrel long about the best way of doing it. I do not mean to imply that nothing has been accomplished in this matter. That would be far from the truth. We have at the present time in the United Kingdom about 187,000 persons receiving instruction in drawing from certificated teachers, and the total income of the various schools of art throughout the country is returned at nearly £38,000 for the year ending 1870. I cannot say that these figures, taken by themselves, seem very satisfactory. If you were to take corresponding figures in almost any small German State they would probably require to be multiplied five or sixfold at least in proportion to population. But when we compare ourselves as we are with ourselves as we were—when we see that the £38,000 of 1870 were represented by less than £27,000 in 1866, and that the 180,000 students were, in 1866, only 105,000—we have evidence of growth and life and progress for the time sufficiently rapid. There is one other point on which I should have liked to say a word if time allowed. We live in a very busy and not in a very beautiful part of England. If the country continues to prosper, these districts will be still busier and still less pleasant to see. More than half our population now live in great towns, and these towns, I am afraid, are the ugliest as well as the biggest in Europe. Now, can it be a good thing for generations to grow up, one after another, seeing nothing, except on some rare holiday, except what is squalid, dirty, and mean? It seems to me absolute cruelty to give a man by artistic training a keen sense and appreciation of natural beauty, and then to set him down to live in the centre of—well, I will say even Liverpool, and still more of such places as the great towns on the coalfield. Is it the law of nature that things must always continue as they are in this respect? I do no not see it. The smoke which shuts out the sky, the chemicals which destroy vegetation, the unlovely sights which in any one of these towns meet you at every turn, are all preventible evils, and preventible most of them at no very great cost. There may be persons who think a question of this kind very trifling and unpractical. I differ from them. All art imitates nature. If I were to look at it from an artistic point of view only, I should not be very sanguine of your being able to develop a real and a popular taste for art in places where all natural beauty is driven away and destroyed. That, however, is a very wide subject, and perhaps in this part of the world it is rather a delicate subject. I leave it for other others to dwell upon if they choose. Meanwhile, we shall all agree in wishing success to this School of Art, and that the example set here may be widely followed.

EDUCATIONAL NOTES.

Fees in Denominational Schools.—This question now appears likely to be one of the principal difficulties in working the Education Act. During several weeks past it has been largely discussed in the press and elsewhere; and on the 5th inst. a crowded and enthusiastic public meeting of Nonconformists and other friends of religious equality was held at the Cannon-street Hotel, for the purpose of memorialising the London School Board against the payment of fees in denominational schools, and to take measures for obtaining an amendment of the Education Act. The chair was occupied by Mr. Charles Gilpin, M.P. A memorial, embodying the views of the meeting, was adopted. In the course of a recent speech, Mr. Forster clearly expressed his own opinion on the subject. He said that the Act had three provisions for meeting the case of parents who were too poor to pay school fees. The School Board had power to remit the fees which the parent paid at the school he selected. It had also power to pay the fees at the school, and it further had the power, under certain conditions, of setting up free schools. There was this difference in the provisions—the first two gave the Boards discretionary power, and they might pay the fees, whether the central power in London approved or not; but in regard to setting up free schools, they had to satisfy the government in London that it ought to be done. The Liverpool School Board determined to remit the fees at their schools, and they sent up their bye-laws for approval; but some gentlemen of the highest character protested against the rules on these grounds—that they did not think it right that the money of the ratepayers should be given to any denominational schools whatever. He told these gentlemen that the Liverpool Board were quite within the powers of the Act, and that the government could not interfere. His individual opinion was that, while it was advisable that the two schools should be kept as much apart as possible, it would be almost, if not quite, impossible to enforce compulsion, unless the parent had power given him to choose his own school, even if he were too poor to pay the fee. He therefore suggested to the Liverpool Board that they should so alter their bye-laws as to make it clear that their sole object was to take away any reasonable ground on the part of the parent for resisting compulsion, rather than to take the ratepayers' money to assist the denominational schools. They did so alter the bye-law, and it was his opinion that the Liverpool bye-laws were those which would practically work the best. He had sent those bye-laws round to the School Boards, and they had been in some cases adopted. Other School Boards took quite another line. Two or three Boards had sent up rules which contained the power of remission, but did not contain the power of payment. The idea prevailed that the Government refused their sanction to School Boards when they proposed such bye-laws. This was not true. On the contrary, they were prepared to sanction such laws, because they felt that it was properly in the discretion of the Boards to take that line, and that upon them rested the responsibility. At the same time he felt it his duty to remind the Boards of the difficulty they would be in if they enforced compulsion, and did not make use of the power which they had of paying the fees of the children whose parents preferred another school. He would even go further, and say that if he was not sure that the Boards possessed this power, he would have doubted the justice of passing a bye-law to enforce compulsion without the power of using it. The *Times*, in a leader, referring to the Cannon-street meeting, where a resolution was passed to the effect that the payment of fees "would involve a direct violation of the principles of religious equality, create a system of concurrent endowment, inflict grievous injury on many consciences, and prevent the establishment of national schools," says:—"Considering that the proposed payments would only be made in the case of the small minority of children whose parents cannot pay for their schooling, it requires a conscience of strong magnifying power to foresee these momentous consequences. If the Dissenters are resolved to make a point of conscience of this little matter, they will be able to render it important. Still they must not deceive themselves with respect to the consequences of their policy. They may succeed in delivering ratepayers from being compelled to pay fees for denominational schools, but, at least, in the prsent state of religious feeling, it will be at the cost of rendering it impossible to compel parents to educate their children." On the other hand, the *Daily News* is of opinion that only those parents who can pay for their children's education have the right to choose the kind of school at which they shall be educated, and that all that the State has concern with is, that these children should have a secular education.

Scientific Instruction.—In a speech at the distribution of prizes of the Lancashire and Cheshire Union of Institutes, the Right Hon. W. E. Forster said there was a very strong feeling in the country on the part of employers, and also on behalf of those they employ, that it is absolutely necessary that there should be more scientific and more technical education for their workpeople. He thought, sometimes, when they talked about this necessity, that they forgot that the employing class required that education as much as those they employed, and when they were so very anxious that their workpeople and their overlookers should obtain scientific and technical education, they ought to be perfectly sure that their own sons, and those whom they are putting into business with capital behind them, obtained that education. Sir John Lubbock, in an address at the distribution of prizes at the Liverpool Trades' Hall, in connection with the local school of science for operatives, whilst acknowledging that the government had never been chary of incurring expense for important scientific researches, said he could not speak with equal satisfaction of their conduct in the matter of elementary schools. Scientific men throughout the country unanimously regretted the manner in which the grants to these schools were distributed. Reading, writing, and arithmetic, although the foundations of education, were not education itself, and the schools would never be placed on a sound and satisfactory basis until they took a wider ground. Sir John quoted, in support of this view, the resolutions of the British and the Social Science Associations, and the opinions of those practically concerned in education. He argued that were more advanced subjects taught, the reading and writing themselves would be of better quality.

CORRESPONDENCE.

THE RESOURCES OF INDIA.—THE COTTON INDUSTRY OF MADRAS.

SIR,—When the vexatious and inquisitorial Moturpha tax was abolished in 1861, there were on an average only 204,623 cotton looms at work in the whole presidency of Madras, while there are now 279,220, showing a great advance in the last 10 years, a result chiefly due to the abolition of the above tax, as every other circumstance has been, on the whole, against the industry since that date, especially the high price of the raw produce.

The average number of looms, as per Moturpha tax returns, during the five years from 1856-57 to 1860-61, (the date of its abolition), was 204,623; of which there were 46,007 in towns, and 145,734 in villages; North Arcot heading the list with a total of 20,071, Cuddapah, 19,431; Bellary, 17,074; Tanjore, 16,745; Salem, 15,068; Kistna, 14,721; Tinnevelly, 14,039, while Trichinopoly, Malabar, and Ganjam, shared least in the industry, having only at work 5,052, 4,057, and 4,492 looms respectively.

Of the total number of looms at work in 1869-70, namely, 279,220, there were 59,205 existing in towns, and 220,015 in villages, so that the great bulk of the looms have been, and are still, situate in the villages and hamlets, not in the towns. Of these, Vizagapatam worked the largest number, namely, 34,004, Tinnevelly next, with 24,049; Bellary next, with 23,293, and then Kistna, Salem, Godavery, and North Arcot, with 19,640, 18,981, 15,438, and 15,037 respectively; those entering on a smaller scale into this industry, were the districts of Trichinopoly, Malabar, and South Canara, respectively working 6,738; 4,904; and 2,047 looms.

The increase during the last 10 years, has been about 25 per cent. The industry has declined in 5 districts only, namely, in North and South Arcot, Tanjore, Cuddapah, and Malabar. The decline in South Arcot has been attributed to the rise in the cost of the raw material, and large importations of piece goods by sea, but it is notorious that our active neighbours in that district, the French at Pondicherry, export large quantities of native-woven cloth dyed in that place.

On the whole, the weaving industry of Madras, seems to be in a tolerably healthy state.

The quantity of twist worked up into cloth by these native looms, is about 31½ million lbs., or about 112lbs. per loom annually; in many districts they only weave during the slack months, the looms working in many cases only half and three-quarter time; of this quantity, about 9 million lbs. was foreign imported twist, while 22½ million lbs. were country made.

The value of the cloth manufactured from these 31½ million lbs. of twist was £3,508,365.

Table Showing the Quantity and Value of Cotton Twist Imported into the Madras Presidency for the last Twenty Years.

	lbs.	Value.
1851-52	2,647,246	£171,925
1852-53	2,567,125	169,007
1853-54	3,086,901	200,881
1854-55	3,242,427	211,002
1855-56	3,929,839	226,807
1856-57	4,205,740	227,038
1857-58	3,505,233	214,530
1858-59	6,147,607	354,607
1859-60	7,366,788	415,959
1860-61	7,035,001	388,496
1861-62	6,177,535	380,575
1862-63	4,023,301	258,563
1863-64	6,978,675	453,279
1864-65	6,418,914	617,679
1865-66	6,522,650	716,102
1866-67	7,165,098	785,912
1867-68	9,196,894	833,663
1868-69	10,095,240	916,348
1869-70	11,683,508	927,194
1870-71	12,816,005	1,043,217

The above table shows a steady advance in the import of twist; and the official value has risen from 1s. 4d., to 1s. 8d. per lb., while its importation in 1870-71 represented more than one million pounds sterling.

Of the sorts of twist imported, the great bulk consisted of those low numbers which are worked into the more ordinary native cloths, viz., the numbers between 20 and 42, which may possibly somewhat account for the falling off in the number of looms in North Arcot, and Malabar, as the finer native fabrics, such as Arnee muslins, and

Malabar Nayar cloths, and similar ones, are being beat out of the market, and the looms employed on these finer textures have discontinued working.

It is calculated that a single loom can turn out eight women's cloths per month—each cloth taking six skeins of twist of $3\frac{3}{4}$ pollams each, in all 162lbs. in 12 months of ordinary work.

As it requires from 6 to $6\frac{1}{2}$ lbs of cleaned cotton to make 5lb. of twist, the wastage in working it up being about 25 per cent, the average consumption of raw cotton in the manufacture of the $22\frac{1}{2}$ million lbs. of country-made twist will be about 28 million lbs., or allowing for a somewhat greater wastage with country spindles, &c., and some under-estimating both of looms and twist, about 35 million lbs. may be roughly estimated as the quantity of raw cleaned cotton worked up into country twist for the use of the native looms.

The average value of the out-turn of each loom is £12 10s. per annum.

The value of the annual export of country-made cloth amounts to about £222,000. The following is a detail of the value of cotton piece-goods exported from the Presidency of Madras for the last twenty years.

	Value.
1851-52	£290.893
1852-53	352.151
1853-54	314,102
1854-55	269.840
1855-56	214,591
1856-57	202.529
1857-58	208.722
1858-59	236,718
1859-60	206.131
1860-61	187.468
1861-62	207.560
1862-63	198.676
1863-64	163,778
1864-65	156,389
1865-66	204.717
1866-67	235,572
1867-68	336 659
1868-69	230,027
1869-70	221.815
1870-71	216,209

The exports by land are very small.

The above table shows a very valuable indigenous industry.

The acreage under cotton has fluctuated considerably, but a very large permanent increase has taken place of late years, and the average yield per acre annually may may be taken at about from 65 to 70lbs. of clean cotton. The following table shows the Madras cotton cultivation from 1852 to 1870.

	Extent cultivated. Acres.
1852-53	983,040
1853-54	911,489
1854-55	868.210
1855-56	797.504
1856-57	938.047
1857-58	932,180
1858-59	1,041,848
1859-60	1,076,658
1860-61	1,060,558
1861-62	1,020,184
1862-63	1,309,324
1863-64	1,766,312
1864-65	1,747,501
1865-66	1,395,697
1866-67	1,316,944
1867-68	1,486,861
1868-69	1,341,365
1869-70	1,758,022

The exports and official values of raw cotton, exported from the Presidency for the last 20 years, points out a permanent and very valuable advance, as shown below.

Exports of Raw Cotton.

	Quantity, lbs.	Value. £
1851-52	35,359,252	403,521
1852-53	76,067,998	866.507
1853-54	31,325,840	378,538
1854-55	26,849,395	311,942
1855-56	21,013,464	252,135
1856-57	53,988.065	722,228
1857-58	55,015,309	877,172
1858-59	38,652,542	611,790
1859-60	82,512,521	959,713
1860-61	78.822 027	1,129,121
1861-62	86,544,471	1,704,021
1862-63	62 374,133	2,381,288
1863-64	72.490,886	4,471,811
1864-55	73,101,578	4,041,893
1865-66	120,034.216	4,841.631
1866-67	24.367,331	943,778
1867-68	47.026,932	1.238.638
1868-69	89,181,858	2.139.982
1869-70	68,474.448	1,912.505
1870-71	42,347,132	1,060,413

Though these exports have been fluctuating, they show that between 1851-52, and 1853-54, the average export was, 47,584.000lbs., valued at Rs.0. 1. 10. per lb.; while between 1868-69, and 1870-71, the exports averaged 66,668,000lbs., valued at Rs.0. 4. 1., or 6·125 per lb.—I am, &c., A. Romaine Wragge, Lieut.-Col.

Old Charlton, S.E., Oct. 2, 1871.

Commerce of Genoa in 1870.—The Chamber of Commerce of Genoa have published the following statistics of the steam navigation of the Port of Genoa in 1870. The arrivals during the year was as follows:—

	No.	Tonnage.
Italian	1,127	307,344
French	594	187,586
English	185	136,477
Various other nations	28	17,642
Totals	1,934	649,049

The departures were the following:—

	No.	Tonnage.
Italian	1,215	298,439
French	628	204,083
English	180	121,593
Various other nations	30	13,037
Totals	2,053	637,152

Thus making a total movement of 3,987 steam vessels, of the aggregate tonnage of 1,286,201. The greatest number of arrivals were from Marseilles, being 383, of 127,965 tons; and the greatest number of departures were from Leghorn, being 854, of 333,368 tons; whilst the number of vessels that left Genoa for Marseilles was 425, of 139,669 tons. Comparing the movement of steam shipping in 1870 with that of the previous year, we find a considerable reduction in the number of vessels, but, on the other hand, a sensible augmentation in tonnage. The following shows the arrivals and departures in 1870 as compared with that during 1869:—

Arrivals.

	No.	Tonnage.
1870	1,934	649,049
1869	2,115	610,197

Departures.

	No.	Tonnage.
1870	2,053	637,152
1869	2,115	580,449

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All communications for the Society should be addressed to the Secretary, John-street, Adelphi, London, W.C.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.

By Dr. Crace Calvert, F.R.S.

LECTURE III.—DELIVERED TUESDAY, FEBRUARY 21ST.

Blue Colouring Substances.—Indigo, Orchil, Cudbear, Litmus, Prussian Blue, and Ultramarine.

Indigo.—This most valuable dyeing substance was used as a dye-stuff in India and Egypt long before the Christian era, and the Romans were acquainted with it, although they only used it as a pigment, not knowing how to render it soluble, and so available for dyeing. It is only since the sixteenth century, or from the time of the discovery of the passage to India round the Cape of Good Hope, that it has become generally known in Europe; and its employment as a dye was greatly retarded by the opposition it met with from the large vested interests of the woad cultivators, who induced the English, French, and German governments to promulgate several enactments against its use. So severe were some of them, that Henry IV. of France issued an edict, condemning to death any one who used that pernicious drug called the "devil's food." It is only since the year 1737 that the French dyers have had the right of using indigo without restriction.

Indigo exists in several varieties of plants, among which may be mentioned the *Polygonium tinctorium* and the *Isatis tinctoria*, or woad; but, as in the case of nearly all the dye-stuffs already spoken of, it is found most abundantly in plants of the leguminous order. It is extracted commercially from the genus *Indigofera*, varieties of which grow abundantly in India, Java, China, and in some of the South American States.

To extract the indigo which the plant contains, it is mowed when in full flower, made into bundles, and carried into large vats containing water. Fermentation ensues, which is allowed to proceed for eight or nine hours, when the liquor, which was yellow at the beginning of the operation, assumes a dark green colour, forming a blue scum on the surface. This liquor is then run off into shallow vats, where it is violently agitated with sticks, stirred by men or women, or with a dasher, which produces the same result, the conversion of the white, soluble indigo into blue insoluble indigo. A little lime-water is now added, and the whole allowed to rest. The blue indigo thus deposited is boiled with water, when a scum, composed of vegetable and animal matters, comes to the surface, and is removed. The blue paste is thrown on a filter, pressed, and placed in wooden frames, which are divided into small squares, where the indigo is allowed to dry first in the sun, and afterwards in the shade. The quality of the indigo produced depends mainly on the care bestowed on its manufacture.

Until 1855 we had no correct ideas as to the state in which the indigo existed in the *Indigofera* plants, nor of the changes which it underwent during the process of extraction. It had been stated by M. Chevreul, many years before, that white indigo was oxidised into blue. But in the above year, and subsequently, in 1857 and 1865, Dr. Schunck published a series of papers, in which he described the true nature of the chemical changes which take place in the manufacture of indigo. He operated on the *Isatis tinctoria*, or woad, which contains the same colour-giving principle as the *Indigofera* and is the only plant yielding indigo that grows freely in this country.

By these researches, he demonstrated that indigo existed in the plants, combined with a sugar, forming a glucoside, to which he gave the name *indican;* this compound, under the influence of fermentation in the manufacturing process, was unfolded into indigo and sugar. By treating the dried woad with ether or alcohol, Dr. Schunck obtained indican, and, among other processes for its extraction, gives the following simple one. He treats the pounded dried woad leaves with ether in a displacement apparatus, and distils off the greater part of the ether. The remaining green liquor is then evaporated at a moderate temperature, a little cold water added to the syrupy residue, and the insoluble chlorophyl and other matters separated by filtration. The yellow liquid thus obtained is evaporated, either spontaneously or in vacuo.

Indican is a yellow, transparent, glutinous solid. As may be seen from the above, it is soluble in alcohol, ether, and water. When boiled with caustic alkalies, it evolves ammonia, but its most remarkable and interesting property is that of yielding indigo blue when treated with strong acids. If sulphuric or muriatic acid be added to its water solution, no change whatever is perceptible for some time. But on heating to near the boiling point, the solution immediately becomes sky-blue. On boiling for a short time, the solution becomes opalescent. On continuing to boil, it acquires a purple colour; and then, provided the solution is tolerably concentrated, a copious deposit of dark purple flocks is formed. These are collected on a filter, and washed with water. By treating the washed flocks with alcohol, Dr. Schunck obtained pure indigotine, and a reddish blue substance was dissolved, called by Berzelius indigo-red, and by Schunck indirubine, which may be considered as a product of the decomposition of indican.

The colour-giving principle of the plant may be considered, like those of the dyewoads, as a glucoside, yielding by its decomposition a colourless principle, which is afterwards converted into a colour. Dr. Schunck explains by the following formula the decomposition of indican into indigo:—

$$\overset{\text{Indican.}}{C_{26}H_{33}NO_{18}} + \overset{\text{Water.}}{H_2O} = \overset{\text{Indigo.}}{C_8H_5NO} + \overset{\text{Indiglucine.}}{3\,(C_6H_{10}O_6)}.$$

In 1864 he published a most valuable paper, throwing much light on the manufacture of indigo, and the management of what is called a woad vat. In it he gives the chemical actions which take place, and explains why, if the indigo manufacturer does not take the greatest care in conducting the process of fermentation, to extract the indigo from the plant, he will either get an inferior quality of indigo, or a great decrease in the yield of the product, or even in some cases entirely lose the colouring matter. He shows that these results take place when the fermentation in the vats is allowed to be either too rapid or too prolonged, in which cases not only is indican decomposed, but the *indiglucine*, or sugar, is converted into alcohol and acetic acid; and he shows that the indigo combines with this alcohol and acetic acid, yielding a compound which does not permit the indigo it contains to be oxidised on exposure to the air. This explains the loss of indigo in its manufacture. Dr. Schunck represents the change by the foling formulæ:—

$$\overset{\text{Indigo.}}{C_8H_5N\,O} + \overset{\text{Alcohol.}}{8\,(C_2H_6O)} + \overset{\text{Acetic acid.}}{3\,(C_2H_4O_2)} + C\,O_2$$
$$= C_{31}H_{39}NO_4 + 13\,H_2O.$$

He produced this compound more easily by treating pure indigo blue with alcohol, to which was added an alkaline solution of protoxide of tin, until the indigo was dissolved, acetate of soda was then added, and the whole digested at a moderate temperature. The indigo blue after some time ceased to be deposited on exposure to air, having entirely disappeared, having been converted into the new compound.

Pure indigo, or indigotine, can be prepared from indican, by the process already described, or by reducing indigo to powder, placing it in a small dish on which is a cover, and applying a heat of about 300° or 400° Fahr., when beautiful prismatic needles of indigotine are sublimed, which are removed mechanically. It is insoluble in water, alcohol, or ether, or in weak acids, or alkalis, but is slightly soluble in creosote, carbolic acid, and anhydrous acetic acid, to which a very small quantity of sulphuric acid has been added. From this latter solution, the indigotine may be precipitated by the addition of water. It is the only solution of blue indigo that can be applied directly on a fabric.

Indigotine, when heated, gives off beautiful violet vapours, having a characteristic odour. Under the action of oxidising agents, such as nitric acid, it yields three distinct products, *isatin*, $C_8\,H_5\,N.O_2$; *indigotic or nitrosalycilic* acid $C_7\,H_3\,(NO_2)\,O_3$, and picric acid, $C_6\,H_3\,3\,(NO_2)\,O$. The first is formed by simple oxidation, whilst in the second and third, part of the carbon is oxidised, and hyponitric acid is substituted for part of the hydrogen. These chemical reactions lead me to call your attention to some very interesting scientific deductions, showing indigo to bear a very close relation to aniline and carbolic acid, both products derived from coal-tar. If indigotine is heated with potash in a small retort, aniline is produced, and distils over. When indigo is heated for some time with caustic potash solution of specific gravity, 1·35, it yields anthranilic acid, which may be considered as a phenyle-carbamic acid. Anthranilic acid again, being heated to 570° Fahr., gives salycilic acid, which may be considered as a compound of carbonic with carbolic acid. Lastly, indigotine, like carbolic acid, yields on treatment with excess of nitric acid, picric, or trinitrophenic acid.

These facts have produced on the minds of chemists a conviction that indigotine will one day be artificially prepared from carbolic acid, and recently MM. Emmerling and Engler have accomplished the scientific artificial production of indigotine from a compound acetone, discovered in 1857 by M. Friedel, to which these gentlemen have given the name of acetophenone. Their process consists in acting on this compound with fuming nitric acid, when two nitro-compounds are produced, one crystalline, the other syrupy. To the latter, after its evaporation to the state of a resinous mass, they add ten parts of reduced zinc and one part of soda-lime. The mixture is heated in small tubes, when a little water evaporates and a dark coloured substance sublimes, which contains indigotine in small quantities. This result is certainly a triumph of scientific chemistry, and brings us another stage nearer the commercial artificial production of a most valuable dye,

A great variety of substances, by adding one equivalent of hydrogen, convert blue indigo into white indigo, which is a colourless substance, without taste or odour, insoluble in water, but soluble in alcohol and ether, and in solutions of the alkalis and alkaline earths. On this point I may observe that, many years ago, I devised a process, by which many pounds worth of indigo were recovered from the refuse bottoms of the blue dip vats, the preparation of which I shall explain further on. I found that indigo was susceptible of forming insoluble compounds with the lime and protoxide of iron. White indigo dissolves freely in strong sulphuric acid, giving a dark purple blue liquor.

Many substances are employed commercially to convert blue indigo into the white indigo, soluble in alkalies. Thus, I may mention lime and protoxide of iron, caustic alkali and protoxide of tin, or sulphuret of tin or arsenic, and zinc and caustic alkali; also organic substances, such as grape sugar and bran, which enter easily into fermentation. The following formulæ show the difference of composition of the two indigos:—

$$\overset{\text{Indigotine.}}{2\,(C_8\,H_5\,N\,O)} + \overset{\text{Hydrogen.}}{2H} = \overset{\text{White Indigo.}}{C_{16}\;H_{12}\;N\;O_2}$$

I shall now have the pleasure of proceeding to describe some of the methods employed by chemists to determine the relative commercial value of samples of this expensive dye. The best qualities of indigo from Bengal, Java, and Guatamala, are light, have a uniform texture, and a fine coppery hue, which is increased by friction. The following analysis, made by M. Chevreul, shows the composition of a fair sample of commercial indigo:—

Indigotine	45
Matters soluble in alcohol	30
Matters soluble in ether	12
Resin soluble in hydrochloric acid	6
Mineral matters	7
	100

Commercial indigos are often adulterated with mineral matters of various kinds. This fraud is easily detected by calcining a known weight of the sample, which ought not to leave a residue of more than ten per cent. The most common adulteration, however, is the addition of starch. This can be detected by boiling some of the pulverised indigo with a weak solution of hydrochloric acid. The insoluble starch is thus converted into soluble dextrine, which yields a beautiful purple colour with iodine.

There are several processes employed to determine the amount of indigotine in commercial indigos. I shall here only give the outline of three. The first consists in dissolving one gramme of the dry pulverised indigo in twelve grammes of concentrated sulphuric acid, and heating the whole at a temperature not exceeding 120° Fahr., when the indigo combines with the sulphuric acid, and becomes perfectly soluble in water. It is then diluted with water, so that the whole occupies one litre. The operation is repeated with one gramme of pure indigotine, which serves as a standard of comparison. A solution of bleaching powder, or bichromate of potash—the first proposed by M. Chevreul, the latter by Dr. Penny—is prepared of such a strength that one hundred volumes of the solution will completely destroy the whole of the colour produced by the gramme of indigotine. Part of the same liquor is then applied to the solution of the commercial indigo, and the number of volumes required to destroy the colour represents the per-centage of indigo. Thus, if 60 divisions are required, it is assumed that there is 60 per cent., if 70 divisions, 70 per cent. This method of estimating the indigotine is not to be relied on, as it always gives a much higher per-centage of colour-giving principle than exists in the indigo, owing to the hypochlorous acid of the bleaching powder, and the chromic acid of the bichromate not only decomposing the indigotine, but acting on several colouring matters which are included in the portion soluble in alcohol in M. Chevreul's analysis.

The second process gives better results; it is due to Professor Fritzsche, and consists in introducing one part of indigo, finely pulverised, and one part of grape sugar, into forty-eight or fifty parts of boiling alcohol, to which is added two parts of a concentrated solution of caustic soda. The whole is put into a bottle exactly large enough to hold it, and left to cool. By exposing the colourless liquid to the atmosphere, the reduced indigo which is in solution absorbs oxygen, and the indigotine is precipitated under the form of beautiful prismatic crystals.

The third process, devised by myself, I have found to give satisfactory results. It consists in introducing into a flask one part of finely pulverised indigo, two parts of green copperas, and two hundred parts of water containing ten per cent. of caustic soda. The whole is kept at the boil for a short time, and allowed to cool. The clear liquor is exposed in shallow vessels to the atmosphere, when the soluble indigo is oxidised, and precipitates as pure indigotine. The residue in the flask is submitted to the treatment three times. The whole of the indigotine thus obtained is collected on a filter, dried, and weighed.

A commercial process, founded on the above method, is carried on by Messrs. Haas and Co., who sell indigo so purified under the name of refined indigo. An inferior quality is also prepared by heating indigo, at a moderate temperature, with weak muriatic acid, which dissolves lime and other mineral matters, as well as any starch it may contain; it is slightly washed and boiled with weak caustic soda, to dissolve the chlorophyl and other resinous impurities.

I shall now call your attention to three commercial preparations of indigo, obtained by the action of sulphuric acid on it. The first is called *sulpho-purpuric acid* or *phenicine*, which is made by adding one part of indigo to four parts of highly concentrated sulphuric acid, heating for a short time, varying from half an hour to an hour, or until a small quantity of it mixed with a large quantity of water gives a deep purple colour. Great care must be bestowed on this part of the operation, so as to avoid the formation of a compound, to which I shall have again to call your attention, *sulpho-indigotic acid.* The acid mass produced is thrown into about 40 or 50 parts of water, when a beautiful purple precipitate is produced, which is collected on a filter, and slightly washed with weak muriatic acid. To dye wool with this sulpho-purpuric acid it is necessary to add to the bath a little muriatic acid, when it yields to the wool a fine dark purple-blue, that can be converted into various shades of purple by passing the wool so dyed in a bath containing a small quantity of carbonate or acetate of soda, which removes a small quantity of sulpho-indigotic acid that may be present, and gives rise to *sulpho-purpurate of soda*, which is a faster dye than the acid itself.

Sulpho-indigotic Acid is manufactured by dissolving one part of indigo in ten or twelve parts of concentrated sulphuric acid, and heating the whole at a temperature of 120° F. very carefully for some hours. The operation is completed when a small quantity dissolves entirely in cold water.

The acids above described, when obtained perfectly pure, have the following formulæ:—Sulpho-purpuric acid, $C_{16}H_{10}N_2O_2, SO_3$; sulpho-indigotic acid, C_8H_5NO, SO_3.

Berzelius admits a third compound, called *hypo-sulpho-indigotic acid.* These acids are transformed into neutral salts of soda, and sold under the names of neutral paste and carmine of indigo. They are prepared by neutralising the sulpho-acids with carbonate of soda, and the paste so formed is thrown on a woollen filter to remove the sulphate of soda which it contains, as well as a green colouring matter, which is doubtless modified chlorophyl. The paste is then washed with a solution of chloride of sodium. It is a curious fact that carmines of indigo, which are perfectly soluble in pure water, are altogether insoluble in water containing either sulphate of soda or chloride of sodium.

Whilst speaking of the sulpho-indigotates, it may be useful to notice that the sulpho-indigotates of potash and soda are soluble in 100 to 150 parts of water, the sulpho-indigotates of lime, magnesia, and alumina are freely soluble, whilst those of baryta and lead are insoluble.

The carmines of indigo are especially used by silk-dyers, in consequence of the removal of the green colouring matter above referred to, and which, if allowed to remain, would spoil the blue or purple which they wish to obtain. The method practically adopted to ascertain if the sample has been well washed, consists in rubbing a small quantity of it on a piece of glazed paper, which, when the colour dries, gives a colour varying from a pale blue to a rich copper purple, according to the mode of manufacture; and if any green colouring matter is left in, it shows itself as a green ring round the blue circle.

The following may be taken as the composition of a sample of carmine of indigo of fair quality:—

Water	85
Indigo	10·2
Saline residue	4·8
	100·0

The sulpho-indigotic acids are especially used by woollen-dyers, who add to the dye-beck a little alum and cream of tartar, which helps the fixing of the indigo on the wool. The green colouring matter is in this case not objectionable, having no affinity for the fibre of wool.

The carmines of indigo, as well as the sulpho-acids, are easily decolourised by reducing agents, such as hydrogen and sulphuretted hydrogen, but they gradually reassume their original colour when exposed to the atmosphere, through the absorption of oxygen.

The above compounds, not being suitable for dyeing cotton, and not giving colours on silk and wool that may be considered fast, I shall now proceed to describe a few of the methods followed to obtain fast indigo blues. They are all based on the principle of the reduction of blue indigo into white indigo. The latter compound is held in solution by an alkali, which enables the dyer or printer to introduce it into the fibre of the fabric, where, on exposure to the atmosphere, the alkali combines with carbonic acid, and the white indigo thus liberated absorbs oxygen, and becomes insoluble blue indigo. The principal class of goods to which this chemical reaction is applied is to the vegetable fibres, linen, and especially cotton. As far as dyeing is concerned, the processes can be classed under two heads, hot and cold. The hot process is principally applied to wool, the cold to vegetable fibres, especially cotton.

The oldest and still most generally employed method of preparing cold vats consists of putting into a vat containing about two thousand gallons of water, sixty pounds of indigo, very finely powdered, one hundred and eighty pounds of slacked lime, and one hundred and twenty pounds of sulphate of protoxide of iron or green vitrol (free from any trace of copper salt), the two latter substances being added from time to time. The greater part of the lime used unites with the sulphuric acid of the iron salt, to produce sulphate of lime or gypsum, and the liberated protoxide of iron removes the oxygen from the indigo, becoming converted into saline oxide, whilst the reduced indigo dissolves in the excess of lime employed.

Messrs. R. Schloesser and Co., of Manchester, have introduced within the last year or two a marked improvement in the preparation of cold vats, which removes the great objections of the bulky precipitate of sulphate of lime, the formation of an oxide of iron, and the loss of indigo by its combination with the oxide of iron referred to in the previous part of the lecture. The bath remaining much more fluid, the pieces are less apt to be spotted, and a better class of work is produced. To carry out their process, they add to the ordinary two thousand gallon vat twenty pounds of ground indigo, thirty pounds of iron borings, thirty pounds of their remarkable powdered zinc, and thirty-five pounds of quick lime; the whole is stirred up from time to time for twenty-four hours, when it is ready for use. If the bath is not considered sufficiently strong, a little more lime and zinc are introduced.

The chemical theory of the process is, that the zinc, under the influence of the lime, decomposes water, combining with its oxygen, and the hydrogen thus liberated, removes oxygen from the indigo, which then dissolves in the lime.

To dye cotton yarn in the above vats, it is simply necessary to dip it for a few minutes in the dye bath, and expose it to the atmosphere, when the green hue it has acquired passes rapidly into blue. This operation is repeated until the yarn has attained the required depth of shade, when it is passed into weak vitriol, washed, and is ready for market.

To dye calicos, the pieces are hooked on frames, passed through a bath of weak milk of lime, and then dipped into the reduced indigo vat. After fifteen minutes, the frame is taken out and the cloth exposed to the air for about the same length of time. It is again dipped, the process being repeated until the required depth of tint is attained. It is then passed through weak vitriol, and washed. The cold vats are especially used when it is wished to obtain white and yellow designs on a blue ground; but when the object in view is to produce a self-colour, a more rapid process is adopted. This consists in passing the pieces through a dye-beck, then through an acid liquor, and lastly in water, by means of rollers fixed in the vat. The bath is composed of lime, sulphate of iron, and indigo, but is kept hot, instead of cold as in the former case.

There is still another process, which is now used to a limited extent only, but was at one time very extensively employed. It produces on the cloth a pale blue, which has a great similarity of tint to that seen on the china porcelain, from which it derives its name of china-blue. To produce it the pieces are printed with a mixture containing very finely-powdered indigo, and a little acetate of iron, and are made to pass through six successive vats. The first two contain lime, the third sulphate of iron, the fourth a solution of caustic soda, the fifth a dilute solution of sulphuric acid, and the sixth water. When the design has acquired the required depth of blue, the pieces are washed, passed once more through weak sulphuric acid, and again washed. The chemical reactions are exactly similar to those in the cold vat process.

For dying wool, a modification of the old woad vat is employed. The use of woad being now almost entirely discontinued, I shall merely call your attention to the process in which indigo has been substituted for woad. It bears the name of Indian vat, doubtless from the process having been practiced in India and imported from thence. It is as follows:—Eight pounds of powdered indigo is added to a bath containing 3½ pounds of bran, 3½ pounds of madder, and 12 pounds of potash, which is maintained for several hours at a temperature of 200° Fahr. It is then allowed to cool to 100° Fahr., when fermentation ensues. After about forty-eight hours, the indigo is rendered soluble, being reduced, by the decomposition of the sugar and other products contained in the bran and the madder-root during the process of fermentation. The bath should have a greenish yellow appearance, having a frothy scum of a blue coppery hue.

Of late years, improvements have been made in this class of vats, by which the expense of using madder is avoided. They are now prepared by adding to water, at a temperature of 200° Fahr., twenty buckets of bran, twenty-six pounds of soda crystals, twelve pounds of indigo, and five pounds of slacked lime. After five hours, the bath is allowed to cool to 100° Fahr., when fermentation ensues, and the indigo is dissolved in the alkali. The management of these vats require great experience and care, for if the fermentation is too slow the indigo is not properly reduced, whilst if too active large quantities of indigo may be lost. The researches of Dr. Schunck, already referred to, not only show the method of avoiding this loss, but explain why it occurs. The remarks which I made as to the causes of failure in the manufacture of indigo are applicable here, namely, that if the fermentation becomes alcoholic and acetic, the non-oxidisable indigo compounds described by Dr. Schunck are generated.

I cannot leave the subject of indigo without bringing before you a most curious source of its production, namely, the human body. Medical men had observed from time to time that urine, secreted under certain pathological conditions, became brown, and sometimes even blue, when exposed to the atmosphere. The late Dr. Hassel discovered that in some instances the colouring matter was indigo, but here, again, we are indebted to Dr. Schunck for much information on the subject. In three papers presented to the Royal Society, he has proved that urine, in cases similar to those examined by Dr. Hassel, contained the glucoside of indigo, or indican. He also observed that indican was a very frequent constituent of urine secreted by persons in a healthy state, and, in fact, that it is produced generally when persons do not take sufficient exercise, and he has on several occasions succeeded in producing it by taking in his food a rather large excess of sugar.

Orchil, Cudbear, Litmus.—I shall now call your attention to a colour which was discovered in 1300, by an Italian named Federigo, who, during his travels in the East, observed the tinctorial powers of a certain class of weeds called *lichens*, and he introduced the colour into Florence under the name of *orchil.* By this discovery he and his family made a very large fortune.

Lichens are small plants which live either in the stems or leaves of trees, or on rocks, or damp soils. To this class belongs all the vegetation found in the Arctic circle, but the species growing there are not employed to produce the colouring matter orchil, the varieties used for this purpose being found in warmer, and especially in tropical climates. These latter can be divided into two classes; the first and most abundant, which grow on rocks near the sea-side, includes the species *Roccella tinctoria* and *Roccella fuciformia.* They are obtained from the Canary Islands, Cape Vere, and Sardinia, but principally from Madagascar, Zanzibar, Angola, and South America. The second class grows inland, and includes the species *Variolaria orcina,* found especially in the Pyrenées.

Lichens do not contain any colouring matter already formed, but contain colourless acids, which, under the influence of ammonia and the oxygen of the atmosphere, give rise to the orchil. As the lichens imported into this country vary considerably in the amount of orchil which they yield, Dr. Stenhouse has rendered a great service to the manufacturers in furnishing them with a simple and accurate process, of ascertaining their commercial value. The following is an outline of his method:—One hundred grains of the lichen are macerated with a dilute solution of caustic soda, two treatments being sufficient to extract the whole of the colouring matter. A solution of hypochlorite of sodium of known strength is added to the soda solution from a graduated alkalimeter; the moment the bleaching liquor comes in contact with the soda solution of the lichen a blood red colour is produced, which disappears in a minute or two, and the liquid has only a deep yellow colour. A new quantity of bleaching liquid should then be poured into the soda solution, and the mixture carefully stirred. The operation should be repeated as long as the addition of the hypochlorite of sodium causes the production of the red colour, for this shows that the soda solution still contains unoxidised colouring principle. Towards the end of the process the bleaching solution should be added by only a few drops at a time, the mixture being carefully stirred between each addition. By noting how many measures of the bleaching liquor have been required to destroy the colouring matter in solution, the amount of colouring principle contained in the lichen may be determined.

The manufacturers of orchil, are also indebted to Dr. Stenhouse for a process of obtaining the orchil, which, besides simplifying the operations required, gives brighter colours and extracts than could be produced before the publication of his method, in 1848. Of this you will easily judge when I tell you that the process carried on for centuries, consisted in breaking up the weeds in water, to which putrid urine, lime, and carbonate of soda were added from time to time. After two or three months' exposure to the air, the colourless principles of the lichen became transformed into the colouring matter orchil. As the science of chemistry progressed, and cheap means of producing ammonia were devised, this compound was substituted for the urine. Dr. Stenhouse's process consists in exhausting the lichens, by macerating them with milk of lime, squeezing the liquor off, and after having repeated this treatment two or three times, he adds an acid to the liquors, when a white gelatinous precipitate is produced, which, when collected and placed in contact with ammonia, gives rise to orchil.

You are doubtless aware that the beautiful purple and mauve colours obtained on silk and wool from orchil are extremely fugitive, losing their brilliancy on exposure to the light or to the influence of weak acids, such as sulphurous, which is so abundantly produced in our manufacturing districts. M. Marnas, of Lyons, succeeded in the year 1856, in making orchil colours which gave fast purples and mauves.

Before describing this valuable discovery, allow me to state that it had a most important bearing on the marked progress which the art of calico-printing has made since the date above mentioned. Until that time, neither dyers nor calico printers would use expensive dyes, but since then, they have paid as much as £40 or £50 per pound for the solid dyestuff, although these enormous prices have been apparently decreased by the colours being sold in the state of paste or solution.

The demand for a fast purple in this country was so great, consequent on the introduction of the fast purples and mauves on the Continent by M. Marnas, that attention was directed to the preparation of these colours. Mr. Perkin had obtained from aniline a fine purple colour, as fast as the orchil colours, and M. Bechamp discovering about this time a method of producing aniline artificially from benzine, Mr. Perkin was enabled to manufacture his colour commercially. This may be considered as the first successful step towards the introduction of the splendid and varied coal-tar colours which are now so universally admired.

Returning from this digression, let us now enter on a description of the process of M. Marnas. He treated the lichens, as suggested by Dr. Stenhouse, with milk of lime, filtered the lime liquor off, precipitated the colour-giving principle from it with hydrochloric acid, and gathered the precipitate on a filter. This precipitate was well washed, dissolved in caustic ammonia, and the ammoniacal liquor kept at a temperature of 153° to 160° for twenty to twenty-five days, when, under the influence of that temperature, the colour-giving principles of the lichens fix ammonia and oxygen, and are transformed into a new series of products. These were separated from the liquid by the addition of chloride of calcium, which caused a fine purple-lake to be deposited. This, after being washed and dried, was sold under the name of French purple.

To dye silk or wool with French purple, it is simply necessary to mix the lake with its weight of oxalic acid, boil with water, and then filter, the oxalate of lime remaining on the filter, while the colour passes through in the filtrate. This liquor is added to a slightly ammoniacal liquid in the dye-beck; all that is now necessary is to dip the silk or wool in the beck, when they will become dyed with magnificent purple or mauve.

To dye cotton, it is necessary to mordant it with albumen, or prepare it as for Turkey red, before putting it in the bath.

Robiquet was the first chemist to isolate a colourless principle from lichens susceptible of assuming a fine purple hue when brought in contact with ammonia and oxygen. This principle he named *orcine*. He obtained it by treating the *Variolaria orcina* by strong alcohol. This solution, on being allowed to cool, gives crystals, which, on being dissolved in water and allowed to crystallise, assume the form of large well-defined crystals of hydrate of orcine. By crystallisation from ether anhydrous orcine can be obtained. Orcine gives a fine, dark red colour with perchloride of iron; but its most remarkable property is its transformation into *orcëine*, which Robiquet shows to be due to the following reaction:—

$$\overset{\text{Orcine}}{C_7 H_8 O_2} + \overset{\text{Ammonia.}}{N H_3} + O_2 = \overset{\text{Orcëine.}}{C_7 H_9 N O_3} + \overset{\text{Water.}}{H_2 O}$$

Orcëine presents itself under the form of a brown powder, slightly soluble in cold water, to which it gives a red colour. It is soluble in alcohol, but insoluble in ether. It is soluble in alkalis and ammonia, to which it communicates a magnificent violet colour. It exists in commercial orchil under the form of orcëinate of ammonia.

Time will not permit me to describe the researches of Heeran and Sir R. Kane. I must therefore confine myself principally to a short description of those of Dr. Stenhouse and Dr. Schunck.

The chief merit of Dr. Schunck consists in having pointed out the connection which exists between the orcine of Robiquet, and the *erythrine* and *pseudo-erythrine* of Heeran, and in showing that orcine is the sole immediate colour-producing principle of the series. This he proved by his researches published in 1842, in in which he treated the dried and powdered variolaria orcina by ether. On evaporating this solution, there remained a residue, from which he isolated a substance which he called *lecanorine* or *lecanoric acid*. This compound crystallises in white needles, and gives a red colour with bleaching powder, and a dark purple with perchloride of iron. It yields a similar colour when dissolved in ammonia and exposed to the atmosphere. Its most interesting property is its conversion into orcine and carbonic acid, when boiled with an aqueous solution of baryta. The reaction is—

$$\overset{\text{Lecanorine.}}{C_8 H_8 O_4} = \overset{\text{Orcine.}}{C_7 H_8 O_2} + \overset{\text{Carbonic acid}}{C O_2}$$

He found also that on boiling lecanorine with alcohol it formed an ether, which proved to be identical with the pseudoerythrine of Heeran.

Dr. Stenhouse has succeeded in extracting the important compounds to which he has given the names of *erythrite* and *orsellic acids*. The first-mentioned body is a product of the decomposition of erythrine under the influence of lime-water. The erythrine splits up into carbonic acid, orcine, and erythrite, according to the following equation:—

$$\overset{\text{Erythrine.}}{C_{12} H_{16} O_7} + H_2 O = \overset{\text{Erythrite.}}{C_4 H_{10} O_4} + \overset{\text{Orcine.}}{C_7 H_8 O_2} + \overset{\text{Carbonic acid.}}{C O_2}$$

The orsellic acids were obtained, one from the South American weed, the other from the South African. The first appears to be identical in composition with lecanorine, and is capable of splitting up under the influence of baryta or lime into carbonic acid and orcine. The one from the latter appears to be composed of lecanoric acid and a substance called roccellinine. According to

Schutzenberger, lecanoric acid may be made to undergo a decomposition into orselic acid, or may be further converted into orcine.

The employment of orchil is at the present day comparatively limited, but it is still used for producing browns, maroons, and other dark shades, in conjunction with other dye-stuffs. Its chief use is to top cheap indigo blues on woollen goods; this is effected by lightly dying the fabric with indigo (an expensive dye) and then passing it through a bath of orchil, which gives to the cloth a rich purple hue, similar in appearance to one dyed wholly with indigo.

Cudbear is a special preparation of orchil, first manufactured by Dr. Cuthbert Gordon, from whom it derives its name.

Litmus is obtained from the same lichens as those employed for producing orchil, only lime and carbonate of potash are added to the ground weed and urine; in fact the process is very similar to that used in former times to produce orchil. After three or four weeks, a blue colour is fully developed, when it is mixed with sulphate of lime or chalk, dried, and is ready for market. The chief employment of litmus is to communicate a peculiar tint to the cheese made in Holland.

Prussian Blue.—I shall now have the pleasure of drawing your attention to one of the finest, brightest, and most permanent colours known. It was discovered accidentally in 1710, by a colour manufacturer named Diesbach, of Berlin, from which it derived its name. The process by which it was produced was kept a comparative secret until 1724, when Dr. Woodward showed how the colour had become a very profitable affair, and described a process by which it could be obtained. The process has in time undergone many improvements; but I shall here confine myself to a description of it as now carried out. I shall be obliged here to enter slightly into theoretical chemistry.

Prussian blue is a combination of iron with *cyanogen*, a compound of carbon and nitrogen. There are two well-defined cyanides of iron corresponding to the two oxides, the *proto-cyanide*, $Fe.\ Cy.$ and the *sesquicyanide*, $Fe_2.\ Cy_3$. These two cyanides, combining together in different proportions, give rise to the various shades of Prussian blue found in commerce. But, strange to say, you cannot produce either of these compounds or Prussian blue by the direct combination of cyanogen with iron. Cyanogen must be first united with potassium, giving rise to cyanide of potassium, under the influence of which salt the iron combines with cyanogen, and the cyanide of iron thus formed in its turn combines with the cyanide of potassium, forming a double cyanide. There are two double cyanides of potassium and iron; the first, called ferrocyanide of potassium, or yellow prussiate of potash; the second, ferri-cyanide, or red prussiate of potash. The formula may be represented as follows:—

Yellow prussiate .. $Fe.\ Cy. + K\,Cy.$
Red Prussiate .... $Fe._2\ Cy._3 + 3K\,Cy.$

To produce Prussian blue from these salts, it is necessary to replace the potassium by iron. This is effected by adding a persalt of iron to the yellow prussiate or to the red prussiate, a proto-salt of iron. The iron of the iron salt replaces the potassium of the double salts, and double cyanides of iron are produced, as seen by the following formulæ:—

$$\overset{\text{Yellow prussiate.}}{3\,(Fe.\ Cy.\ K.\ Cy.)} + \overset{\text{Sesquichloride of iron.}}{Fe._2\ Cl._3} = \overset{\text{Prussian blue.}}{3\ Fe.\ Cy.,\ Fe._2\ Cy._3}$$
$$\overset{\text{Chloride of potassium.}}{+\ 3\ K.\ Cl.}$$

$$\overset{\text{Red prussiate.}}{Fe._2\ Cy.\ 3\ K.\ Cy.} + \overset{\text{Protochloride of iron.}}{3\ Fe.\ Cl.} = \overset{\text{Prussian blue.}}{Fe._2\ Cy._3,\ 3\ Fe.\ Cy.}$$
$$\overset{\text{Chloride of Potassium.}}{+\ 3\ K.\ Cl.}$$

That this is the case can be easily demonstrated, for if you mix together a solution of persalt of iron and one of red prussiate, which contains only percyanide of iron, no Prussian blue is formed. Again, if you mix yellow prussiate of potash with protochloride of iron, you get no Prussian blue, because, in the first case, you have no protocyanide of iron present, and, in the second, you have no percyanide.

Simple as the production of Prussian blue appears, it requires much practice to prepare it with certainty as a pigment where a given shade of blue is required. It is seldom found pure in commerce, being generally mixed with starch, chalk, or gypsum. Sometimes they are added with a view to deception, sometimes in order to produce a lighter shade of colour. The testing of a Prussian blue by chemical means is not, therefore, a true criterion of its quality. The method usually employed consists in grinding in oil equal weights of a Prussian blue of known value and of the one to be tested, white lead is added to each, and the intensity of the colours compared.

The best quality of Prussian blue is obtained by mixing a dilute solution of red prussiate of potash with proto-salt of iron; the second quality is made by mixing yellow prussiate of potash with pernitrate of iron, and is called *Turnbull's blue.* Cheaper qualities are made by mixing solutions of yellow prussiate and protosulphate of iron (green copperas), which produces a pale-blue precipitate. This is transformed into Prussian blue by the addition of bleaching powder, which oxidises part of the iron, and transforms the protocyanide into percyanide. For still lower qualities, alum is mixed with the iron solution previously to the prussiate being added. Alumina is by this means mixed with the blue.

Prussian blue was first obtained on silk fabrics in 1811, by a professor of chemistry at Lyons, named Raymond, in consequence of the high premium offered by the First Napoleon for the production of a fast blue, as indigo could not at that time be imported into France. His process, with slight modifications, is followed at the present day, although the colour is not much used, owing to the introduction of the aniline blues. It consists in dipping the silk, for several hours, in a salt of peroxide of iron, when the oxide of iron becomes fixed in the silk, which is washed and dipped in a slightly acid solution of yellow prussiate of potash. Prussian blue is thus produced on the silk, which only requires washing to be ready for market. The only improvement made in this class of dying has been the addition of a persalt of tin to the iron-salt.

The production of Prussian blue on cotton or woollen fibres is effected by a curious chemical reaction. At a temperature of 212° Fahr., all acids, even the organic, such as oxalic, citric, and tartaric, as well as the acid sulphates, possess the property of decomposing the two prussiates. The potassium of the cyanide combines with oxygen of the water, and with the organic acid. The cyanogen thus liberated unites with the hydrogen of the water, forming prussic acid. The cyanide of iron liberated unites with the fibre of the cloth, and on the latter being passed into a weak solution of bichromate of potash or bleaching powder, or if it is left exposed to the air, part of the proto-cyanide of iron is converted into sesquicyanide, and Prussian blue is produced. As salts of tin greatly facilitate the fixing of the prussiate on the cloth, chloride of tin is now generally mixed with the prussiate of potash. In this case prussiate of tin is produced. To this mixture tartaric or oxalic acid is added; it is then properly thickened and printed on the calico. When the design is dry, the fabric is submitted to the action of steam, and the blue is produced on the fabric. It then only requires to be passed through a bath of bichromate of potash, to develop the full depth of the shade.

Ultramarine Blue is a most valuable pigment, both on account of its cheapness, and the brilliancy of its colour. It is used extensively in many branches of trade—by the calico printer in pigment printing, by the paper stainer and manufacturer, the typographic and lithographic printer, by the match manufacturer, the sugar refiner, and by the house decorator. The value of the pigment depends on the fineness of the powder, and the brilliancy of its hue.

The greatest care and much experience are required in every stage of the manufacture, in purifying the substances employed, in mixing, in heating at the proper temperature, and in grinding, washing, and drying the manufactured mass. Fourteen distinct operations are required to produce it, and it would take too much time at this late hour to enter into the details of these processes. I will therefore only attempt to give you a very rough outline of the principal points of the manufacture.

The proportion of materials used, may be as follows:—

White china, clay, or kaolin	50	parts.
Sulphate of soda	19	,,
Sulphur	25	,,
Charcoal	12	,,
Carbonate of soda	28	,,
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These substances are most intimately mixed together and introduced into an earthenware crucible, which is carefully closed and heated at a temperature of about 500°F. for twelve hours. The temperature is then gradually raised till it reaches a white heat at the end of 48 hours; the fire is then removed, and the crucible allowed to cool gradually in the furnace. The mass, as taken out of the crucible, is of a beautiful bright green colour. It is ground, washed, and dried, and then calcined in in an open furnace, to oxidise it; but as the slightest excess of oxidation spoils the colour, the workman from time to time adds a small amount of sulphur to the mass, by this means controlling the oxidation. The green mass gradually becomes blue, and is washed and dried, when it is ready for market.

The colouring matter of ultramarine is not well known. It is supposed to be a peculiar sulphite or hyposulphite of soda. The solid matter itself is a double silicate of soda and alumina. What is certainly worth notice is that, although we are ignorant of the true colouring matter of this pigment, we find its composition to be almost identical with that of the natural *Lapis lazuli*, which, although very costly, was employed by printers for many centuries. The following analyses will show the similarity of composition:—

	Lapis lazuli.		Ultramarine.
Silica	45·40	....	46·60
Alumina	31·67	....	23·30
Soda	9·09	....	21·46
Potash	*nil*	....	1·75
Iron	0·52	....	1.06
Lime	3·52	....	0·02
Sulphuric acid	5·89	....	3·08
Sulphur	0·95	....	1·68
Chlorine	0·42	....	trace.
Water	0·12	....	*nil*
Loss	2·42	....	1·05
	100·00		100·00

Artificial ultramarine was discovered by a French chemist and druggist, named Guimet, who kept the process of its manufacture secret for many years.

EXHIBITIONS.

INDUSTRIAL EXHIBITION OF NATIONAL PRODUCTS AT TURIN.

Some time previous to the convulsion in continental affairs of last year, a society was instituted in Turin for the purpose of holding an international exhibition in that city at the epoch of the opening of the great Alpine tunnel. This important scheme was to have been entirely accomplished by private enterprise, and was warmly taken up by a number of persons, who subscribed for shares, and it remained to examine the question of the site and the building requisite to contain the collections. One of the projects consisted in the proposition of a building of a very solid nature, with several floors, which might serve, at the close of the exhibition, for many purposes connected with the development of trade.

The cry of "*Allons à Berlin*," which early announced the impending collision between the two most formidable powers of Europe, paralysed all exertion, and amply sufficed to demolish all the operations of the company, of which nothing more was consequently heard for the time. It is not yet two months since the inauguration of the tunnel was officially announced to take place on the 17th September, and it was at once decided to revive the project, under the more modest garb of a national exhibition, limited to manufactured produce.

It is unnecessary to discuss the very momentous question how far it is practical, or even practicable, to get up a national exhibition in a great hurry, and without the mechanism which has been proved by long experience to work so well on similar occasions, especially including an office where demands for admission might be thoroughly investigated, and efforts made in order to see that producers of known reputation should not be absent. The present result has proved too important to permit the ungenerous criticism which might accrue from such a discussion, though far too insignificant to give a mere glimpse at the great manufacturing resources of the country, which is much to be regretted. As a partial, rather than a general, exhibition of Italian manufactures, got up in the course of a few weeks, very great credit is due to the commission, of whom the president is the Chevalier di Sambuy, and the vice-presidents Messrs. Ajello and Mazzonis. The exhibition was opened on the 19th September, by the honorary president, H.R.H. the Prince of Carignan, in the presence of the Minister of Agriculture, Industry, and Commerce, Signor Castagnola, and the Prefect and Mayor of Turin. Classifying the exhibitors geographically, they are as follows:—City and province of Turin, 339; other provinces of northern Italy, 124; central and southern provinces, 72—total, 535 exhibitors.

The great question at the bottom of all projects regarding the extension of manufactures in Italy is the very difficult one of the sources of motive power, and a moment may be well devoted to its consideration before going further. It is generally known that coal does not exist in the country. Lignite of the cocene, miocene, and pleiocene formations is frequently met with; the former kind is, indeed, sometimes found, as at Monte Bamboli (Grosseto), of a quality about equal to that of coal, but then, in the place of 80 beds superposed on one another, as is the case at Liège, it is only one or two beds, of from one to six feet, which are to be seen; probably nowhere are there three distinct workable beds. These deposits, too, are not large, and are the sites of lake basins or estuary deposits of a limited extent. The combustible is in most cases mixed with a large proportion of earthy water; elsewhere it is not thoroughly mineralised, often retaining the fibre of the wood, and scarcely mineralised at all, the fuel from most of these basins being rich in sulphur. Specimens have been exhibited from the mine of Nucetto, near Mendosè (Cuneo); a good lignite, procurable in considerable quantities, and once much employed for glass-works which were erected in the neighbourhood. The lignite of Caniparola, near Sarzana (Genoa), also exhibited, is of excellent quality, and serves not only for the large lead-smelting works of Portusola, on the Gulf of Spezia, but has been also employed with good result in experimental trips made by the steam vessels of the royal navy, starting from the arsenal of Spezia. A third sample comes from the commune of Murlo, near Vescovado (Sienna). It is rather dry, but has been lately employed with perfect success by the Roman Railway Company, for the use of their locomotives, and can be furnished to them for about 10s. a ton. The basin is probably one of the largest in Italy, and, as the works have only lately been opened, it will serve for many years for a limited production. The Alps contain pulverulent anthracite in small quantities, scarcely worthy of mention out of the villages near which the beds exist, and even locally confined to the use of smiths. Peat is often substituted for coal, and with good results, for a great variety of manufactures. English coal is chiefly used near the sea-ports or on the railways, but mineral fuel is chiefly replaced advantageously by water-power. The mills are generally driven by the agency of water, whilst most manufactories possess a steam-engine as an auxiliary for the season of droughts. The little torrents descending from the Alps, from the Mont Viso to the Adriatic, and forming the innumerable feeders of the Po on its left bank, are largely turned to account, in order to furnish water for turbines and other water-wheels employed in the manufactories. Since the change of the capital, it was seen that Turin, the centre of the life of the country, must either dwindle away to the rank of a mere cathedral town, or else plunge boldly into the manufacturing line. A supply of water having been placed at the disposition of the city, through the exertions of the then minister, Sella, and other able men, the local authorities have given the use of it to manufacturers at a moderate price, by which means fresh activity has been elicited, and large manufactories are constantly springing into existence along the course of the stream. The vast irrigatory system of Lombardy, and the new Cavour Canal, in Piedmont, combine together to form a network of water communication, which will be available in no less degree as a source of power as it is successively sought for. With the exception of the Po, the Arno, and the Tiber, there are so few rivers in Italy, that we may consider the northern provinces as destined to be the principal seat of the future manufacturing activity of the peninsula; added to which the more temperate nature of the climate, and the robust, energetic, and disciplined character of the inhabitants, point it out in preference to the central and southern provinces, wherever hard and continued in-door labour is required.

Decidedly the most striking feature in the exhibition consists in the great variety and beauty of the textile fabrics, embracing silk, woollen, cotton, flaxen, and hempen goods, as also those in which enter aloe fibre and horsehair. Such abundance of products would no doubt surprise the foreign traveller who visited Italy for the first time, nor would he be prepared to learn what extension the silk and cotton manufactures have already assumed, especially in the sub-Alpine provinces. Several manufacturers exhibit cotton goods of good quality, partly made of indigenous cotton, such as the house of Annecy and Pont (Turin), who have shown plain and *piqué* goods, and a variety of coloured fabrics. A very great mistake has been made by the landed proprietors of southern Italy and the adjacent islands, who in their impatience abandoned the cultivation of cotton, so admirably commenced in 1863-4, owing to the enlightened exertions of Comm. Devincenzi, now Minister of Public Works, and the encouragement and assistance given by the Manchester Cotton Supply Association.

The hosiery and various knitted goods of Matteo Turin, manufacturer at Turin, are of the best kind, and through the intelligence of the late founder of the house, Buxtorf's circular looms, with all the most recent improvements are employed in their manufacture, with admirable success. The linen manufacture seems to promise great extension and prosperity. It is more popular as a material for household purposes than cotton, which, owing to secular custom, many will not employ even for shirtings. Excellent twilling and table-linen, both grey and bleached, or damasked, and at very moderate prices, is exhibited by Bironcini, of Milan. Another manufacturer, Melano, of Poirino (Turin), exhibits sheeting, bed-ticking, and other common coarse fabrics, of good quality. Elsewhere may be remarked the tulle made near Pignerol (Turin), and next the hempen and flaxen goods of Roi, of Vincenza—coarse, but good for ordinary purposes, and made by mechanical looms. This manufactory has existed for the last fifteen years.

Solei, of Turin, exhibits his famous silk manufactures for furniture, which, in addition to the excellent workmanship, are remarkable for the taste of the designs, and the good combination of the colours. Several brothers, of whom mention will be made presently under the head of furniture, have presented the same quality of goods as the preceding manufacturer, and it is most probable that he will rapidly attain to the same degree of perfection; but the time which has elapsed since the formation of this manufactory is too short to have permitted him to do so yet. A branch of manufacture which is new, and yet has assumed considerable importance, is that of fringes, tassels, bindings, &c., in silk and wool, for various purposes, such as for carriages, furniture, &c. From this we pass to the cheaper class of woollen shawls, of Cremonesi, Varesi, and Co., of Lodi (Milan), together with similar articles of clothing, worthy of mention for the softness of the material and the quality of the weaving. Another important branch of woollen fabrics is that of blankets, made at Perugia (Umbria), and belonging to Bonucci.*

The cloth manufacture of Biella is not represented by a single exhibitor, but among the woollen fabrics made by circular looms, those of Tensi Brothers, of Turin, are highly commendable for their softness, even texture, close weaving, and comparatively low prices. It is probably the first attempt to make cloth by this process, if not the only manufactory of the sort at the present moment in Italy.

Carpeting is an article comparatively little consumed in the country, and few manufacturers find it worth while to turn their attention and capital in that direction. It is only in winter that it is found necessary to employ carpets, even in the most sumptuous palaces. During nine months of the year, or more, rugs, often very elegant, and chiefly imported from England, take their place, and are arranged in different parts of reception rooms and sleeping apartments. Imitation Kidderminster carpets are exhibited by Rey Brothers, of Vinovo (Turin); they are made of Italian wool, spun and dyed at the manufactory. Being intended to substitute the ordinary kinds, which are otherwise imported from England, they do not possess any particular merit; the patterns, too, are all, more or less, the same as those of English carpets of a similar kind.

The great extent of the railway system of Italy—there were at the period of the opening of the great tunnel through the Alps about 4,200 miles of railway in the kingdom—has produced a great activity in the manfacture of first-class carriage linings. The specimens of such goods exhibited by Costamagna, of Turin, are such as are used on the southern Italy railway, &c., and consist of cotton with aloe fibre interwoven, with a very small proportion of horsehair. A slight drab-colour is given to the vegetable fibres, which take the dye equally well, so that the whole, when seen at a little distance, presents almost the appearance of silk, while it is cooler and stronger, and, moreover, easily washed with a sponge in the carriage itself.

Clothing, &c.—Eula, of Turin, exhibits excellent silk and felt hats of various descriptions, the lightness and good taste of which recommend them to notice. Righini, also of Turin, has a display of umbrellas and parasols of the better class, which, in addition to their taste, are sold at prices which bring them within the reach of most persons. With regard to boots and shoes, without specifying any particular person, it may be interesting to remark the great stride made within the last five or six years in the diffusion of sewing-machines among shoemakers, although this trade may be said to be exclusively carried on in Italy by the tradesmen themselves who sell the goods. Great precision has been obtained in this branch of industry, which, with the low prices, point out the desirability of exporting boots and shoes to England on a large scale.

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* As a specimen of the prices, we may mention—Coarse blankets, 18 francs each; common blankets, 25 francs each; fine blankets, 35 francs each. Size, 80 inches by 96.

The best artificial flowers are certainly those of Massola, of Turin. This exhibitor has obtained a high degree of perfection, and combines exquisite taste with truthfulness of form. Other specimens, sent by different manufacturers, compared with these, seem rather, by the regularity of their forms, to be types of what we might call the gardener's pride, still attached to the parent plant, than the frail symbols of perishableness, torn from the branch, such as Mossola has admirably succeeded in representing them. The leaves, too, which too generally betray the hand of man, are far above the average. Fiorio, Brothers, of Turin, hold a high place in the home market for real kid gloves of the best kind, but they are, probably, too expensive to suit the export trade.

Furniture.—The principal material employed in Italy at the present moment for the manufacture of furniture are indigenous walnut-wood and iron. The former has been used for centuries by the cabinet-makers and ornamental workers throughout the country. It assumes the same place which mahogany holds in England, and only of late years, and in certain towns, on account of its increasing rarity and high price, is employed as a veneer, being usually solid, while cherry, apple and pear wood, generally stained, are used for commoner furniture, and iron is rapidly becoming the only material for bedsteads. We have before our eyes a remarkably beautiful variety of juniper (*Juniperus sabina*), the variegated tints of which, wine-red and straw-yellow, with all the intermediate shades, offers a material which, when judiciously worked up in inlaid furniture, has a peculiarly fine effect; unfortunately, this has not been in the least degree taken advantage of in the samples of work presented on this occasion.

The most important manufactory of furniture in Italy, almost entirely made by machinery, is that of Levera Brothers, of Turin. Their exhibit shows the quality of work turned out by them, but gives but a very poor idea of the infinite variety of branches which they embrace, commencing with the sawing, carving, and adapting the wood-work, the upholstering department, the manufacture of fringes, silk fabrics, bronze and iron castings, and ending in the retail trade in the objects manufactured. Nor is it to be passed over in silence that there is a school of design in the establishment to form able workmen. Were the prices more moderate, it would be a great advantage to the purchasers.

Botthard, of Florence, has sent a good set of samples of his gilt mouldings for pictures and other frames, admirably manufactured, and largely supplied to retail vendors in all the principal towns. Gargiulo, of Sorrento (Naples), is perhaps better known to British and American tourists who have had the good fortune to push their southward journey to the paradisaic shores of the Gulf of Naples than to his own countrymen; his accurate and tasty inlaid mosaics, which take the name of the town whence they come, are artistic, and bear a peculiarly Italian stamp. In all probability, the art was carried thence to Tunbridge Wells, where a very similar trade is carried on. The defect of these mosaics is the great ease with which they come to pieces when placed in a damp spot—an evil which might be, in some degree, remedied by employing the strongest glue. Lanceti, of Perugia (Umbria), who stands far higher as a manufacturer of mosaics of a more artistic nature, exhibits this time some admirable samples of inlaid mosaics applied to card-cases, album-covers, &c. In addition to the use of stained woods, and engraved ivory with ornamental designs, figures, &c., for which he is so celebrated, he has combined geometrical borders having so close an analogy with Bombay work as to show that he has studied Indian manufactures to advantage. He cannot, indeed, come up to the exquisite minuteness of the latter, but the introduction of figures breaks the tiring monotony observed in the Oriental patterns, and the introduction of engraved figures is so important an improvement, that we may venture to suggest that Indian workmen, when making their mosaic, should be counselled to insert classical ornaments in carved ivory, which could be easily supplied them from Italy for that purpose by the merchants who purchase such manufactures for the European market. The subject is worthy of the attention of those interested in the development of taste in India; and we venture to hope that Dr. Forbes Watson will take up the idea in the Indian Museum in London; for, though at first sight it might appear to be mixing two styles essentially different, the artistic effect is so remarkable that it defies too severe a criticism.

Paper-hangings are principally used in northern Italy, where, indeed, the influence of the neighbouring countries is seen at every step. Elsewhere, the more national custom of fresco decoration prevails, whether executed by hand or by the aid of designs cut out in wood, metal, or other material. Since manufactories of machine-made paper have extended in many places, a considerable impulse has been given to the manufacture of paper-hangings, which sell at from lire 0·30 the roll of metres upwards. The specimens, however, observed in the exhibition are principally of the better class, many of them highly commendable for the taste displayed, showing the excellent influence exerted by the numerous schools of design which exist in all the towns of Italy of some importance. Although the patterns are inferior to those manufactured at Mulhousen, they show a decided improvement on the productions of a few years past, and may be fairly ranked as decorative papers. One point in particular may be noticed, which is the introduction more generally of a ground, with designs better grouped than formerly, leaving more repose to the eye than where the entire paper is surcharged with a pattern on its entire surface. The patterns themselves are less vulgar and common-place than they used to be, and the colours combined with better harmony and contrast. Among the best samples sent are those of Oggioni, of Milan, and Ferro, of Turin.

As accessories to furniture may be mentioned the ornamental castings of Colla and Company, of Turin, well worthy of examination; while Pellas has sent from his electro-chemical laboratory at Florence some good samples of oxidised silver work, imitated from Collins and other masters, now made so cheap by the scientific applications of the day as to be accessible to a large proportion of the community, and highly suitable for purchase by travellers who sojourn for any time in the artistic capital of Italy.

Leather and Leather Manufactures.—The manufactory of Luigi Arneudon exhibits its beautiful products in the form of leather of great variety. Others have sent articles manufactured in leather, such as portmanteaus, reticules, harness, &c., but none deserve special attention.

Musical Instruments.—With the fine display of brass wind instruments of Pelitti before one's eyes, we are involuntarily led to reflect that scarcely a combat of any importance—perhaps not one battle—has been fought in the country from the day in which war was declared between Italy and Austria, in 1848, down to that in which the Bersaglieri rushed up the breach in the walls of Rome last September, in which the shrill blast of the instruments from the manufactory of Pelitti were not employed to inspire the warriors in the noble task of emancipation from tyranny and despotism. With these the thousand landed in Sicily; with these, the "Hymn of Garibaldi" resounded in full many an Alpine crag. Caldera, of Turin, exhibits an instrument whose melodious notes entitle it to the name which he gives it of melopiane; but when we see an array of barrel-organs, however beautiful the rosewood cases, and however harmonious and exact the airs or operas performed by the boys who show them off, our patience is exhausted, in thinking that the country where the mere workman has a keen appreciation for music, and an aptitude for learning that art, should so desecrate the science of mechanics as to inundate the world with instruments which give a livelihood to the most lazy and undeserving class of society, not to speak of the physical torment to which citizens are unmercifully subjected by hearing this substitute for music.

Building Materials.—Chinaglia, of Turin, has samples of bricks made in his continuous kilns, rendered so famous of late by the war which has waged in the courts between him and Hoffmann, who accused the former of having infringed his patent. There is a decided progress in brick and tile making in these products—always limiting these observations to what has been done elsewhere in Italy. The little hand-machine for making the bricks, invented by Chinaglia, consists simply in a table, on which are disposed one or two brick-moulds. The clay is pressed into these by means of a heavy iron framework, moving on a hinge behind. The brick is raised by a lever, acting by a pedal. He does not exhibit any machine for mining the clay, but the homogenity of the products seem sufficient to indicate that he must employ one. The ornamental tiles are highly ingenious. He does not make them like Minton and others, but forms a design in the act of making the tile, so as to produce a hollow. This is afterwards filled with plaster of Paris, cement, asphalte, &c., so as to produce the most accurate patterns of the desired colour. The inlaid pavements in Venetian mosaic, exhibited by Gianoli and Co., of Firenze are very well made; they consist of small pieces, in the form of lozenges, hexagons, squares, &c., which can be easily united to suit the floor, previously covered with a layer of cement. Hitherto it has been the general custom to imbed the fragments of marble, serpentine, and other stones on the cement in the apartment or passage itself, and afterwards to rub the surface until the whole formed a smooth plane,. The cost of such mosaic tiles is from 6d. to 1s. per square foot.

Hydraulic cement is being much more largely employed than was at first anticipated, not only for subaqueous constructions and foundations, but also for making bridges, flooring, &c., but we are not aware of its being applied anywhere so admirably as at Grenoble, and elsewhere in France, where the whole fronts of houses are faced with cement, previously moulded, and then put in the walls. The Upper Italy Railway Company possess very extensive cement works at Palazzuolo, near Brescia, where they have applied all the modern improvements for its manufacture, packing in sacks, and carriage to the main line, whence it is conveyed to all parts of their immense railway system, extending, as it does, from the Alpine tunnel at Bardonnêche to the Austrian frontier, near Trieste, and from Turin to Florence, with all the innumerable branch lines.

Next to this we find a sample of agglomerates employed in the submarine station of Venice, consisting in a block of 10½ cubic feet (1 cubic mètre). It is formed of—

Hydraulic lime	0 30
Sand perfectly dry	0 50
Gravel, perfectly dry and sieved ..	1 00
Water (fresh) 120 litres	0 12

and, after having been submerged for four years at Venice, is perfectly sound and solid.

Other cement works exist near Bergamo, and serve for the use of the public. The samples are from the Bergamask Company for the manufacture of cement and hydraulic lime in that city. This company was formed in 1864, and is now able to produce 20,000 tons of cement and hydraulic lime yearly. The imitation Portland cement competes with that hitherto imported from the Tyrol and Grenoble. Among other places where the Bergamo cement has been applied may be mentioned the crypt of St. Mark's, at Venice.[*]

Two quarry-masters of Luserna, in the Waldensian valleys (Turin), have sent slabs of gneiss and worked pieces of the same material for window sills. There is nothing new in this material; the streets, not only of Turin, but of most of the cities of northern Italy, excepting those near which quarries exist, are flagged with the stone of Luserna, one of the best kinds in the country. Many persons have an idea that the nucleus of the Alps is crystalline, which is not invariably the case; indeed, in piercing the Mont Fréjus, in the whole distance of 12,200 metres, only clay-slate and a stratum of quarryite were met with, but no gneiss or other crystalline felspathic rock whatever. This gneiss is largely employed even at present in Alpine country villages for roofing; and possibly where the weight of the snow in winter is very considerable, and the winds strong, it is preferable to tiles, which are easily blown off during the gales so prevalent in mountainous regions.

Machinery.—General Cavalli's machine for determining the resistance of metals to tension, compression, and flecture, is a most important one, and has been sent by the Royal Arsenal of Turin. By means of a drum, furnished with a pencil, a diagram is formed showing the limit of resistance to rupture, the limit of elasticity, and the successive elongations produced under the influence of inincreasing resistance, as determined by weights placed in the scale appended to the longer arm of a steel yard. Micrometer compasses and other appliances for accurate measurements, all of very perfect execution, have also been exhibited by the arsenal authorities. Decker, of Turin, has shown some of his well-known accurate balances for various purposes. The Upper Italy Railway Company, however, must have the palm in this category for the marvellous progress which has been been made in their head fitting and repairing works, but recently opened at the central station in Turin. With a network of some 1,700 miles of railway opened at the present moment, the number of locomotives constantly requiring repair is very considerable, and, although the locomotives themselves are the produce of the manufactories of Manchester or Mulhousen, it would be too expensive to procure all the parts required for repairing them from such a distance. The objects the Upper Italy Company exhibit comprise such portions as the fire-box, boiler-frame, piston-crank, suspension springs, bearings, and the entire series of brass-taps employed, got up with surprising precision, and showing that in all probability, in the course of a few years' time, skilled mechanics will be ready for the establishment of an extensive locomotive manufactory in Italy.

Polla and Galvani gave the first impulse to the science, the practical application of which to the railway system has been the study of Sig. Maroni, who has exhibited a simple electrical apparatus for keeping station-masters' informed whether the switchmen have executed their duty correctly or not. It consists in a small diagram of the various lines, with a needle, which indicates by its direction which line is opened. In moving the counterpoise of the switch backwards or forwards, connection is established or broken with an electric wire terminating in the diagram. The Upper Italy Railway Company have sent another electric apparatus for signalling the approach of trains arriving from different directions at junctions out of sight of the station. This is employed at Milan. When a train approaches, the switchman touches the bottom of his machine, and, while the current established rings the bell at the station, it also moves a board placed at the end of a lever in a box, so as to present it before an opening in the front of the box. Each line has its wire terminating in the same box, and furnished with a separate board, on which is painted the name of the station from whence the train is coming.

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[*] Prices of the products per ton at Bergamo:—Portland cement, £4; slow setting cement, £1 1s.; quick setting cement, £1 8s.

Ceramic Manufactures.—The Marquis Ginori, of Florence, has a very good assortment of porcelain for domestic purposes, in which the influence of English forms and style of decoration are plainly evident. Richard, of St. Cristoforo, Milan, has a class of stoneware and porcelain goods more suited to the multitude, and having more of a French type. He largely employs plain copper-plate and chromo-printing; the latter might be better and more harmonious. Hitherto this manufactory strives rather to supply the demand for cheap, solid earthen and stoneware, which it is unable to do to the full extent, than to gain reputation for master-pieces of art. Chiara, of Turin, has for some years past devoted his attention to the decoration of porcelain, which he imports plain and coloured in his laboratory, thus evading the heavy duty on decorated porcelain. He is thus able not only to supply the market with what suits the taste of the purchasers, but secures to himself a large share in the profits of the manufacture.

All the other manufactories of pottery in the country are inferior to those just named, and confine their attention to common earthenware or stoneware goods. We must mention, however, that Devers, better known as having long worked at Paris, where his reputation among English and French connoisseurs was established, is just returned to Italy, and has been appointed in his native province professor in the Royal Academy of Fine Arts in Turin. The specimens exhibited by this great natural genius are few, as he has placed his principal productions at the Palazzo Carignano; but, as usual, they embrace every variety of material in terra-cotta, porcelain, and glass, with portraits, ornaments, imitations of the antique, and so on, so that in a few square feet we have a restless succession of samples of the most different kinds, which few would credit to be the work of the same brain.

Jewellery.—Twerembold, the great jeweller of Turin, has exhibited some highly creditable and classical work, especially a gold necklace and a gold ornament representing a vase, from the lip of which hangs a series of diamonds imitating the crystal drops of liquid poured out of it. The silver and gold filagree work of Beretta, Turin, has the general characteristics of Genoese work, and is equally as good as any manufactured there.

Alimentary Products—In this section may be mentioned the wines, which are improving in quality, owing to the exertions of the several anological and agricultural societies springing up everywhere, but more so by the competition arising from the facilities afforded by railway communication. The only new branch of industry in this place is that of Cirio and Co., who have their central house in Turin, and branches in many other large cities of Italy. They make preserved provisions, such as vegetables, which they sell in Vienna and St. Petersburg, much to the sorrow of those who, while living in a country groaning under the weight of its vegetable productions, find the market products extremely expensive. This is so important a commerce that it might be extended to all northern countries, and especially to England, during the winter months.

Instruction.—It is to be regretted that so important a subject as instruction and education should barely form part of the Exhibition, where school books and appliances would have been so fittingly sent, no less than school furniture. Of the latter, the only thing worthy of remark is the sample of the benches and desks employed in the International Elementary School at Turin, founded two years ago on the German system. Each bench is intended for two children, so that they are easily kept in order, without requiring so much space as where each child has his separate desk. The supports are of cast-iron, with vertical slides, in which the bench and foot-boards are fitted with bolts at the desired height. It is true that the school in question is private, and supported by the fees given by the scholars, but in a country where instruction is free to all who will avail themselves of it, such an expensive kind of school furniture could never be extensively used.

It is highly gratifying to find geometrical figures, curves, and other drawing apparatus so accurately made as in the samples exhibited by Merlino, of Turin, and at prices so moderate that they may not only be employed in the technological schools of Italy, but could be exported wholesale to England for private colleges and schools of design. Professor Boidi, of Turin, has also sent some geometrical figures for drawing projections on two or three planes at right angles to each other. All other attempts to improve instruction are absent from this exhibition. In a word, there is much to be studied in this exhibition. It is only to be regretted that the classification has been a complete *fiasco*, and the catalogue a mere mosaic, in which lead pipes, models of vessels, dinner services, and gold ores, are literally all in the same class with tiles, timber, and German silver spoons.

In terminating, we may remark, that almost all large commercial houses in Italy are now beginning to have a branch at Rome, and manufacturers are establishing agencies there, which will be the best sign for all the staunch friends of regenerated Italy—and they are numerous in England—that progress, civilisation, and light will rapidly penetrate into the city which has been, alas! for more than a millenium, the centre of all which is corrupt, despotic, and false; and let us hope, also, that with all these exertions towards material progress, the light of the Gospel and morality, and sound education, may take root there and flourish. J.

THE EUPHRATES VALLEY RAILWAY.

The report from the Select Committee on the Euphrates Valley Railway has been published, with the evidence of several distinguished oriental travellers and eminent engineers, upon the route best fitted to secure a direct communication between this country and our Indian Empire. The Committee have, for the present, agreed to report to the House of Commons the evidence they have gathered, leaving the many important questions raised until the sittings can be resumed at the commencement of next session. Apart from certain minor questions of more or less relative consequence in regard to the direction which the line of railway should follow, we learn there is a divergence of opinion upon the desirability of using the Black Sea or the Mediterranean as the basis of operations. These points were clearly explained at the outset, by Sir Henry Rawlinson, the first witness called, who speaks with the authority of personal knowledge, gained by twelve years of residence and travel in Turkish Arabia. We learn from his description that several routes have been recommended which possess certain advantages, and are therefore deserving of the consideration of the Committee. The first is a route which has been proposed by the Turkish government, and for which the Porte gave, or offered, a concession as long ago as 1866 or 1867. This was intended to connect Constantinople with the Persian Gulf. It was to start from Scutari, opposite Constantinople; then it passed along to Izmid, Kutayïeh, Kara-hissar, Kuméh, and Kaïsarieh to Aleppo, and then down the Valley of Euphrates to Bagdad and Bassorah, and from Bassorah to the head of the Persian Gulf. The distance was estimated at 1,700 miles, including a branch from Aleppo to Scanderoon. It was 800 from Constantinople to Aleppo, including the Scanderoon branch of about 120 miles; and it was 900 miles from Aleppo to the Gulf. The second is what is generally called the "Andrew's" line, or the well-known Euphrates Valley route, which is the same as the lower portion of the route described, but the essential difference being that the terminus is at Scanderoon instead of Constantinople. The distance is estimated at 850 miles, whereas it should be in reality 1,000 miles. The third route, which has been strongly recommended to the government by Colonel Herbert, the present political agent in Arabia, would also leave the Mediterranean at Scanderoon, but it would subsequently pass by Aleppo across the Euphrates at Bir or Orfah, which is the ancient Edessa, and so on to Diarbekr, Nisibin, Moosul, and then along the Tigris to Bagdad and Bassorah. This route would be 100, or perhaps 150 miles longer than the Euphrates Valley line, as it makes a considerable detour to the north-east, but it has the advantage of passing through a number of large cities and centres of trade, and lying generally among settled and populous districts. These are the three routes which exist between the Mediterranean and the Persian Gulf.

There are, besides, two or three routes from the Black Sea which ought to be considered. There is, in the first place, a route which has recently been advocated. It leaves the Black Sea at Jereboli, near Trebizond; it crosses the mountains to the Valley of the Euphrates, at Erzingam; it then takes a steamer and passes down the Euphrates to the point nearest to Diarbekr; it then crosses to Diarbekr, and follows the Tigris down to the sea by steamer. This would be about 950 or 1,000 miles, partly water and partly railway, but the water communication would be only practicable for a few months in the year, and then only downwards. There is another route, which leaves the Black Sea at or near Samsun, and follows the high road to Sivas; from Sivas it would follow a line by Malatieh and Diarbekr, and from Diarbekr it would follow Colonel Herbert's route to Bagdad and Bassorah. This would be about 1,000 miles in length. There is another route also from the Black Sea, although the project has not attained any substantive form, and that is a line from Trebizond to Erzeroom, across the mountains, and from Erzeroom to Van, and then down the Betissú to the Tigris, above Moosul, and from that point along the same line as the last route. This line would cross the range of the Taurus in about its most difficult and impracticable position, and would be impossible to effect, the country being cut up by a succession of precipitous ravines, mountain torrents, and impracticable defiles. Other lines have been projected connecting Europe with India, but this question involves much larger considerations than those affecting the mere limited question of connection between the Mediterranean and the Persian Gulf. There are, according to Sir Henry Rawlinson, three great lines which have been projected to connect Constantinople with India. The first would pass from Constantinople along the northern or high road to Erzeroom; from Erzeroom, it would cross the Persian frontier to Khoi and Tabreez, and so on to Teheran, the capital of Persia; from Teheran it would pass to Shahrood and Mushed; at Mushed it would run south-east to Herat, and so on to Kandahar, and through the Bolan Pass to Shikarpoor and Sukkur, where it would join the Indus Valley base. The length of this line would be nearly 3,000 miles, which is not quite so much as the line which connects Sacramento with New York, and which distance is traversed in a week. The second line also leaves Constantinople, and follows the Central route through Asia Minor, or, as it is now generally called, "the telegraph route," being the line along which the Turkish wires which carry our messages to India are placed; it passes by Angora, Yusgat, Sivas, Diarbekr, and Moosul to Kifri, which is the nearest point to the Persian frontier on that line, and where our telegraph turns off to Persia. From Kifri it would cross the Persian frontier, and ascend through the "gates of Zagros" to Kermanshah, and so on by Humadan to Teheran, where it would join the route contemplated to the Indus Valley. The length of this line would be about 3,200 miles; it presents engineering difficulties at two points, namely, the descent of Taurus and the ascent of Zagros, but it has many compensating advantages. There is another, or third route. From Constantinople, it would follow the same line, as far as Bassorah, as No. 1 of the limited routes; that is to say, it would pass by Kutayïeh and Kuméh to Aleppo, and along the Euphrates Valley to Bagdad and Bassorah, being absolutely the same as the line proposed by the Porte. From Bassorah, it would circle round the northern and eastern shores of the Persian Gulf, passing by Bushire and Bunder Abbas, and would then follow the sea coast of Mekran to Kurrachee. This would be somewhat shorter than the upper line, about 2,900 miles, and from Bassorah, along the shores of the Persian Gulf, with the exception of Bushire, there is not a town worth speaking of, and a very scanty population—that is to say, throughout the whole distance from Bassorah to Kurrachee.

The evidence given by Colonel Chesney bears more especially upon the advantages of the Euphrates Valley line in particular, and the nature of the country through which it passes. He observes that the route from Trebizond by the Tigris would be highly advantageous to Russia, but of little or no service to this country. The port is an open one, and therefore highly objectionable, with steep mountains behind it, and the Taurus beyond them. In the event of a war with Russia, and Russia having the command of the Black Sea, she would be able to shut up the terminus of the railway upon the Black Sea; whereas, if the terminus were on the Mediterranean, England would have the command of it, as being easily defensible, and there would be an excellent port at which to land an army. In his opinion, therefore, the line by the Euphrates from the Mediterranean is the only one desirable for the English nation to construct. The chief engineering difficulties occur at the first stage from the sea, in the 15 miles traversed from Swedia, or Scanderoon, to Antioch; all the rest is easy. There would not be a single tunnel or cut to make. The population along the proposed line is very considerable. The Arabs would number between 2,300,000 or 2,400,000; they come in summer, and go away again; therefore, there is a large population—several towns with considerable commerce. A great traffic might be established with this country from points where there is already a large trade. The imports through Aleppo are upwards of two millions, coming from the line of Arabia, and the exports are not far short of the same amount. The Tigris has its commerce also, but the commerce of the Tigris is not so great as that of the Euphrates. The land is favourable to the growth of cotton, linseed, corn, and everything which is produced in India. In the early spring, clover and grass may be seen growing nine feet in height. It is the finest alluvial soil in the world, and is much more fertile than the land in the valley of the Tigris. There is an existing traffic passing by means of the caravans, and there has been a communication through Arabia since the time of Abraham; it has never ceased. The caravans go through, and hardly ever meet with any difficulty from the Arabs, except a slight payment, which the sheik expects. There would be no obstruction, and labour would be readily obtainable for the construction of the works along the line. With regard to climate, the deaths from fever and ague are not numerous, and exposure would be better to bear than if exposed on the Red Sea. In comparison with the journey by the steamer on the Red Sea, the railway would be easier, the current of air would be more refreshing; in the case of the former, the steamers are often forced to turn round so as to get air into the ship, to save the passengers from the intense heat. For the conveyance of the light, valuable goods, mails, passengers, troops, and treasure, the Euphrates route would be the best, and both lines would assist each other; there are people and commerce enough to occupy both. The distance would be, from London to Brindisi, 1,504 miles; from Brindisi to Selucia, or Scanderoon, 900 miles. The line of the Euphrates, along the river, as proposed for the railway, is 850 miles, that is from the sea to Bassorah; then, from Bassorah to Bombay, the distance is 1,690 miles. The total distance from London to Bombay is 4,944 miles. The route, *viâ*

Brindisi, Suez, and Aden, the distance is 5,472 miles from London to Bombay, and from London to Kurrachee it is 5,247 miles. The difference in favour of the Euphrates line is, from London to Bombay, 528 miles, and from London to Kurrachee, 803.

With respect to the arrangements that it would be be necessary to enter into with the Turkish government, and the means by which the capital to complete the undertaking could be raised, we learn the full particulars in the evidence given by Sir George S. Jenkinson, Bart., a member of the committee. From conversations and written communications with the Turkish Minister, his Excellency, it appears, on every occasion, expressed himself personally most anxious on the subject, and that the completion of the project would be especially favoured by the Sultan. The result of these interchanges of opinion were reduced to a written document.

The Turkish government consents to the construction of the railway, on its own account, from Alexandretta to Aleppo, and from Aleppo to Bagdad and Bassorah, at the head of the Persian Gulf, under the direction and working control of a mixed committee, to be jointly appointed by the English and Turkish governments, and upon the following conditions:—1. The funds to be raised by means of an Ottoman loan, the interest of which to be counter-guaranteed by England, at the rate of 4 per cent. per annum, and 1 per cent. for sinking fund. 2. The proceeds of such loan, when raised, to be deposited in the Bank of England, in the names of the mixed committee, and to be applied by them exclusively for the construction of the railway, and the provision of the necessary rolling-stock, and for no other purpose. 3. All the land necessary for the railway, and for all the works in connection therewith, to be provided for by the Turkish government. 4. In order to secure, with regularity and certainty, the payment of the interest upon the loan, the following stipulations to be agreed upon and enforced:—1st. The net income proceeds of the working of the railway when made, wholly or any part of it, to be paid into the Bank of England, and applied exclusively to the payment of the interest of the sinking fund. 2nd. The customs duties and port charges of the ports of Alexandretta and Bassorah, as well as certain revenues and other resources of the province through which the railway may pass, to be assigned by the Turkish government to the mixed committee, as a security for the payment of the interest of the loan and of the sinking fund. 5. The Turkish government to guarantee to England the privilege of the conveyance of troops at all times by the railway to and from this country and any of Her Majesty's Eastern possessions, and at a rate not exceeding that which will be paid for a conveyance of troops belonging to the Ottoman Empire, and upon such other conditions and regulations as shall be settled and agreed upon by a convention between the English Government and the Sublime Porte. 6. The transport, free of any charge, at all times, by the railway, of all English mails to and from this country, and any of her Majesty's Eastern provinces. 7. Until the extinction of the loan, by the repayment of the principal and interest, the English government and the bond-holders, as represented by the committee, to have an absolute mortgage upon the railway, and land, and works.

CORRESPONDENCE.

RESOURCES OF INDIA.—WURRORA COAL.

Sir,—Under the heading of "Correspondence," at page 729 of your *Journal*, of the 25th of August last, you did me the favour of inserting a letter on the "Mayo Colliery," in which I mentioned that a seam of coal had been struck at Wurrora, twenty-six miles nearer to the Great Indian Peninsula Railway than the Mayo Colliery, and I then stated that I had no doubt that the use of the coal from both these places would be very instrumental in reducing the working expenses of that railway; and I am glad to find that a specimen of the Wurrora coal, brought up by the steam-borer, of about three or four inches cube, proved on analysis to be superior to the Mayo coal, in fact, about 30 per cent. better and more valuable; but as the coals of this part seem more or less variable, too much reliance must not be placed on the analysis of the single specimen already made, but when the pit has reached the seam, which it is expected very shortly to do, it will then be ascertained very satisfactorily whether the average contents of the seam agree generally with the specimen analysed or not.

It will be seen from the following analysis of a specimen of the coal from both pits, that the Wurrora coal contains a little more sulphur and three times as much ash as the Mayo coal; but this latter substance will probably be found to vary in proportion, and the percentage of ash may, perhaps, be less in future specimens of the Wurrora coal; but again, the Mayo coal contains, according to analysis, 19·82 per cent. of water; and as the water dries off the coal falls to pieces, whereas the Wurrora coal appears to have only 11·42 per cent. of water in it.

Analysis by the Bombay Chemical Analyser.

Description of Test.	Mayo pit coals analysed, August 12, 1870.	Wurrora specimen analysed, February 10, 1871.
Specific gravity of the coal....	1·25	1·51
Hygroscopic moisture, per cent.	19·82	11·42
Coke, per cent.	44·02	66·59
Ash, per cent.	5·31	16·09
Sulphur per cent.	0·22*	0·75*
Approximate Calorific Value by Berthier's Method:—	lbs.	lbs.
Pounds of lead reduced by 1 lb. of coal	13·86	18·31
Hence:—lbs. of water raised from 32° to 212° by 1 lb of coal....	31·41	41·38
Pounds of water evaporated from 212° by 1 lb. of coal	5·85	7·70

The Great Indian Peninsula Railway have received 106½ tons of Mayo pit coal at their Wurdah Station, and they burnt it in their locomotives in February and March last, chiefly on goods and mixed trains, having a load of from 200 to 240 tons, running between Budnaira and Nagpore, a distance of 108 miles, with fire-bars placed two inches apart; the consumption averaged 51 lbs. per mile, or about 34 per cent. more than that of English coal burnt under similar circumstances; and I hear that the head of the locomotive department was of opinion that, if the Wurdah station were put in connection with the pit by a line of rail, and the coal obtained at a reasonable rate, that the Nagpore branch could be worked entirely with it; and that if it could be supplied at, say 30s. per ton, delivered at the railway, it would be 20 per cent. cheaper than English coal on the Nagpore extension. It has the drawback of throwing off a great deal of dust while burning, but the engine-drivers are becoming better satisfied with it.

The consumption of Raneegunge coal on the East Indian Railway averaged about 75 lbs. per mile, in October 1869, while that of the Mopani coal, in the Nerbudda valley, averaged 57 lbs. per mile; so the Mayo coal will prove a valuable fuel, only consuming 51 lbs. per mile.—I am, &c,

A. Romaine Wragge, Lieut.-Colonel.

Old Charlton, Kent, Sept. 29, 1871.

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* The per-centage unaccounted for is probably volatile matter.—A. R. W.

DEAF AND DUMB INSTRUCTION.

Sir,—May I trouble you with a few words in reference to what Mr. Buxton said of me in his letter in the *Journal* of (I think) the 15th September. I write this to place myself right with you, and to justify you in inserting my letter in your *Journal* of the 1st September.

In regard to my ability to give an opinion on what concerns the education of the deaf and dumb, I may say that I have been engaged as a teacher in this institution for the past fourteen years, and I think I may claim for myself that, by all the means in my power, I have endeavoured to make myself acquainted with what has been said and done in regard to this subject. Although I have been engaged in no other institution for the education of deaf-mutes, it is not true, as Mr. Buxton asserts, that I have never entered any school other than that in which I am engaged. Besides this, not a few of the pupils of provincial institutions and their teachers have come here, and, in daily intercourse with these, one must shut one's eyes and ears to know as little as Mr. Buxton supposes.

But the particular remark to which Mr. Buxton takes exception was meant to bear no reference to the interior doings of the institutions. I believe it would be easy to prove the statement in the sense I intended. It cannot be said that the quality of education generally has improved, nor is the average period of instruction longer than it was some years ago. This latter remains at a very inadequate term of about an average of five years. I said in my letter, our pupils did not receive a good education. The lowest estimate I can give of this would be represented by a pupil understanding sufficient of language to know the meaning of a simple narrative, and to write an account intelligibly, and in correct phraseology, of a simple occurrence. If fifty per cent. of our born deaf pupils could do this, in view of the great difficulties to be overcome in teaching them, I should be satisfied; but, as matters are now, I should be surprised if 25 or even 15 per cent. of the pupils who leave school—any school—could be produced with such a standard of proficiency reached.

By the census tables of 1861, the number of deaf and dumb in England between the ages of 5 and 15 years was 3,556, and it was stated that educational provision was made for 991 of this number. The numbers of the deaf and dumb must have considerably increased during the past ten years, but I believe there has been very little, if any, increase in the numbers under instruction. Indeed, I should not be surprised if a positive decrease were shown in the next tables published. One more fact. In January, 1870, the number under instruction in the State-supported institutions of the United States amounted to 3,282 persons, and this number has since increased by several hundreds. The total deaf-mute population is not more, most probably less, than that of the United Kingdom, but with us it is probable that not more than half the number are under instruction of that in the United States. With these facts present to my mind, and in view of the progress that is seen on every side of us, I do not think I was far wrong when I spoke of "stagnation" in regard to deaf-mute education.

I should have stated these matters more fully, and perhaps more clearly, for your *Journal*, had I not been prevented by a resolution of the committee of this institution, forbidding anyone in their employ from publishing in the public prints anything which had not been previously approved by them. I do not know if the letter I ventured to address to your *Journal* had anything to do with this resolution; I know the matter of it was not objectionable, if the fact of its having been put forward by a subordinate was. Being virtually forbidden to take part in a public discussion, I thought it was due to myself and to you to give this explanation of my silence.

What was said of the blind in the concluding paragraph of a recent article of the *Times*, applies with equal if not greater truth to matters in reference to the deaf and dumb. Class interests are so interwoven with the efforts that are made in their behalf, that all that is necessary for their good will never be accomplished, until some philanthropic and influential gentlemen take up the consideration of their claims, and influence public opinion so that they may be recognised. That the discussion you have begun may help towards this desirable result, and so help to raise an unfortunate class to the position they are capable of taking, is my earnest wish.—I am, &c., Richard Elliott.

Asylum for the Deaf and Dumb, Old Kent-road, S.E.,
September 28th, 1871.

MONTHLY NOTES ON SCIENCE.

The question of what is a primary colour would appear to be not yet settled. Originally seven, the colours were eventually reduced to three—blue, yellow, and red. Before giving the reasons of a contributor to *Nature* why blue, which has hitherto been allowed to retain its place among the primaries undisputed, should be relegated to the rank of a secondary, it may not be amiss to glance at some of the opinions held on this subject. Sir Isaac Newton, having analysed a beam of light by means of a prism, and having subjected the spectrum thus obtained to a minute inspection, concluded that white light was composed of seven distinct colours, which, commencing with the most refrangible, were ranged in the following order, viz., violet, indigo, blue, green, yellow, orange, and red, and these he called primary colours, because when he examined them, by allowing each to pass through a hole in a screen, and refracted it by a second prism, he found that the beam, although bent, was not drawn out into a band, or elongated, as before, in the case of the white light. Brewster, however, reduced the number of primary colours, so called, to three, blue, yellow, and red, and pointed out that the other colours were produced by the overlapping of those just named. Where the blue overlapped the yellow, there was green formed, and in like manner was orange produced by the overlapping of red and yellow. But in course of time, about ten years ago, Professor Maxwell, when lecturing at the Royal Institution on the theory of the primary colours, started the novel theory that the three primary colours were not blue, yellow, and red, as had for many years previously been believed, but were blue, green, and red. Green, he held, was not a secondary colour, but a primary one. If we accepted the theory that light is an undulation, then, as there are undulations of every different period from one end of the spectrum to the other, there are an infinite number of possible kinds of light, no one of which can be regarded as compounded of any others. Physical optics did not lead us to any theory of three primary colours, but left us in possession, of an infinite number of pure rays, with an infinite number of compound beams of light, each containing any proportions of any number of the pure rays. While opticians say that there are an infinite number of kinds of light, painters account for all actual colours by supposing them mixtures of three primary colours. As we have said, the primary character of blue has now been attacked. Dr. Aitken says that if it be a primary colour, a mixture of yellow and blue transparent pigments could not produce green, but would form an opaque combination, and the colour produced would depend on the colour reflected by the coloured layer itself, and not on the light passed through it from the white surface underneath. The brilliancy of the green produced by the admixture would be a measure of the transparency, to the green rays, of the blue pigment employed; in other words, there is as much green in the blue pigment as there is green in the green produced by mixing that pigment with yellow; and since the blue pigment passes the green rays, it is argued that blue must therefore be a compound colour. This conclusion is further strengthened by the fact that, when light reflected from a blue substance is examined with a prism, it is found to be composed of green and violet; and when, on the other hand, green and violet are combined by means of a rotating disc, blue is produced. To further establish the fact that blue is not an elementary colour, but that violet is, the following experiment is recommended:—Take a piece of red, a piece of green, and a piece of violet glass. Any two of these form an opaque combination; that is to say, the first glass stops all the rays which could pass the second, and the second all that could pass the first. But a green and a blue glass do not form an opaque combination, but pass the green rays. If we place red, green, and violet glasses in a row close to each other, the green in the centre, with a piece of yellow glass so as to overlap the junction between the red and the green, and a piece of blue similarly to overlap the junction between the green and violet glasses, it will be seen that the yellow glass passes the red and green rays, and the blue glass passes the green and violet, the only effect of the yellow and blue glasses being to deepen the colours while the light passes through them. Dr. Aitken's observations are very interesting, and will not fail to receive much attention.

A large induction coil, believed to be the most powerful in the world, has lately been constructed in Boston. It contains $44\frac{1}{3}$ miles of wire, is 40 inches in length, weighs over 200 pounds, and with three cells gives sparks 21 inches in length. The iron core consists of iron wires about $\frac{1}{16}$ inch thick; they are not insulated from each other. The primary wire is 200 feet in length, the secondary wire being 234·100 feet. The battery for exciting this huge coil consists of three glass jars 12 in. high, and 10 inches in diameter, into which are lowered, by means of a windlass, plates of carbon and zinc, 10 by 8 inches, five of each occupying each jar. The exciting liquid employed is a mixture of a solution of bichromate of potash and sulphuric acid.

An improved method of preparing vegetable parchment has been described. The ordinary way, it is well known, is to immerse unsized paper in diluted sulphuric acid, but in doing so the greatest care must be taken, both in having the proper strength of the acid solution, and in the time the immersion lasts. In the new method discovered by Mr. Campbell, the paper is first dipped in a strong solution of alum, then, after being well dried, it is drawn through concentrated sulphuric acid. The alum prevents too strong an action on the paper, which has only to be washed and dried slowly. The discoverer proposes to make parchment in endless lengths, by putting the alum and the sulphuric acid both in connection with the paper making machine. Paper which is already printed on can be converted into parchment by this plan.

Of the ways and methods by which oxygen is made, there is almost no end. In the meantime, however, small consumers confine themselves to its preparation from a mixture of chlorate of potash and black oxide of manganese, which when heated in a retort evolves the gas very freely, and in a state of great purity. To obtain the gas under the best conditions, some niceties are required. Dr. Morton, who has had much experience in its preparation, advises that, instead of heating the retort slowly, a brisk heat should be applied, and continued until the oxygen in copiously liberated, when it ought to be diminished until the flow of gas decreases. The theory of a safe and successful working of the process, he says, is this:—"If the mixture is very rapidly heated, one part of it will be entirely decomposed without fusing before another part has reached the required temperature, and so the evolution of the gas will be gradual and steady. But if the heat be more gradually applied, the entire mass may be slowly fused with very slight escape of gas; but when once the temperature for this is reached, the action goes on simultaneously throughout the mass, and is then of a very violent character. The melted material is also liable to froth up and close the outlet, but by applying the heat rapidly, all difficulty is avoided. After being used, the retort, if made of thin iron, should be cleaned out by breaking up the residuum with a sharp stick, rather than by washing, as is usually done. By doing this it lasts much longer than it otherwise would do.

Several years ago, the photographic world was startled by an announcement, couched in the most definite terms, that a certain photographer had been able to take photographs by moonlight, and this assertion was backed up by the exhibition of a variety of photographs alleged to have been taken in that way. This was for a time very puzzling to photographers, who marvelled by what wonderful combination of chemicals such great sensitiveness could have been obtained, for the more philosophical among them had estimated the light of the moon, as compared with that of the sun, to be so defective as to require an exposure of the plate in the camera for a period of time equal to several days, whereas these "moonlight" views were obtained instantaneously. It eventually transpired that they were really taken by sunlight, certain effects peculiar to moonlight having been obtained by clever manipulation. A small portion of the scientific world appears again to be in a state of excitement, in consequence of a verified statement that photographs have recently been taken by moonlight only, an exposure of twenty-five minutes having been required to secure a photograph of a landscape. But alas! for lunar landscape photography, if it be necessary, as the artist states, to use a reflector to throw on the object the greatest amount of moonbeams! Of what avail would a mirror be in reflecting light on the landscape visible from any eminence, say from the top of St. Paul's? The moon itself has often been photographed; but we shall, in the present state of optical and chemical science, have to wait for a long time before landscapes can be photographed by its pale rays, even although a reflector be used to aid them.

GENERAL NOTES.

The Production and Export of Grain in Various Countries.—Some interesting statistics of the production and export of grain throughout the world have recently been published at Berlin by Herr Behm, from which it appears that Prussia produces annually 158 million quarters of grain, and exports 12 million quarters. Austria produces from 56 to 70 million quarters, and exports $3\frac{1}{2}$ million quarters of grain and 160,000 tons of flour. The production of the Danubian provinces is from 13 to 17 million quarters, and the exportation from 3 to $3\frac{1}{2}$ million quarters. The United States produces annually upwards of 227 million quarters, and exports $2\frac{1}{2}$ million quarters. In Denmark the production is 10 million quarters, and exports $1\frac{3}{4}$ to 2 million quarters. The principal countries that import grain are Great Britain and Ireland, the annual production of which is estimated at $45\frac{1}{2}$ million quarters, and the imports at from 17 to 20 million quarters. Switzerland produces $2\frac{2}{5}$ million quarters, and imports $1\frac{1}{3}$ million quarters. In Belgium the production is estimated at $9\frac{2}{5}$ million quarters, and the imports from $\frac{1}{4}$ to 1 million quarters. Italy produces $23\frac{3}{4}$ million quarters, and imports 2 million quarters. The Zollverein produces 83 million quarters, and imports $3\frac{2}{5}$ million quarters (chiefly rye). The production of grain in the Netherlands is estimated at from 3 to 4 million quarters; the imports vary considerably. In France both the production and imports of grain are exceedingly variable; in 1867, the imports amounted in value to upwards of 10 millions sterling.

Coal Mines at Panama.—In the district between Aspinwall and Panama some very valuable beds of coal have been discovered, which cover a very large area. The quality of the coal is excellent, and the mines can easily be placed in communication with the coast by means of the rivers and canals.

Herrings in New Zealand.—It is stated in the *Otago Daily Times* that the important discovery has lately been made that the home herring (*Aupea harengus*) frequents the shores of New Zealand. A few specimens have occasionally been obtained on the shores of Green Island and Saddle Hill, which were believed to be the real herring; and recently a settler, walking along the beach, picked up three fishes so much resembling herrings that he kept them as curiosities, without proving them by taste. Lately, however, the matter was placed beyond the shadow of a doubt. Between the boat-harbour and the Kuri an immense shoal of fish, pursued by large numbers of sea-fowl, were seen, extending for several miles seaward and along the shore. From the peculiar movement of the fish, and the evolutions and clamour of the sea-gulls, the practised eye of the Macleods—three brothers, experienced fishermen—came to the conclusion, before a specimen was obtained, that the fish were neither more nor less than the real home herrings. Hotly pursued by their natural enemies, a small portion of the shoal, consisting of upwards of twenty dray-loads, along with eight barracouta, was cast on the beach. Joyfully did the Macleods recognise the Highlandman's best friend, the herring, and they and the surrounding settlers secured a goodly number before next tide. Macleod and others assert that in flavour and quality the fish were equal to Loch Fyne herrings. The fish, however, were young, being from four inches to four inches and a-half in length, but a full-grown one was observed occasionally. On examination, the fins and teeth exactly corresponded with the British species, the latter being small and numerous, and situated not only on the jaws, but in the other parts of the mouth, as the vomer and the tongue. In reference to the British herring, Chambers states:—"The opinion once entertained that its proper home is within the Arctic Circle, and that its vast shoals issue thence at certain seasons, is now discarded as having no foundation, and the herring is believed to be an inhabitant of deep water, from which, at certain seasons, it approaches the shores, probably not migrating to any great distance." On the west of Scotland, the opinion entertained was that its home was within the zone of latitude 45 degs. to 60 degs., then following up the coast, entering its numerous bays and locks. There they were followed on the surface by the solan goose, the gull, and other sea birds; beneath the water by whales, porpoises, dog-fish, hakes, &c. Here it appears, a shoal is followed by the gull, mutton bird, and barracouta (closely resembling in size, shape, and taste, the hake), and probably the whales, which occasionally approach the coast, are in pursuit of it. To promote an inquiry, which could not fail, if fairly started, to become an important one, it is recommended that a bonus should be given by government, to be used in equipping a boat of from forty to fifty tons burden, with the necessary apparatus for fishing. There are in Port Chalmers numerous experienced fishermen who would readily enter upon such an undertaking, provided the necessary funds were forthcoming. If a regular herring-fishery were established, not only could a ready market be found in the Australian colonies, but California might be expected to absorb considerable quantities of the dried herrings. There is, moreover, every reason to believe that numerous species of other edible fish, not yet known, live near these shores. At no great distance, banks are supposed to be teeming with cod. An experienced fisherman told us that he caught cod-fish the exact counterpart in size and flavour to that obtained on the west coast of Scotland.]

New Oyster Beds.—A rather extensive bed of oysters has been discovered, says the *Cambrian*, between Old Castle Head and Stacpole Head, on the South Pembrokeshire coast, about eight miles distant from Tenby. The discovery was made by some Jersey vessels, and the bed extends for about six miles in length, the oysters being large, resembling the celebrated Caldy bed oyster. A large number of vessels and boats have been dredging the ground since the discovery, and the take of some of them has been unusually large.

The Growth of Tobacco in Ireland.—In the Parliamentary session of 1870, says the *Birmingham Gazette*, the Right Hon. Fitzstephen French addressed a very plain and distinct question to the Chancellor of the Exchequer—namely, whether he would consent, on any terms, to permit the cultivation of tobacco in Ireland? The reply was equally distinct. It consisted of an emphatic "No." The Finance Minister might have remarked on the facility which a permission to cultivate the narcotic herb would afford to the evasion of the duty by those who would grow it to a very small extent, and to the difficulty of ascertaining the value and collecting the tax on numerous and separate patches. He might have intimated an intention to take into consideration the practibility of allowing the tillage to be pursued, under stringent excise regulations, such as notice of the intention to till, full specification of the place, and the exact measurement of the space intended to be appropriated to the crop. He might have insisted that not less than an acre, or even two, should be planted. As the use of small stills are prohibited in the production of spirits, so mere plots of tobacco might reasonably be declared objectionable, for fiscal reasons. But the subject was one which it seems could not even be considered by a member of that cabinet the leader of which reverts with pride to his identification with the opinions of Cobden, and his determination to adhere to the principles of free trade. There is no commodity of greater or more general consumption than tobacco. It is the material on which a considerable portion of the national revenue is levied. It rises with Antæan strength against the enormous taxes which every European government impose on its manufacture or sale. Still, it continues to be grown extensively, not only in Virginia and Maryland, and in the cigar-famed Cuba, but also in every continental country of Europe. Its cultivation is pursued in the southern provinces of Russia and in the Northern parts of France. In all these countries it is made heavily subsidiary to the public revenue, but in none has its cultivation been prohibited. Horticulture has latterly become, not merely a fashion, but a passion amongst the Londoners. Windows and areas are made redolent with blooming flowers. Balconies are not likely to be left with naked rails and every little space is made subservient to the pervading taste. At most of the suburban railway stations shrubs and flowers greet the passenger's view, and amongst them are numbers of tall, vigorous plants, now in full florescence, their broad and luxuriant foliage surmounted by bunches of scarlet blossoms. In the gardens by Clement's-inn these plants appear abundantly, and excite the admiration of crowds to whom their name and nature is unknown; but it is at the South Kensington International Exhibition that they assume, in the enclosure before the Café Français, almost a monopoly. There a large circular bed is allotted to them, and they certainly justify the expectation of those who placed them there for high ornamental effect. They prove, by their vigorous growth and abundant blossoms, the suitable nature of the soil and climate for their production, but it is only an ornamental capacity that they can be tolerated. The plants to which we allude are the Virginia tobacco, the same kind as about forty years ago constituted a very profitable cultivation in Wexford, Meath, and some other parts of Ireland, until supreme legislative rule decreed its prohibition.

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ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

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PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.

By Dr. Crace Calvert, F.R.S.

Lecture IV.—Delivered Tuesday, February 28th.

Quercitron, Fustic, Persian Berries, Weld, Aloes, Turmeric, Annatto, Ilixanthine, Lakao, Tannin Matters—Gall-nuts, Sumach, Divi-divi, Myrobalans, Catechu.

I shall have the pleasure of devoting the first part of this lecture to some of the most useful and important yellow substances used by dyers and calico-printers, and to one or two other colouring matters which, although scarcely commercially important, are interesting from a scientific point of view.

Among the most valuable of these bodies is *quercitron*, the bark (from which the epidermis has been removed) of a particular species of oak, called the *Quercus nigra* or *Quercus tinctoria*. This tree is indigenous to the United States of America, and is especially found in the forests of Pennsylvania, Georgia, and in North and South Carolina. A chemist, of the name of Bancroft, first introduced it to the English dyers in the year 1775. The most esteemed qualities are those imported from Philadelphia, New York, and Baltimore. The bark, after being removed from the tree, is dried, and ground between mill-stones. The value of a sample bears a direct ratio to the fineness of the powder, for the woody fibre of the bark, which contains only a small quantity of colouring principle, is not easily reduced to a fine powder.

M. Chevreul was the first chemist who examined this dye, and he found it to contain a peculiar tannin, which has since received the name of *quercitannic acid*, and a yellow colouring principle, to which he gave the name of *quercitrin*, but which has since received the name of *quercitric acid* from M. Bolley.

M. Chevreul, by boiling quercitron bark in water, and allowing the aqueous solution to stand, obtained fine, laminated crystals, which were gradually deposited, and to which he gave the name of quercitrin.

M. Bolley followed a better process. He treated the bark by alcohol, precipitated the tannin from the alcoholic solution by gelatine, evaporated the alcohol, and obtained the quercitron under the form of colourless crystals. These, under the influence of air or oxidising agents, assume a bright yellow colour. The alkalis give quercitron a brownish tint, but its most characteristic property is to give a greenish-yellow precipitate with chloride of iron, and a beautiful bright yellow precipitate with protochloride and oxymuriate of tin.

M. Rigaud discovered, a few years since, by boiling quercitron with water containing 10 per cent. of sulphuric acid, that it is a glucoside, which decomposes under the influence of the acid into glucose and quercitrin according to the following formulæ :—

$$\overset{\text{Quercitrin.}}{C_{36}H_{40}O_{21}} + \overset{\text{Water.}}{2\,H_2O} = \overset{\text{Glucose.}}{2\,(C_6H_{12}O_6)} + \overset{\text{Quercitine.}}{C_{24}H_{20}O_{11}}$$

Quercitrin is a crystalline powder, of a bright lemon colour, and of a much richer hue than quercitron. It has no taste, is insoluble in cold water, and only slightly soluble in hot, but is freely soluble in alcohol. It is soluble in alkalis, to which it communicates an orange-yellow hue. Its alcoholic solution gives orange precipitates with the salts of lime, baryta, and lead. It assumes an orange colour with perchloride of iron.

Although quercitron bark gives a fine yellow colour on woollen goods, when mordanted with salts of tin, to which has been added alum or cream of tartar, still its employment has greatly decreased of late years, owing to its colour assuming a reddish hue when exposed to the atmosphere.

Within the last twenty years, a preparation from it has been imported into this country from America, under the name of *flavine*, which in reality may be considered as commercial quercetine. It is now manufactured in England by two different processes. The first consists in boiling half a ton of quercitron bark with sixty-three pounds of soda crystals, in about 2,000 gallons of water; after boiling for about a quarter of an hour, 250 pounds of concentrated oil of vitriol are added. The whole is then maintained at the boil for two hours, when it is run off on to woollen filters, washed until free from acid, pressed, and dried, and is ready for market. The second process, which I consider the better one, consists in boiling for two hours one hundred parts of quercitron bark with three hundred of water and fifteen of oil of vitrol, and then washing, pressing, and drying, as in the first process. One hundred parts of quercitron bark give eighty-five of flavine, which have a dyeing power equal to 250 parts of quercitron.

Flavine is not much employed in calico printing as a yellow dye, its principal use being to communicate a brown and orange hue to madder reds.

The best mode of estimating the value of a sample of quercitron bark or flavine is to dye some mordanted cloth in the same way as in testing the value of a madder or garancine.

We shall now pass to the study of another colouring matter, called *old fustic*. The tree which supplies it is called *morus tinctoria*, and grows in the Brazils, Mexico, and in Jamaica, Cuba, and other islands of the West Indies. It arrives in this country in logs of various sizes. Dyers prefer those which are dense, are not worm-eaten, and which are of a fine orange yellow tint in the inside.

In this case, again, my master, M. Chevreul, was the first to isolate the two colouring matters which the wood contained. To the first of these Wagner gave the name of *morintannic acid*, and to the second that of *moric acid*. To extract these, rasped fustic is boiled twice with water and the solution concentrated to the state of a syrup, when after a few days a crystalline deposit takes place, which is separated, washed rapidly with cold water, and pressed. To separate the two colour-giving principles, the pressed mass is treated with boiling water, which leaves the moric acid as an insoluble mass, while the morintannic acid is dissolved. The moric acid is treated with weak hydrochloric acid, to remove some lime salts; it is then dissolved in alcohol, from which it crystallises in the form of yellow needles. To obtain the morintannic acid which was dissolved, the solution is concentrated, when the colouring matter crystallises out, and only requires recrystallising once or twice from acidulated water to give it almost pure. It forms yellow crystals, soluble in alcohol, which have the formula $C_{13}H_{10}O_6$. It gives a greenish black precipitate, with sulphate of protoxide of iron, and, with salts of lead, a yellow precipitate, soluble in acetic acid. It is decomposed by concentrated alkalis, and when boiled with zinc and sulphuric acid, the solution assumes a very bright red colour, due to the transformation of morintannic acid into two most interesting substances, *phloroglucine* and *machromine.*

Moric acid, though insoluble in water, is freely soluble in alcohol and ether, but is insoluble in bisulphuret of carbon. It is soluble in alkalis, to which it gives a yellow colour, and from this solution it is reprecipitated by the addition of an acid. Perchloride of iron communicates to its alcoholic solution an olive green shade. It gives yellow precipitates with salts of zinc, tin, lead, and alumina, and a dark green precipitate with copper. It has the formula $C_{12}H_8O_5$.

Old fustic is especially employed for dyeing wools in yellow or olive green shades. They are mordanted with a salt of alumina for yellow, or with a salt of iron for green. By the employment of salts of copper and other mordants a variety of shades can be obtained. It is much used by dyers, but only to a limited extent by calico printers.

Young fustic belongs to the same genus as sumach, of which I shall speak further on, and its botanical name is *Rhus cotinus.* It grows in the West Indies, and in France and the southern parts of Europe. It is found in commerce in the form of small logs and crooked branches. Young fustic contains a tannin matter and three colour-giving principles, a red, a brown, and a yellow. The yellow colouring matter, when isolated and crystallised, bears the name of *fustine.* It is soluble in water, alcohol, and ether. Alkalis communicate to it a fine orange hue. It rapidly oxidises when exposed to the atmosphere, assuming an orange colour. A decoction of the wood is affected by the alkalis and air in the same manner as fustine. It gives a bright orange precipitate with lime and baryta waters, and a similar coloured precipitate with chloride of tin. Persulphate of iron yields with it an olive green precipitate. Young fustic dyes wool mordanted with salts of alumina a fine orange colour, but it is easily affected by light; its chief employment is in conjunction with cochineal, to the red colour of which it imparts a brilliant orange hue. It is much used in Turkey and the Tyrol by tanners, to impart to their leather an orange yellow colour.

Persian berries, which are extensively employed by woollen and mixed fabric dyers, calico printers, paper-stainers, and leather dressers, are the berries or fruit of a genus of plants called *Nerprun,* which grows freely in France, Spain, Turkey, Persia, &c. Generally speaking, the berries are gathered before they are quite ripe, which is the reason why the berries, which are the size of a small pea, have a yellowish green shrivelled appearance. The berries only give good results when recently gathered; after one or two years they lose a great deal of their value, not yielding to the dyer such brilliant hues. The yellower they are, the less price they command in the market. They bear among the dealers the names of the countries from which they are imported; thus there are Avignon berries, Spanish berries, Turkish berries, and Persian berries. The latter are the best, and are obtained from the *Rhammus amygdalinus.* Among dyers and calico printers all the varieties are called Persian berries.

The yellow decoction of the berries assumes an orange yellow tint with alkalis, which is not changed on the addition of an acid. Lime-water gives it a greenish hue, persulphate of iron a greenish yellow. Chloride of tin gives a greenish yellow colouration, and a slight precipitate.

Sir Robert Kane succeeded, some years ago, by treating the berries with ether, in extracting a substance, crystallising in fine golden yellow crystals, to which he gave the name *Chrysorhamnine,* and assigned to it the formula $C_{23}H_{11}O_{11}$. He found that, when a solution of this compound was boiled in the air or in presence of an oxidising agent, it became converted into a substance which he named *xanthorhamnine,* to which he gave the formula $C_{23}H_{12}O_{14}$.

Since then, several eminent chemists have examined into the nature of these colouring matters, among whom may be mentioned Gellaty, Bolley, and especially Lefort and Schützenberger.

From their researches the following facts may be gathered. Lefort, in 1866, succeeded in isolating two colouring matters from the berries, which he named *rhamnagine* and *rhamnine.* Rhamnagine is soluble in water, and may be obtained under the form of crystals, while rhamnine is an insoluble yellow amorphous powder. In researches published in 1869, he found that rhamnagine was identical in composition with rhamnine, and that only a molecular change took place in the transformation of rhamnagine into rhamnine, such as we are all aware starch undergoes on conversion into dextrine. He supported this view by analyses, showing that both these substances had the same formula, namely, $C_{24}H_{32}O_{14}$. The researches of Schützenberger further proved that, under the influence of weak sulphuric acid, rhamnagine is decomposed into a peculiar sugar, and a substance to which he gave the name *rhamnatine,* thus showing that rhamnagine is a glucoside. The following formulæ show the decomposition which takes place:—

$$\overset{\text{Rhamnagine.}}{C_{24}H_{32}O_{14}} + \overset{\text{Water.}}{3H_2O} = \overset{\text{Rhamnatine.}}{C_{12}H_{10}O_5} + \overset{\text{Sugar.}}{2(C_6H_{14}O_6)}$$

From these results it would appear that the real colour-giving principle is rhamnagine, and that rhamnine and rhamnatine, which are insoluble in water, are only products of decomposition.

Decotion of Persian berries is principally used in print works for producing bright yellows and greens, on prepared tin cloth, in steam styles. To obtain yellows, the extract is mixed either with a little red mordant (sulpho-acetate of alumina) or with a little muriate of tin. The mixture is thickened, printed on, and the fabric steamed. To produce greens, the decoction of berries is mixed with prussiate of tin, the mixture is thickened and printed on the fabric, which is then steamed, when the yellow of the berries and the Prussian blue which is formed unite to produce green on the fabric. The decoction of berries is very apt to enter into fermentative decomposition, and thereby become ropy; this may be prevented by the addition of a little carbolic acid.

A very fine brilliant yellow lake is produced from a decoction of Persian berries, the manufacture of which was kept secret for a long period by the Dutch. It consists in adding pure carbonate of lime to the decoction, when the lime salt falls, carrying with it the colouring matter of the decoction. The yellow lake thus produced is moulded into small lumps, which are dried in the shade.

There is a variety of mignionette which used to be cultivated in England and France, called weld, its botanical name being *Reseda luteola.* This plant yields a most valuable yellow dye when fixed on wool by means of alum, not only because the colour is exceedingly brilliant, but because it is very solid, resisting light, heat, and acids. Alkalis only communicate to it a slight orange tint. Its colouring matter was extracted by M. Chevreul many years ago, and he gave it the name of *luteoline.* He obtained it in yellow transparent crystals. By the action of oxidising agents, such as bichromate of potash, it assumes a magnificent yellow tint, identical to that produced with it in cotton fabrics.

M. Moldenhauer has since studied luteoline, to which he assigned the formula $C_{20}H_{14}O_8$. It is slightly soluble in water, but very soluble in alcohol. It dissolves without decomposition in strong sulphuric acid, and yields, even when greatly diluted with water, a fine green colour with perchloride of iron. Schützenberger, who has lately studied this body, states that when mixed with water and heated to a temperature of 480° Fahr. in sealed glass tubes, it decomposes into what he considers pure luteoline and resin. The luteoline is found in crystals adhering to the sides of the tube, while the resin collects at the bottom. He states also, that if a decoction of the berries is boiled with weak sulphuric acid, a new yellow colouring matter is produced, which possesses a high dyeing power as well as a pure yellow hue.

The introduction of quercitron and flavine is the principal reason why weld has nearly disappeared from the market.

Aloes is imported into Europe from Bombay, Barbadoes, Jamaica, and the Cape of Good Hope, in the form of resinous masses, varying considerably in size. It is the dried sap or juice of several varieties of aloes, of the family of *Asphodels.*

Dr. Stenhouse, who has examined this substance, has succeeded in isolating two compounds; one, which crystalises in yellow prismatic needles, is soluble in cold water and alkalis, the solution having an orange tint. It has an intensely bitter taste. He has given it the name *aloïne* and assigns to it the formula $C_{17} H_{18} O_7$.

The second compound, which may be considered as the resin of aloes, has received the name of aloëtine. Dr. Schunck has produced from aloes a yellow dye, called *chrysammic acid*, which will probably be yet extensively used. It is prepared by heating in a water bath eight parts of nitric acid with one of aloes, when the violence of the action has ceased, a second part of aloes is added. The application of heat is continued, until hyponitric fumes cease to be given off. The mass is then poured slowly into a large bulk of water. The chrysammic acid falls in flakes to the bottom of the vessel. These are washed with water, until it assumes a fine purple colour. The formula of this acid is $C_7 H_2 2 (N O_2) O_2$. It forms small golden-yellow scales, soluble in alcohol and ether. Although but sparingly soluble in water, it communicates to it a magnificent purple tint, and its dyeing power is considerable. Mr. Saac has made a great number of dyeing experiments with chrysammic acid, and has produced with it a variety of shades. He believes that one day they will become commercial.

Turmeric is the root or underground stem of the *Curcuma tinctoria*, a plant which grows abundantly in the East Indies. It is imported principally from Bombay, Java, Batavia, and Barbadoes. That from Bombay is the most valuable. It is ground and sold to the dyers in the state of a fine powder of a remarkably brilliant orange hue, and of a strong odour. Vogel and Pelletier succeeded in extracting from it a colouring matter, to which they gave the name of *curcumine.* M. Lepage has, however, given the best process for its extraction. The ground roots are treated with bisulphuret of carbon, which dissolves a volatile oil and resinous matters. The root is then dried and acted on by a weak alkaline solution, which dissolves the curcumine. To liberate it, the alkaline solution is neutralised with an acid, when the curcumine falls as a precipitate. This is collected, dried, and dissolved in ether, from which it separates under the form of small, brown scales, which yield on trituration a brillant, yellow powder.

Turmeric is seldom used as a dye, owing to its colour being so easily affected by alkalis, a fact well-known to chemists, as they often employ it to ascertain the presence of a trace of free alkali or boracic acid in solutions. It is used in India to flavour rice, and by the natives to colour their skin.

Annatto is the pulpy part of the seeds of the *Bixia orcellana*, which grows in South America. It is imported into this country from Mexico, Brazil, the Antilles, and especially from Cayenne, in masses covered with leaves, and varying in weight from 5 to 20 pounds. It is also imported in casks, weighing 4 or 5 cwt., as a homogeneous paste of the consistency of butter, and often having a repulsive odour of urine, which, it is stated, is added by those who store it, to keep it moist and to impart to it a richer hue.

At Cayenne, when the fruit of the bixia is ripe, it is gathered, coarsely crushed, and thrown into water, where it remains for several weeks. By this means the pulpy matter is separated from the kernel. It is next strained through a coarse cloth, and the colouring-matter gradually subsides. It is then collected and the excess of water evaporated, until it assumes a pasty state, when it is exposed to the atmosphere in the shade until sufficiently dry to be shipped. The powder so prepared, and especially at Cayenne, is comparatively inferior, owing to the mass fermenting and producing matters which prove injurious in the drying process. The following analysis may be taken as the average composition of such qualities of annatto :—

Water	72.25
Leaves	3·85
Starch, mucilage, woody fibre	18·30
Colouring-matter	5·60
	100·00

Some thirty years ago, a M. du Montel introduced at Cayenne some marked improvements in the manufacture of annatto. He suppressed the crushing of the seeds, separated the colouring-matter by water, and prevented the fermentation by the addition of some chemical fluid. By this means he obtained annatto in a minute state of division, and having a very beautiful red colour, which is imported into this country in the form of small tablets, which are much used for colouring cheese.

An alkaline solution of annatto gives an orange precipitate with acids, alum, or sulphate of protoxide of iron, a yellowish brown precipitate with salts of copper, and a lemon-coloured precipitate with chloride of tin.

The colouring-matters of annatto have been studied by MM. Chevreul, Kerndt, and Bolley. It contains two colouring-matters, one a yellow, which is soluble in water and alcohol but insoluble in ether, and which gives a yellow colour to cloth mordanted with alum. It has received the name *orelline*, and its formula is $C_{12} H_{22} O$. According to Kerndt's statement, however, it is only a product of the decomposition of the second colouring-matter, the real colour-giving principle of annatto being *bixine*, $C_5 H_6 O_2$. Bolley proposes the following method to obtain bixine :—The best quality of annatto from Cayenne, after having been washed and dried, is boiled with concentrated alcohol; the alcoholic solution is evaporated to dryness, and placed to digest with ether, which dissolves a part of the residue, leaving a bright red powder, insoluble in water, but soluble in soap and alkalis, to which it imparts an orange tint, and yields a dark blue colour with sulphuric acid.

The use of annatto in print and dye-works is rather limited, its chief employment being to modify the shades of other dyes, such as certain tints of yellow produced by fustic or quercitron. It is also used to give a bottom to cotton before it is dyed with safflower or cochineal. In the production of oranges in steam styles, annatto is now entirely superseded by *aurine*, a colour derived from carbolic acid. It is still often used in dyeing a low class of cotton yarns. The yarn is dipped in an alkaline solution of annatto, and then passed through a weak solution of oil of vitriol, which precipitates the bixine in the fibre. It is then only necessary to wash the cotton to complete the operation. If an orange-yellow tint is required, the cotton is previously mordanted with tin.

Ilixanthine is the name given to the pale primrose yellow crystals obtained by Dr. Schunck from the leaves of the *Polygonium fagopyrum*, or common buckwheat. This body, to which he gives the formulæ $C_{30} H_{20} O_{20}$, is only sparingly soluble in hot and cold water, but more soluble in alcohol. Strong sulphuric acid changes its colour to a deep yellow without decomposition. It yields on a piece of calico mordanted with alumina a dark yellow colour, with tin a light yellow, and with oxide of iron various shades of yellowish brown, according to the strength of the mordant employed.

Lo-kao.—In 1851 and in 1852, public attention was drawn by several English gentlemen to samples of a green colouring-matter imported from China; in 1853, Messrs. Guinon, of Lyons, imported such quantities as to enable them to dye silk for the requirements of the trade. The silks so dyed were known by the names *Vert-Venus*, *Vert-Azof*, and *Vert-Lumiere*, and were especially admired from their remaining green in artificial light. They are not, however, now produced, as the colours were unstable, and Messrs. Guinon, Mamas, and Bonnet found that they could produce greens which maintain their colour in artificial light by first dyeing their silks in Prussian-blue, and then immersing them in an acidulated bath of picric acid. It is interesting to observe that, if indigo be substituted for Prussian-blue, the colour appears blue by artificial light.

Lo-kao is the only substance with which I am acquainted, capable, with proper re-agents, of producing the seven colours of the spectrum.

M. Charvin, of Lyons, obtained lo-kao from a weed indigenous to Europe—the *Rhamnus catharticus*, and received for his discovery a gold medal, worth 6,000 francs, from the Chamber of Commerce of Lyons. All these vert-lumieres are, however, now replaced by the brilliant greens obtained from aniline.

Tannin matters can be divided into two classes, those which give a blue-black precipitate with persalts of iron, such as gall-nuts, sumach, divi-divi, myrobalans, and valonia, and those which give a green colouration with persalts of iron, such as catechu, gambier, gum kino, and elder, larch, and willow barks.

The first class are characterised by containing two acids, which have received the names of tannic and gallic acids.

Tannic acid, which is the all-important compound in this class of substances, was extracted some years ago by the following simple process, devised by M. Pelouze. It consists in treating in a displacement apparatus, coarsely ground gall-nuts with ether, which has been previously well shaken with water (during this process it has taken up one-tenth of its weight of the water). The ethereal solution, on being allowed to stand, separates into two layers, the upper one being nearly pure ether, and the lower one being an aqueous syrupy solution of tannin, which only requires to be evaporated in a water bath to obtain the tannic acid as a pale yellow spongy mass, inodorous, and having a most astringent taste. As is seen by the process of extraction, it is soluble in water, but insoluble in ether. It is soluble in alcohol. It is characterised by giving a blue-black precipitate with persalts of iron, but none with protosalts, and a white precipitate with tartar emetic or salts of lead. It gives a precipitate with gelatine and the vegetable alkaloids, and turns rapidly brown or black in presence of air and caustic alkali.

Tannic acid is a glucoside, decomposed by acids into a peculiar sugar and gallic acid, as seen by the following formulæ:—

$$\begin{array}{ccccccc} \text{Tannic acid.} & & \text{Water.} & & \text{Gallic acid.} & & \text{Sugar.} \\ C_{27}\,H_{22}\,O_{17} & + & 4\,H_2\,O & = & 3\,(C_7\,H_6\,O_5) & + & C_6\,H_{12}\,O_6 \end{array}$$

Gallic acid presents itself under the form of fine, white, silky needles, and is soluble in water, alcohol, and ether. Under the influence of a temperature of 410° F., it unfolds itself into carbonic acid and a beautiful white crystalline compound called pyrogallic acid, which has of late years been extensively employed in photography. If the temperature be raised to a higher point than the one above mentioned, gallic acid is decomposed into carbonic acid, water, and gallhumic acid. The first decomposition may be represented by the formulæ—

$$\begin{array}{ccccc} \text{Gallic acid.} & & \text{Carbonic acid.} & & \text{Pyrogallic acid.} \\ C_7\,H_6\,O_5 & = & CO_2 & + & C_6\,H_6\,O_3 \end{array}$$

the second as—

$$\begin{array}{ccccccc} \text{Gallic acid.} & & \text{Carbonic acid.} & & \text{Water.} & & \text{Gallhumic acid.} \\ C_7\,H_6\,O_5 & = & CO_2 & + & H_2\,O & + & C_6\,H_4\,O_2 \end{array}$$

Gallic acid has been produced artificially by the action of potash on a di-iodosalycilic acid. When sulphuric acid is made to act on gallic acid, it transforms it into a a red acid called rufigallic, which has the formula $C_7\,H_4\,O_4$. When in the contact with alkalis, in presence of air, gallic acid, like pyrogallic and tannic acids, and various other organic substances, rapidly absorbs oxygen, as was shewn by M. Chevreul in 1820. On this fact, Liebig in 1838, founded an elegant method of determining the amount of oxygen in a mixture of gases. The process is however, only approximately correct, as I proved in 1863, that under these circumstances oxide of carbon was liberated.

Gallic acid gives a purple-black precipitate, with persalts of iron, but none with the proto-salts. It gives no precipitate with gelatine, which is a most important fact, as I shall now proceed to show.

Tannin matters, such as oak-bark, are employed for tanning leather, and the conversion of a hide into leather depends on the gradual transformation of the animal matter which it contains into gelatine. This combines with the tannic acid, producing an insoluble compound which fills the pores of the animal tissue, and thus contributes, not only to prevent its putrefaction, but to render it impermeable to water. The value, therefore, of a tannin matter, depends on the amount of tannic acid it contains, the gallic acid taking no part in the tanning of the hide.

Tannin substances, such as gall-nuts, sumach, or bark, contain a ferment, which is susceptible of unfolding the glucoside tannic acid into sugar and gallic acid. It is necessary, therefore, that the tanner take great care in the management of the vats, to prevent any fermentation, especially the one called ropiness, for in such a case the vat would become useless. As it is a difficult matter often in summer to prevent this state of things, I may state that I have found that the addition of a few thousandths of carbolic acid is sufficient to prevent these chemical changes, without interfering with those which must take place in the hide.

Tannin matters, as you are aware, are much employed for producing blacks on fabrics, mordanted with peroxide of iron. I asked myself some years since, whether it was the tannic or the gallic acid which produced the black, or if both participated in its production, and the results of my experiments clearly proved that tannic acid alone took part in its formation. This may be seen if two pieces of calico mordanted with iron, are dipped, the one in a solution of tannic acid, and the other in a solution of gallic acid. Both pieces at first become dyed, but after a few days, the one dipped in tannic remains black, while in the one dyed with gallic acid the colour has disappeared, the gallic acid having reduced the peroxide of iron to the state of protoxide, which, as I have already remarked, does not produce a black with these acids.

As gallic acid is of no value to the dyer as a colour-giving principle, he must take care that his tannin matters, such as sumach, are carefully stored and kept dry, so as to avoid any gallic fermentation taking place, which would decrease the amount of tannin they contain. He should also avoid holding a large stock, as the fermentation above mentioned slowly proceeds in the tannin matters, as is proved by the fact of sumach, for example, decreasing considerably in value, after it has been some time prepared.

I shall now proceed to give you a brief outline of the characteristic differences of the several tannin matters.

Gall-nuts are the most valuable and important of all tannin matters. They are produced by the female of an insect called *Cynips*, which pierces the buds on the young branches of the *Quercus infectoria*, a tree growing especially in the East. There she soon deposits her eggs, and the bud loses its natural growth, and swells out to the size of a hazel-nut, having a green, red, or pink colour. The eggs thus inclosed soon hatch, and the insect undergoes all its metamorphoses until it attains the perfect state, when, if allowed (which is not to the interest of either the gatherer or consumer), it makes a hole and escapes. Good gall-nuts should not be so pierced, and they should be heavy, and of a fresh green colour. If the insect has escaped they are yellow, and are not of nearly so good quality.

In the market, they generally bear the name of the port from which they were shipped. Thus, there are Aleppo gall-nuts, which are considered the best in the market, then the Morea, Smyrna, &c.

The following may be considered as the composition of an average sample of gall-nuts:—

Tannic acid	65·0
Gallic acid	2·0
Ellagic acid Luteo-gallic acid	2·0
Chlorophyl and volatile oil	·7
Brown extractive matter	2·5
Gum	2·5
Starch	2·0
Lignine	10·5
Sugar, albumen, &c., and ash	1·3
Water	11·5
	100·0

Gall-nuts are employed to produce blacks on silks, in the preparation for Turkey-red, to produce fast blacks in calico printing, and lastly, large quantities are used in the manufacture of pyrogallic acid,the consumption of which in the present large requirements of photography must be enormous. We shall see, as we proceed, that gall-nuts are the only available tannin matter for the production of this acid.

An inferior quality of gall-nut is also sold, which is found on the *Quercus rubur*, which grows in Hungary, Styria, Croatia, and Piedmont. It is used in those countries for tanning leather, and in some parts of Germany as a cheap substitute for the Eastern nuts.

Sumach is, as Dr. Stenhouse's researches show, the only substance in which the tannin principles are identical with those of gall-nuts, although in this tannin matter there is a comparatively large quantity of gallic acid. It also contains a soluble yellow principle.

Sumach is found in commerce as a coarse powder obtained by the trituration of the young branches and leaves of several varieties of the family *Terebanthaceæ*. The species most cultivated is the *Rhus coriaria*, which is a plant indigenous to Italy, Sicily, France, Spain, and Portugal. The shrub grows to a height of sixteen feet in the most arid soils, and is very extensively cultivated in some of those countries. The twigs and leaves are gathered once a-year.

Although sumach varies greatly in the amount of tannin it contains, there can be no doubt that from the *Rhus coriaria* is the best, whilst the most inferior comes from the south of France, and is the produce of the *Coriaria myrtifolia*.

In consequence of the powdered state in which sumach is sold, it not only varies greatly in quality, but is often deliberately adulterated with sand, or the leaves of other plants. It is easy to discover the sand, it being only necessary to put some of it in water, when the sand, from its greater specific gravity, readily falls to the bottom of the vessel. I will describe the method of determining the amount of tannic acid later on.

Extract of sumach is sometimes employed in print-works, to produce yellows with acetate of tin, blacks and greys with iron mordants, and dark yellow with sulphate of zinc. It is also used to produce blacks on woollen fabrics, although it does not give as good blacks as gall-nuts. Its principal use, however, is to mordant, either alone or in conjunction with salts of tin, the cotton warps of the mixed fabrics so extensively manufactured in Yorkshire, by which means the cotton takes the same colours as the woollen weft, both with vegetable dye-stuffs and those derived from coal-tar.

Sumach is too expensive a tannin matter to be used for the tanning of leather, but it is employed by the currier in the preparation of skins for dyeing with light shades.

Valonia is the acorn-cup of the *Quercus ægilops*, which grows in the isles of the Grecian Archipelago and on the coasts of Asia Minor. It is especially employed for tanning leather and adulterating garancine.

Divi-divi is the pod of the *Cæsalpina coriara*, and is chiefly imported from South America.

Myrobalans, which is largely used for tanning leather and producing blacks on wools, is the dried nut of the *Terminalia chebula*, and is imported chiefly from Calcutta.

Dr. Stenhouse has shown that the tannin matter of valonia, divi-divi, myrobalans, and oak bark are not identical with those of gall-nuts and sumach. They do not yield gallic acid when boiled with dilute sulphuric acid, but sugar and some other organic principle.

From the above facts, it must be obvious to all who use tannin matters, whether dyers or tanners, that these substances not only vary in value, according to the variety of plant from which they have been obtained and the country whence they are imported, but there are sources of deterioration which cannot be detected by the eye. Thus, for example, if a new sumach be mixed with a comparatively old one, it is impossible to detect the fraud. The only method, therefore, of ascertaining the value of a sample is to determine chemically the amount of tannic acid it contains. This may be done by the following process:—A weighed quantity (say 100 grains) of the substance to be tested is boiled with distilled water, and the decoction run off into a beaker, without filtering. This process is repeated four or five times. A test solution is prepared by dissolving one drachm of gelatine in four ounces of water, and adding 15 grains of powdered alum to the solution. 155 grains of this solution represent five grains of pure tannic acid. The test fluid is carefully dropped into the beaker until, on the falling of a drop upon the surface, the characteristic ring of tannate of gelatine is no longer produced. The quantity of test fluid used is then ascertained, and from this the amount of tannic acid is calculated.

Before passing from this class of tannin substances, there is one that I must mention, which has been used from the most ancient times, in Egypt, Arabia, and other Eastern countries, to dye wool, horse-hair, leather, &c. It is the leaves of the *Lawsonia inermis*, which appears to be the gopher wood of Scripture and the hennis of the Egyptians. The leaves are mixed with water, to form a paste of an orange-brown colour. This paste also is employed by the Asiatic ladies to dye the nails of their hands and feet, as well as their ears and hair.

Catechu, *gambier*, and *gumkino* are the most valuable of the tannin substances, which give a green colouration with persalts of iron. They are most extensively used to produce a great number of shades, varying from light drabs to dark brown, in cheap dyed cotton goods, such as fustians and corduroys. They are used in calico printing chiefly to produce browns, in silk dyeing to weight the silk, and in tanning to produce a low class of leather, easily distinguishable from that properly tanned with bark and other matters belonging to the first class, because when used for making shoes it communicates to the stockings a peculiar orange yellow hue.

For a long time there was much doubt as to the genus of plants from which catechu, gambier, and kino, which resemble each other very closely in their properties, were derived. M. Guibourt, a few years ago, solved the problem. He found that real *catechu*, *cutch*, or *Terra japonica* was the berry of the *Arica* palm. called *Areca catechu*, and the *Acacia catechu*, whilst gambier is extracted from the leaves of the *Uncaria gambir*, belonging to the family *Rubiaceæ*, and kino is obtained principally from the *Butea frondosa*, a leguminous plant.

Catechu is found in commerce principally in two states, the best in lumps varying in weight from 80 to 90 lbs., of a dull purple colour, and covered with leaves; the second, in masses, more or less covered with sand.

Gambier is imported into this country in the form of small cubes, having a yellowish brown colour.

Good catechu should not leave, on incineration, more than 4 or 5 per cent. of ash. Its aqueous solution should give, with alcohol or gelatine, an abundant white precipitate, with lime and baryta a brown precipitate, with salts of lead and tin a yellow precipitate varying in shade with the salts employed, and with bichromate of potash a brown precipitate. It should also take a decided brown hue with alkalis, and assume a greenish colour with salts of iron.

Catechu, besides naturally varying widely in quality, is freely adulterated with mineral substances, starch, tannin matters, and blood.

I have just stated the amount of ash a good catechu should yield. To ascertain the presence of starch, the sample should be first treated with alcohol, and the insoluble residue boiled with water, which will give a fine blue coloration on the addition of iodine if starch be present. The presence of any ordinary tannin matter in the catechu will modify the green coloration which the latter substance gives with the persalts of iron. Blood may be detected if present by treating the catechu with alcohol, and, after drying the insoluble residue, heating it in a tube, when ammoniacal vapours will be given off, as well as vapours of a most offensive odour.

Catechu is composed of three distinct substances, first, a tannin matter called *mimo-tannic acid;* second, *catechine*, or *catechinic acid;* and lastly, a brown colouring matter due to the oxidation of the catechine.

Mimo-tannic acid is prepared by treating pulverised catechu by ether in a displacement apparatus. The ethereal solution leaves on evaporation a yellow porous mass of this acid. Bombay catechu yields about 55·5 per cent. of mimo-tannic acid; that from Bengal, 48·2 per cent., while gambier yields from 36 to 40 per cent.

Catechine, or *catechinic acid*, is obtained by treating with boiling water the residue from catechu, which has yielded its mimotannic acid to ether. The water on cooling deposits a brown crystalline precipitate, which is re-dissolved in water and yields with sub-acetate of lead, and the precipitate washed. The lead compound is then suspended in water, and decomposed by sulphuretted hydrogen, when pure catechine remains in solution. Its formula is $C_{10} H_{10} O_4$. It rapidly becomes coloured brown in the presence of air, and an alkali, being, it is said, converted into *japonic acid*, whilst, with alkaline carbonates, it yields *rubinic acid.* It is also converted into japonic acid under the oxidising influence of salts of copper and of bichromate of potash.

If dyers, instead of employing catechu as imported, were to grind it, and wash with cold water, they would obtain an extract which would yield very pure shades of green drabs, while the insoluble residue of catechine would give a great variety of shades of brown. To increase the permanency of catechine colours, the goods dyed with them should be passed through a solution of bichromate of potash, as is usually done for catechu browns.

Dr. Stenhouse has shown that the tannin matters giving a green coloration with persalts of iron, such as catechu and elder and larch barks, do not contain a glucoside. The only exception he has found to this rule is willow bark.

LETTERS PATENT.

The National Association for the Promotion of Social Science, united with the Society for Promoting the Amendment of the Patent Law, appointed a sub-committee to consider the subject. The proceedings of the committee commenced accordingly with the resolution that it is expedient that the patent-law should exist. They liken the claims or rights of the inventor to own such property to those of the first finder or first occupant, and rest such rights on the same principle as other property. They cannot recognise any distinction in principle between the product of the brain, as embodied in a book, picture, or statue, and in an invention in the arts and manufactures, but admit that substantial differences exist in dealing with such property. The interests of the public, not the interests of the inventor, is the real question, and the results of any reforms hereafter proposed, would, it was hoped, be to diminish the anomalies and reproach of the present system, and lead to more certainty as to the remuneration of the meritorious inventor, and the protection of the public from the unjustifiable claims of those who may be armed with legal power for the defence of property which ought never to have been granted.

Upon the desirability of the patent-laws we learn, from the minutes of evidence given before the Select Committee of the House of Commons, that the opinion of the witnesses differed materially, although nearly all concur in thinking that no patent-law at all would be better, as compared with the present system.

Mr. W. R. Grove, Q.C., F.R.S., was examined at great length, and stated that, in his opinion, a great number of inventions would be made without any patent at all; for instance, a number of applications of voltaic electricity and magneto-electricity. Neither Oersted nor Faraday could have obtained a patent for their discoveries, but they have now many applications to the telegraph and other purposes, and there are many patents on the subject. Some inventions, trifling ones, are certain to be taken up by the public as soon as they are known. If a clasp to a pocket-book is ornamental and convenient, there will be many to take it up instantly; but any alteration that would involve a vast number of changes, and a displacement of labour and capital must encounter a series of oppositions. It is the greatest inventions that are the least likely to be taken up by the public, and it is the greatest inventions from which at present we have no means by our patent-law of severing the minor ones. There ought to be some means of giving for the inventor a fulcrum to work upon, so as to induce him to force his greater invention on the public. The sole ground upon which letters patent can be held justifiable or permissible is that they are beneficial to the public. If they are, and so far as they are, keep them; if they are not, abolish them. Therefore, if it would be possible to sever those greater and valuable inventions from the minor ones, and grant letters patent for the former, the public would be benefited, because the patentee, or those who took up his invention, would be interested in promoting the invention, enforcing it on public notice, and such would never be done unless some profit could be got, though the profit would be limited for a period of years. That would lead to what is done in other countries, namely, not having a hard and fast line, and granting all patents for 14 years, but granting some for a longer and some for a shorter time. The total abolition of patents might impede a small number of very important inventions; but people will use all the small improvements, unless they involve a great outlay, as fast as they come. Any manufacturer, if he only obtains the pre-emption of a season, not only will obtain an immediate benefit quite sufficient to tempt him into using the invention, but that will continue for a long time, he having got the trade into his own hands. With regard to scientific men, the patent-law does not much affect the higher questions of science. Men who are versed in such, look for the more important discoveries, whether they be physical, or chemical, or otherwise; they could seldom obtain a patent for them; they do not care generally to devote their lives to that object. The telescope is one of the greatest inventions in the world, but that would have been, in its inception, not worth while obtaining a patent for. New discoveries have nothing to apply themselves to for many years to come. It is only when they come into the second or third stage that they usually become practically valuable.

Sir R. Palmer, in his evidence, instanced five important patent cases, in which he had been engaged where the patent-law had not operated beneficially for the public. From his observation, there existed a current of inventions going on at the same time, and out of these patents, probably all of them, during a certain period, except a few insignificant ones, would divide themselves into families, according to the wants of the public at the time; sometimes it was guns, or cannons, or shipbuilding, whatever, in fact, the public were in search of at the time. It showed that the current in the arts had its own law, and determined itself, and that the people who wanted those things were all set upon finding them out. It seemed that whatever invention is really valuable was certain, in the present condition of our arts and manufactures, to be reached for the sake of its value, and not for the sake of the patent. On the whole, he concluded that the public loses much more by the obstruction to the arts and manfactures which comes from the multiplicity of patents (particularly those patents which move step by step) than it gains by any of those things. From the number of persons upon the same track, it is more than probable that the same inventions now patented, which were valuable, would have come to the State, at no great distance of time, if those patents had not been granted. With respect to the commercial rewards, that of course, was a speculative question, but it seems the most natural state of things that the most enterprising and able man would desire to keep in advance of the others, and use the best available intelligence to devise improvements and give employment to those who are capable of helping him to do so, and that the enjoyment of the benefit naturally accruing in such a manner would be a sufficient inducement if there was no patent law. He was in favour of the entire abolition of patents; but if there were a discretionary power of rewarding by a patent exceptionally valuable and important inventions, or what might be deemed so, he saw no strong objection to a such a course.

M. Eugène Schneider, the managing partner and director of the great works at Creuzot, gave important testimony bearing in the same direction. We gather from his evidence that, from experience, he was opposed to patents, although willing to accept them in a modified form. According to his opinion, a patent ought not to be granted except on conditions, and in cases absolutely exceptional, and after having been preceded and surrounded by such formalities as will afford a guarantee there is an essential cause for a patent. No patent should be granted except after inquiries had been made which showed that there was a real cause and reason why the patent should be granted in that particular case, and only when the object is recognised to be exceptionally good. He drew a considerable distinction between the creations of art and literature, and what are called industrial inventions. According to his view, a creation of art or literature, a literary or artistic invention, is the man—it is the individual himself; it is the soul, the spirit, the personality of the man who invents it. The "Barber of Seville" is Baumarchais, the author, or Rossini, the composer of the music. Whereas in the case of what is called an invention, in industrial matters, the product, when it is completed, does not represent the inventor, it is rather a material revelation of a thing which is only a solution of a problem which has presented itself to every one, and which anyone else might have hit upon, or else it is the work of everybody. Throughout his industrial career, which extended over forty years, he knew only a a very limited number of cases in which an industrial invention belongs to anyone in particular, represents a work of genius, and is, at the same time, a great service rendered to the public, and which would not have been the next day rendered by somebody else. When a problem is stated, the solution is almost always found out and given, more or less accurately, by the first man to whom the problem is prescribed, which problem proposes itself by the progress of industry itself. He was as much in favour of protection as possible for the works of the mind, including works of art and works of literature, and he would acknowledge a property in them for a very long time almost an indefinite time—because, in his opinion, such a work is the man. In the case of industrial works, he would not acknowledge a property except where there are so many points united, that is thoroughly well proved that another man would not the next day have produced the same thing, so that society would not in any case have enjoyed the same result. There may be patents granted for inventions absolutely exceptional, which constitute a combination of circumstances from which it results that nothing similar has been done before, that no known combination of things will give the same result that there is nothing in the circumstances which makes it almost certain that the same invention, or an analogous one, would be made by somebody else; in a word that there should be true service rendered to society and to humanity.

From amongst the evidence given at variance with these views, we learn from Mr. T. Webster, Q.C., that in his opinion, the patent system has contributed to the rapid development of our manufactures beyond anything that can be conceived, with all the great disadvantages of the present system. In fact, the introduction of new inventions, would be practically stopped without patents. Mr. Henry Bessemer stated that about 17 years ago his attention was drawn to the manufacture of iron for the improvement of ordnance. A number of experiments were made with little success, until the idea occurred of making cast iron malleable, by the introduction of atmospheric air with the fluid metal. The result of an experiment showed that the highest temperature ever known in the arts could be produced in this manner. The experiments which followed extended over two and a half years, and at an expense of about £16,000, at the end of which time it was successfully shown that steel could be made of so good a quality as that, in the workshops where it was introduced, it was not recognised as being anything different from the ordinary high-priced Sheffield article. Had the capital not been furnished by the sale of licenses, these experiments would never have been carried on, nor did the other ironmasters, who had shown great curiosity at the outset, make a single effort. By the assistance of men of capital, works were erected in Sheffield, but the orders were trifling at first, until the manufacturers found themselves undersold by £20 a ton. At that time, railway wheel-tyres were being sold at £90 a ton, and they are now being made and sold at £18 a ton. No man had ever, up to that time, executed an order for a cast steel bar of 500lbs. weight at so low a figure as £40 a ton; but the trade are now making annually 250,000 tons of cast steel railway bars, by the Bessemer process, in England, at a selling price of about £11 or £12 a ton; the selling price of steel plates was £50 or £60 a ton; they are now being sold at £18 a ton. The business progressed until the present period, and the manufacture has not only been introduced this country, but entirely throughout the Continent; it has been worked even in India, and it is extensively worked in America at the present time. Experience had shown clearly throughout the whole of this time, that had there been no patent-law to fall back upon, it would not have been possible to expend two and a half years of time, and £4,000 upon mere experiments, which, if they had failed, would have been an entire loss. Besides the £4,000 spent at the outset, an additional £16,000 was expended, making altogether an outlay of about £20,000, and although the stake was large, in the event of success, still, without the security in the invention by a patent, as a single manufacturer, Mr. Bessemer could never have hoped to recoup himself. On the contrary, in spite of the unfavourable opinion of the trade, by means of the sale of licenses for more than £26,000, Mr. Bessemer was enabled to persist in his endeavours until ultimately the experiments were crowned with success.

Mr. James Nasmyth stated, in his long evidence, that, so far as he knew inventors, the result of taking away the patent law protection would be to introduce a system of secrecy, and cause a great shutting up of ingenious ideas, until the time arrived when they could be brought out, either by the increased means of the inventor, or by such a demand on the part of the public for the invention as would lead to reward. Without the protection of the patent-law, many valuable ideas would be kept secret. Any other mode to attain the object as decidedly as the ordinary patent-law, would entail a tribunal to investigate the value of the invention, and that is a very difficult matter to settle. Many of the most important inventions have sprung from such small beginnings, that if you were to decide upon the probable ultimate fate of an invention at the commencement, the inventor might get a very small reward, or none at all, because the idea might appear so simple, and apparently trifling. The difficulty consists in deciding what is a "great" invention. For instance, Watt's invention of the separate condenser; that, abstractedly viewed, was very simple; instead of injecting cold water into the inside of the steam cylinder, he injected cold water into a separate vessel. Such an invention as that is only proved to be great by the ultimate results. The safest course, in his opinion, was, therefore, to grant patents indiscriminately, and leave the public in general to settle the value among themselves.

The policy and expediency of a patent-law being assumed, the next question raised by the sub-committee of the Social Science Association refers to the means to be adopted for securing that definition and limitation which are essential to the existence and maintenance of property. The public require protection against improvident grants; and inasmuch as inventions are reproduced only to share the fate of their predecessors, the inventor requires protection against his own ignorance, such protection as may be derived from the accumulated experience of persons conversant with the progress of inventions, as recorded in the Patent-office, whereby he may be warned against the failures of those who have been travelling on the same line of invention, and controlled in the description of the invention in respect of which the patent is made, or the property created. The same sub-committee concurred in the recommendation of a previous Royal Commission, as to the expediency of a real examination by competent persons, for the purpose of controlling the granting of patents, the ensuring an adequate description of the property created, and amendment when required, duties for the proper discharge of which experience is absolutely necessary.

Upon this point, we learn that Sir W. Armstrong thinks it would be a very great improvement on the present state of things if we had a really good tribunal to form the best judgment that could be formed, and to pronounce on the policy of giving protection in particular cases. Assuming that the patent-laws are to be continued, the best kind would be a mixed tribunal, partly composed of lawyers, and partly of scientific men. At all events, the system would work infinitely better under such a tribunal than it does at present. There would be, in his opinion, no change for the worse. The practice of granting patents without much limitation was illustrated by several witnesses in their evidence. According to Mr. Grove, there has been no substantial change since 1852, at which time they granted nearly every patent and every disclaimer asked for. There is now more hesitation in granting disclaimers, and a little more hesitation in granting patents, but it is a very limited change. It would be considered a grievance for the Crown not to grant a patent for what is alleged to be a new invention. The number refused is very small compared to the number granted. On the same subject, the testimony of Lord Romilly and Sir R. Palmer went to show that the practice of granting applications for patents exists, as a matter of course, unless objections are raised. The mode is exactly the same as before the passing of the Act of 1852. This system has grown up imperceptibly, without the opinion of Parliament having been intelligibly taken taken upon the subject. It is now treated as a right, unless the law officer of the Crown sees reason to stop the grant of a patent; and out of this laxity in the method of granting patents has arisen opinions adverse to any patents whatever for minor inventions, or even if granted they should be very limited. Upon this point, Mr. Grove observes that the multiplicity of small patents is a very serious injury indeed, but it is an injury which is the less observed because it is spread over a large surface, and a great deal of it is under the surface. If we continue the system of granting patents for everything which courts of law decide to be an invention, then, by all means, have some rough means of limiting them to a term of years; grant them for five, ten, or fifteen years, or three, seven, and fourteen years, according to the original scope of the invention. The practical difficulty arises in separating the class of inventions, and, in his opinion, a patent should be an exceptional thing, granted upon a strong case being shown; that is to say, a strong *primâ facie* case, and should not be in any case a matter of right, or a matter of claim. By that means many valuable inventions might be rejected, but the balance of good and evil resulting to the public would be, that it is better to reject occasionally inventions which may turn out good ones, than to flood the world with inventions which may hamper trade and commerce to a very great extent, and lead sanguine inventors to ruin.

The proposals for an international system, made some years ago, at a congress in Belgium, were favourably regarded by several of the witnesses. Mr. Aston thought if that could be arranged, it would be attended with great benefit, in the same manner as an international copyright, in fact, everything which promotes international communication would be advantageous to the nations which participate in that communication. Mr. S. E. Chittenden had seen some striking illustrations of the cost to parties that has resulted from not having any system of the kind. It seemed to be wrong that a great invention, of value to the country and the public, should be allowed to be a monopoly in one country, and be freely manufactured and used in another country of similar tastes and habits, and perhaps the same language and general wants. In his opinion, the very best system would be to have an invention patented in all countries where they have patent-laws for a certain definite length of time; let it be adjusted as well as it can be, and let the world know that when that limit was reached, the invention was to become public property.

Upon these points and many others of lesser importance, the Select Committee have agreed to report the evidence to the House, and to recommend the re-appointment of the committee at the commencement of next session, for the purpose of continuing the inquiry. In the meantime they desire to state, without prejudicing any question to them, that it is highly desirable that the powers and provisions of the Patent-law Amendment Act, 1852, should be fully carried into effect.

EDUCATIONAL NOTES.

Education at the Social Science Congress.—This subject occupied a great deal of attention at the recent congress at Leeds. The inaugural address of the president, Sir John Pakington, was almost exclusively devoted to it. On the question of the payment by school boards of the fees of indigent children in denominational schools, he said that he did not see how it could be thought consistent with either charity or true liberality to take advantage of the poverty of a parent, to compel him not to send his children to that school for which, on account of its religious teaching, or any other ground, he might feel a preference; and he expressed a hope that the Education Department would be firm in their determination not to sanction any bye-laws which would so control the discretion of parents. On compulsory attendance, while appreciating the difficulties, the president considered it indispensable that the attempt to enforce attendance should be made; and he observed with satisfaction the action of those school boards which had adopted the compulsory clauses. On technical education, Sir John spoke strongly, agreeing with Mr. Scott Russell in his assertion that, as a rule, technical education, in its relation to our national manufactures, does not exist, and that there was great danger to our manufacturing supremacy in delaying the making due provision for it. An interesting address was delivered by Mr. G. W. Hastings, chairman of the Worcester School Board, in which he complained bitterly of the delays in the action of the Education Department; and another by Mr. Baines, M.P., President of the Education Section of the congress. On the question of payment of fees in denominational schools, Mr. Baines reviewed the arguments, objections, and counter-objections on both sides of the controversy, and concluded with an expression of his own opinion as follows:—"Whilst I feel that the state of things is not agreeable to Nonconformists, I confess my judgment regards the replies (in favour of paying the fees) as unanswerable. It is for statesmen to consider whether the law can justly and wisely be modified; but I do not believe it is morally or politically possible (even if it be legal) to punish a poor man for declining to send his child to a school of which he conscientiously disapproves; and if it is not possible to punish, the power of compulsory education is lost for that very class of children for which it was thought most necessary." The special question of large *versus* small schools was introduced in a paper by Dr. Rigg, who is in favour of large schools. He detailed at some length his views as to the most favourable size for schools under various circumstances. The tendency of the discussion was in favour of large schools. Papers on the question of compulsion and other disputed points were read in the Educational Section, and among those treating on subjects in which the Society of Arts has taken special interest, may be mentioned one, on the Education of girls, by Mrs. W. Grey, who urged the general want of a truer conception of what education is, and what are its uses; improved schools; the training of teachers; and that girls should have an object in life to work for, and not look to marriage as their only career. An interesting discussion followed, and but little difference of opinion appeared to exist as to the importance of a higher education for girls. A paper by Dr. Spark, the Leeds borough organist, on "Vocal Music as a necessary branch of Education," excited considerable interest. He asserted that, notwithstanding our wealth, our natural aptitude and love for the art of music, and our constant demand for and employment of it in public and private life, our education as a nation is extremely defective with regard to it. At present the children in all elementary and national schools are taught vocal music chiefly by ear, without any definite system of part-singing. There is a complete absence of plan, and great deficiency of knowledge on the part of teachers and inspectors. In many of our higher class schools the case is even worse, and presents a lamentable contrast to the practice of our forefathers and the custom of similar schools in other countries. Even in the West Riding, where the natural love of music is so strong, the neglect of its cultivation is only too apparent, and to the love and the neglect together we may attribute the spread of that class of comic songs which delight the young men of the period. To counteract their influence, the rising generation should be furnished with correct ideas concerning real music. For this purpose we require in this country sound musical instruction, and substantial as well as systematic government aid. The tendency of the age is towards display rather than knowledge. Hundreds of young ladies, and many teachers, too, will exhibit great manual dexterity, although unable to account for the production of a single chord or sound. Scientific instruction is rarely sought, and of course seldom imparted. In conclusion, the author urged the appointment of a commission of professional musicians, to report to the government upon the best means of imparting musical instruction in schools, and of cultivating the art generally throughout the country. The following is a brief official report of the proceedings of the Education Section, presented at the concluding general meeting:—"In the discussion on the practical application of compulsion in education, it was held that the extension of the provisions of the Half-time Act, so as to exclude from all labour children who had not passed the "third standard," and to exclude from full-time labour all who were not provided with an inspector's certificate stating that they had passed a higher standard, would be practical and advantageous. In connection with the operation of the new school boards, it was almost inevitable that the question of the respective value of large and small schools should occupy the attention of the section. Large elementary schools were held to be preferable to smaller schools, both on the ground of economy and efficiency, and it is hoped that the attention of school managers, as well as of school boards, will be soon called to this important question. A suggestion made in connection with the subject, that mixed or infant schools should supply the wants of children up to the age of nine, and that all older children should be relegated to schools under superior teachers of their own sex, seemed worthy of further consideration. The altogether unusually large attendance when the subject of the education of girls was under discussion points to the great and increasing interest felt by our members on this subject. The dissatisfaction expressed with the present state of female education was especially great in connection with that provided by private adventure schools for the lower middle class; and the feeling was apparently unanimous that much good might be effected if some portion of the endowments intended for the educational purposes served by the Endowed School Commissioners could be used in supplying middle class schools for girls. The attention of educational reformers was called to the necessity of still continuing their efforts to extend the usefulness of the universities, both by altering the subjects of examination for the prizes of the universities, so that their influence on the general education of the country may not be lost, and also by allowing the fellowships to be held on a tenure of work in education throughout the country; such, for example, as lecturing in large towns as well as the universities themselves. The report of the work of this section could not be complete without reference to the extraordinary fact that a deaf and dumb person was introduced to the audience, and spoke in answer to questions, and repeated words spoken to him. This gentleman was taught on the German system."

The Education League.—At the recent meeting at Birmingham, great dissatisfaction was expressed with the working of the Education Act, and Mr. Joseph Chamberlain, chairman of the Executive Committee, moved the following resolution, which was carried:—"That Mr. Dixon be requested to give notice of a motion to the following effect, at an early period of next session:—'That, in the opinion of this House, the provisions of the Elementary Education

Act are defective, and its working unsatisfactory, inasmuch as it fails to secure the general election of school boards in towns and rural districts; it does not render obligatory the attendance of children at school; it deals in a partial and irregular manner with the remission and payment of school fees by school boards; it allows school boards to pay fees out of the rates levied upon the community to denominational schools over which the ratepayers have no control; it permits school boards to use the public money of the ratepayers for the purpose of imparting dogmatic religious instruction in schools established by local boards; and, by the concession of those permissive powers, it provokes religious discord throughout the country, and by the exercise of them it violates the rights of conscience." In referring to the number of boards that had been established, the same gentleman observed that on the last occasion on which Mr. Forster favoured them with official statistics he said that 96 out of 220 boroughs, and 172 out of 14,000 parishes, had provided themselves with schoolboards. He boasted of this result. But if they looked at the other side, he did not think that the right hon. gentleman had very much to congratulate himself upon, when more than half the boroughs, and 90 per cent. of the parishes of this country were yet without the means of national education. That was not the worst, because the national system was rendered absolutely impossible in a vast number of districts, under the provisions of the Act relating to parishes in which there was what was called sufficient accommodation—that was to say, where there was sufficient accommodation provided by a sect altogether beyond their numbers and necessity, and in this way education had become more than ever the monopoly of one denomination. The subjects of permissive compulsion, of the payment of fees of poor children, and other vexed questions came under discussion, and the meeting appears to have been regarded as a great success. In reference to the demands of the League, the *Times* makes the following pertinent observations:—"Their object is to wrest the elementary education of the country from the hands in which, for the most part, it is now lodged, and to establish in its place a uniform system of State education, independent of all religious bias, unsectarian, invariable, compulsory, and, if possible, free. Whatever may be the inherent merits of this proposal, it must at all events appear at the present moment somewhat unreasonable. The League's programme of national education may be the best, and the people may some day agree with them; but the obstacle they have to remove is not in the Education Act, nor the House of Lords, nor Mr. Forster, nor even the present balance of parties in the House of Commons. It lies in the habits, customs, prejudices if you will, of the people themselves. It is to this Mr. Dixon and Mr. Miall should address themselves. These gentlemen have yet to discover that they form but a part, and not the whole, of the Liberal party. Let them by all means convert the rest to their way of thinking. That is their legitimate business. But so long as they find themselves everywhere in a minority—in city, town, borough, parish, and parliament—let them not talk as men grievously injured because the majority, so long as it is a majority, claims to have its own way." The *Pall-mall Gazette* takes a somewhat similar view:—"If the whole question were still perfectly open, and we were about to introduce for the first time a new and symmetrical system of education, we should incline rather to the side of the League than to that of their opponents. We should do so because we are anxious to see the national system of education dependent upon authorities responsible to the nation rather than upon the efforts of the different sects. The only practical method of introducing such a system would be by adopting something like a secular system of education, and trusting to the zeal of the various sects to provide the necessary supplement of religious teaching. This, however, is a purely hypothetical case. We have to deal with the complicated state of things now existing, and to recognise the impolicy and impracticability of throwing aside the machinery provided to our hands by the various denominations."

Scientific Education in the North.—The new College of Physical Science, at Newcastle-upon-Tyne, was opened on Tuesday last, in the presence of the leading nobility, gentry, coal-owners, manufacturers, merchants, and municipal authorities of the north of England, and it has every prospect of success. The funds are ample; there are already a considerable number of students, and the appointments of the professors have given great satisfaction. They are Professor Herschel, B.A., Professor Aldis, M.A., Professor Page, LL.D., and Professor Marreco, M.A. It is also proposed to establish a chair of history and political economy. Dr. Lake, Dean of Durham, delivered the inaugural address, the chair being occupied by Sir William Armstrong.

CORRESPONDENCE.

NO PRIMARY OR SECONDARY COLOURS.

Sir,—The theory of colour is terribly involved, because, as a nation, we are not accustomed to scientific introspection and abstraction. We cannot get over the original misconception that colour is objective and external to ourselves; that things are in themselves—pigments, flowers, &c., &c.,—coloured. This is totally at variance with the accepted physical theory, which, when rigorously understood, attributes every colour-sensation to the mechanical action of undulations of various periods. These various undulations, according to the theory, are of the self-same ether, which of course could not simultaneously be of every colour. It is evident, therefore, that colour exists only as a sensation, and within ourselves. The eye is the only colour-box, and all questions relating to the science of colour must be determined by experiments on our own sensuous organisation. The dynamics of wave action producing sensations of colour should be a separate investigation; but unfortunately, in the study of light, these two sections are so confounded and involved as to continually lead to the most absurd results. If colours, then, are but sensations, there cannot be primaries and secondaries, for a sensation can be primary or secondary only in relation to the order of succession; but, as the order of succession may be reversed at any time, there can be no intrinsic priority in colour sensations. From what we have just determined, it would appear that there is no such thing as the mixing of colours; sensations cannot be mixed. We may combine two mechanical actions, separately producing two distinct sensations, so as to produce a third and different sensation, but we do not mix the colours, *i.e.*, sensations. Moreover, the eye, when experimented upon, shows most distinctly that there is no priority or primacy but in the order of succession; for if the eye experience the sensation of red from external undulations, the spectrum or after-sensation produced by nervous re-action is green; whereas, if the primary sensation be green, the spectrum or after-sensation will be red; and so of other so-called primaries and secondaries. This alteration of sensations not only occurs with colour-sensations, but in those of black and white. If the first action produce the sensation of a black spot in a white field, the spectrum will be a white spot in a black field, and *vice-versâ*. The principle of libration, counterpoise, or compensation grasps the whole science of the harmony of colour. It would appear with that of light, as in all phenomena fluctuating within limits, that there may be as many undulations in excess as in defect of a mean, and that every undulation in excess has a corresponding one in defect. This is well exhibited in the polariscope; and in vital dynamics we shall find that nature restores the balance by compensating excess by defect, and defect by excess; hence the alternation or libration in nervous action, and the compensating colours; the necessity for those just counterpoises which produce harmony.

There is another vulgar error which has to be removed, viz., that light passes through bodies. It does nothing of the kind. It is as erroneous as the common belief that the waves of the ocean progress, when they only rise and fall. A ray of light does not progress, it is only a continuous series of waves undulating side by side. This notion of light passing through glass, &c., &c., is an error, too, which leads to endless confusion and misconception, and is a muddle of the Newtonian and accepted hypothesis.—I am, &c.,

W Cave Thomas.

NOTICES OF PUBLICATIONS.

Model Houses for the Industrial Classes, &c., by Banister Fletcher, A.R.I.B.A. (*Longmans, Green, and Co.*) 8vo., pp. 86, 1871. Mr. Fletcher uses, by way of mottoes for his useful little work, extracts from a speech made by Lord Shaftesbury, at the Society of Arts, in April of the present year, and in speeches or writings of Mr. Ballard, Mr. T. Twining, and Dr. Southwood Smith, and he has evidently taken up the subject of improved dwellings for the working classes with determination. The author is, it appears, architect of a number of houses recently erected at Pentonville, of which he gives the plans and elevations, which are in many respects remarkable. The work contains a number of other designs, all of which are marked by an absence of the barrack air. Mr. Fletcher protests, and as we think wisely, against rendering such buildings conspicuous in any way, and, above all, he objects to open staircases, which have been adopted in many cases, and which not only break the façade in a very ungainly manner, and expose the inhabitants in a very unpleasant manner to the gaze of the outer world and to the weather, but give the buildings an appearance to which the working classes much object. The outside staircase is certainly a feature that calls up the idea rather of an ancient inn than of a modern house. But the principal, or one of the principal points, upon which Mr. Fletcher insists is, that much greater progress may be made, and far more satisfaction given to the working classes, by the transformation of existing than the construction of new habitations for their use; and this point is illustrated by a number of practical plans which deserve attention. Mr. Fletcher shows how he would alter ordinary houses, of various plans, into comfortable flats for several families, and he adds to this, notes on the cost and the economy of so doing.

GENERAL NOTES.

An old "London corner" is about to disappear, in the change effected by the removal of the Provident Institution Savings' Bank (whose premises are required for the enlargement of the National Gallery) to the corner of St. Martin's-lane and Hemmings-row, which house has been occupied by the family of one of our oldest members (Mr. Philip Palmer) since 1746. Horace Walpole, in his "Anecdotes of Painting," article Peter Oliver, vol. ii., pp. 29, 30, mentions that before this time, 1753, "stained glass was a rarity, and that Palmer bought several parcels from one Asciotti, an Italian, who, with his wife, travelled backwards and forwards to Flanders to procure them." Again, in 1754, Walpole, writing to Sir Horace Mann, gives an amusing account of a visit paid to Mr. Palmer, when he called to settle his bill for the painted glass supplied to Strawberry Hill. In later times, Morland, Lawrence, Jackson, and other artists were frequent visitors on business, while Soane, Smirke, Nash, &c., were in frequent communication with the firm.

Cleaning Glass Vessels in which Petroleum has been kept.—In Dingler's *Polytechnisches Journal*, the following method is given for this purpose.—Wash the vessel with thin milk of lime, which forms an emulsion with the petroleum, and removes every trace of it, and by washing a second time with milk of lime and a small quantity of chloride of lime, even the smell may be so completely removed as to render the vessel, thus cleansed, fit for keeping beer in. If the milk of lime be used warm, instead of cold, the operation is rendered much shorter.

The Industrial Museum of Turin.—The Industrial Museum of Turin, although it has only been established a few years, and has received but little pecuniary aid from government, is already one of the most complete institutions of its kind in Europe, and ranks next in importance to the Conservatoire des Arts et Metiers of Paris, and the South Kensington Museum in London, the first of which has been established 87 years, and the latter 16 years. This museum is far more complete than those of Berlin and Vienna, and its success is mainly due to the indefatigable exertions of its director, Signor Codazra, and of our countryman, Mr. W. P. Jervis, its able conservator.

British India. — The little annual Blue-book of Statistics relating to India, issued from the India-office, shows that the imports into British India by sea in the financial year 1869-70 were of the value of £46,882,386—viz., £13,954,807 treasure, and £32,927,579 merchandise; and the exports were of the value of £53,513,727—viz., £1,042,352 treasure, and £52,471,375 merchandise. Going back to 1861, we find the imports, in round numbers, only £34,170,000, and the exports of rather less value, being £34,090,000. The exports, therefore, have increased much more than the imports. The tonnage of all vessels (including native craft) entered and cleared at ports in British India has increased from 5,101,974 tons, in 1861, to 6,274,550 tons, in 1870. At the end of the year 1869-70, 86 millions sterling had been expended on railways in British India; considerably more than 4,000 miles of railroad were open for traffic, and more than 17 millions of passengers were carried in the year. Exclusive of State outlay on guaranteed works, the government expended £6,389,082 upon public works in the year 1869-70, namely, military buildings, civil buildings, and public improvements, the latter absorbing £2,649,277. 14,014 miles of government telegraph lines were open at the commencement of the year 1869-70. 83,032,957 letters and newspapers were transmitted through the Post-office of India in the year 1869-70, and the mails were conveyed over 50,878 miles, by railways, boats, carts, camels, or runners. The troops employed in British India, officers and men, in 1869-70, were 180,820—62,939 Europeans, and 117,881 natives. There were 24,274 schools and colleges belonging to, aided, or maintained by the government in British India, with an average attendance of 789,125 pupils; the government expended £637,463 upon these schools and colleges, and the total expenditure of the year from all sources was £1,070,685. The Vaccine Department reports 1,617,513 successful vaccinations in the year 1869, and 186,389 failures. 15,274 emigrants embarked from British India in the year 1869-70, the majority for British Guiana and the West Indies, 5,404 for Mauritius. The population of India under British administration (exclusive of native states) is reported 151,146,516; the public debt in the year 1869-70, £108,186,338; the gross public revenue, £50,901,081. The area under British administration is stated at 963,929 square miles.

Powerful Steam-whistle.—The most powerful steam-whistle in the world is that which has recently been made at the engine-works at Portland, U.S., for the lighthouse department of the United States. It is 18 inches in diameter, and weighs upwards of 150 lbs. It requires 60 lb. pressure of steam, which is supplied from a boiler made on purpose, and in calm weather can be heard at a distance of five miles. It is intended to be used for a fog-signal.

Industry and Trade of Intra.—The little town of Intra, situated on the Lago Maggiore has of late years been called the "Manchester" of the Lake. How far it deserves this title may be seen from the following statistics, which will give some idea of the industrial importance of this little place:—Manufactories of hats, 6; tan-yards, 7; cotton-spinning-mills, 7; silk-mills, 2; paper-mills, 2; 2 iron and brass foundries, of which one has also a complete mechanical workshop; 8 establishments for the printing and dyeing of stuffs; 2 silk-reeling mills; 1 glass-works; 7 warehouses for corn; 4 saw-mills; 1 tile-kiln; 3 manufacturies of cotton-goods; 2 manufactories of wax, and 8 large wine-stores.

The Rubber Produce at the Amazons.—The extraction of rubber, which has of late years become a large and increasing article of export from the Brazils, absorbs the attention of the Tapugo Indians, who form the agricultural classes of the provinces intersected by the Amazon. The cultivation of cotton, rice, coffee, and many other products is totally neglected, though known to be yielded by the soil in abundance and excellence, and though every facility is afforded for transport by the numerous rivers and water-ways which net the land. The labour of extracting the rubber is so small, observes Mr. Drummond Hay, the British Consul at Para, and yet so remunerative, it seems only natural to the sparse population to prefer that occupation, in which a family, gang, or single man, erect a temporary hut in the forest, and living frugally on the fruit and game which abound, and their provision of dried fish and mandioca flour, realise in a few weeks sums of money with which they are able to relapse into the much coveted idleness, and enjoy their easy gains until the dry season for tapping the rubber tree—June to January—or collecting nuts, returns, rather than by a little exertion to clear the forest, till the ground, and watch their crops for a few months before they can obtain a return for their expended capital. An expert and steady Tapugo will collect about 8 lbs. (English) per day, which, on an average, is worth 8 milreis, or about 13s. 4d., *i.e.*, 1s. 8d. per lb. In a good rubber district, men are known to extract even an arroba of rubber, or 32 lbs. (English) per day, but 8 lbs. may be taken as the average collection per man. The method of extracting the milk from the rubber tree is primitive, and still more primitive and rude is the manner of smoking or curing the rubber-milk over smoke issuing from a funnel, under which is fired an oily nut, the fruit or seed of a different tree than that from which the milk is extracted. Already, however, an American and an Englishman have simultaneously presented for approval simple inventions, by which the operation of smoking the rubber is more speedily performed than the mode at present in use. Whilst nature is found to yield so prodigally the abundant riches in a country where man has but to put forth his hand to gather, no attempt will be made to assist even that very nature by a little industry required to increase the comfort and wealth of the people. The more accessible rubber districts are, it is said, becoming exhausted, and give a less yield than in former years, yet the rubber-bearing country is so vast, that the constantly newly-discovered sources more than supply the deficiency occasioned by the exhaustion of the old, and the slight call for exertion by extra travel has not yet imbued into the inhabitants the idea of planting the rubber tree or caring for its growth.

Canals in Russia.—Notwithstanding great difficulties, Russia is traversed by canals. There is a communication of this kind between St. Petersburg and the Caspian Sea. The Baltic and the Black Sea are united by canals; the White Sea and Caspian are also connected by the same means; in short, with the exception of a few myriamètres, a traveller can go by water from St. Petersburg to Selmguisk in Siberia.

Silicate of Potassium and Zinc White in Painting.—M. Artus, manager of the Vielle-Montagne Company, presented to the Academy of Sciences at Paris, in the name of the company, some specimens of painting with silicate of potassium and zinc white on metallic zinc. This painting, which imitates stone, resists the action of the air, sun, and water. It gives the zinc a monumental appearance; it renders roofing less liable to heat under the influence of the sun's rays. It can be used with the same success on plaster, cement, or brick. The company has again taken up the use of silicate of potassium, to render wood, cloth, paper, &c., incombustible.

Purification of Spirits.—Marshall M. Harris, of New York, has obtained letters patent in England, France, and Belgium for a new and valuable mechanical process for distilling and purifying all kinds of spirituous liquors. The plan adopted, says the *Scientific Review*, of eliminating the impurities incident to distillation by purely mechanical means, is an idea both simple and palpably superior to any process for purifying spirits by chemical means. Hitherto distillers have been compelled to rely on a destruction of the deleterious fusil oil by age, maceration, or exhibition of charcoal or drugs. But under this improved mechanical process, spirits fresh from the still are innocuous, as healthful, and as delicately flavoured as that which has been sleeping away its asperities for years. So superior is this mechanical method of purifying spirits during the process of distillation, that an article made even from inferior materials will be far better than most of what is now in use.

The Norwegian Fisheries.—Norway possesses a long and much-indented coast, which furnishes a large part of the herrings, lobsters, and cod consumed in England. The most valuable Norwegian fisheries are in the extreme north, near the Hofoden Islands, and within the Arctic circle. The great fisheries, and those of most interest to all Englishmen, are the deep-sea fisheries for cod and herrings, which constitute the most important branch of industry practised in Norway. The annual produce of these amounts to a million of money, and they give employment to from 20,000 to 30,000 men. About 1,000,000 barrels of herrings are annually procured, of which a considerable portion finds its way to this country. The fishery begins in February. The cod are caught in two ways, with nets, in the English fashion, and with lines. The lines, or rather cables, are 1,000 fathoms long, and are supported in each case by a buoy, and secured by anchors, to prevent their drifting. Each line is furnished with 1,200 hooks, at distances of five feet from each other, each hook being on a separate hook-line of about a fathom in length. The lines are set at night and taken up in the morning. The fish are not salted, but are merely gutted and hung up in pairs upon poles, to be dried in the wind, and when thus cured, they are exported in large quantities, under the name of round or stock-fish. The total number of men employed in the fishery in 1870 was 18,324, and the yearly produce consisted of 16,456,000 fish, equal to about 8,800 tons when dried. Besides this, there were secured 21,500 barrels of cod oil, and 6,000 barrels of cod roe. The great cod fishery ends in April.

MEETINGS FOR THE ENSUING WEEK.

THURS...Linnean Society, 8. 1. Sir John Lubbock, "On the Origin of Insects." 2. Captain Chimmo, R.N., "On the Flying-fish (*Exocatus volitaus*)." 3. Mr. Albert Müller, "On a Chinese Gall, allied to the European Artichoke Gall."

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FRIDAY, NOVEMBER 3, 1871.

All communications for the Society should be addressed to the Secretary, John-street, Adelphi, London, W.C.

ANNOUNCEMENTS BY THE COUNCIL.

NOTICE TO MEMBERS.

The One-Hundred-and-Eighteenth Session of the Society will commence on Wednesday, the 15th November, when the Opening Address will be delivered by Lord Henry G. Lennox, M.P., Chairman of the Council, and when the Prince Consort's Prize, awarded at the last Examinations to Mr. Thomas Dawe, as well as the Medals awarded during the past Session, will be presented.

The following are the dates of the Wednesday evening meetings, the chair being taken at eight o'clock :—

1871.	November	—	—	15	22	29
„	December	6	13	20	—	
1872.	January	—	—	17	24	31
„	February	7	14	21	28	
„	March	6	13	20	—	
„	April	3	10	17	24	
„	May	1	8	15	22	29
„	June	—	—	—	26*	

For the Meetings previous to Christmas, the following arrangements have been made :—

November 15.—Opening Address by Lord Henry G. Lennox, M.P., Chairman of the Council.

November 22.—" On the Present State of the Through Railway Communication to India." By Hyde Clarke, Esq.

November 29.—" On Tramways and their Structure, Vehicles, Haulage, and Uses." By W. Bridges Adams, Esq.

December 6.—" On Sewage as a Fertilizer of Land, and Land as a Purifier of Sewage." By J. Bailey Denton, Esq.

December 13.—" Observations on the Esparto Plant." By Robert Johnston, Esq.

December 20.—" On the Study of Economic Botany, and its Claims Educationally and Commercially Considered." By James Collins, Esq.

Each Member is privileged to introduce two friends to every Meeting, and a book of blank Tickets of Admission has been forwarded for this purpose.

Members are reminded that should any of their friends wish to join the Society, the opening of the Session is a favourable opportunity for proposing them.

CANTOR LECTURES.

The First Course of Cantor Lectures for the ensuing Session will be " On the Manufacture and Refining of Sugar," by C. Haughton Gill, Esq., and will consist of four lectures, to be delivered on the following Monday evenings :—

Lecture 1.—Monday, November 27.

Sugar from " cane " and from beet-root is the same—Exists dissolved in water in the plant-cells—Some bodies can pass through moist water-tight membranes—Diffusion—Colloids and crystalloids—Solubility: limits of in cold and in hot water—Crystallisation from hot saturated solutions on cooling—Phenomenon of supersaturation—Evaporation—Boiling—" Boiling point "—Boiling point dependent on pressure on liquid—Solutions of sugar boil at higher temperature than water.

Lecture 2.—Monday, December 4.

Properties of sugar—Its ready decomposibility—Action of a high temperature—Action of dilute acids—Conversion into grape and fruit sugars—Other varieties of sugar; their properties—Winning of cane juice by rollers—Rough evaporation in open pans, and consequent destruction of sugar.

Lecture 3.—Monday December 11.

The sugar-beet—Extraction of juice by diffusion and by presses — Defecation — Carbonation — Preliminary filtration — Concentration — Refiltration — " Boiling " — Separation of syrup from crystals—Treatment of Syrup — Second and third products — Molasses — Nature of molasses—Difference between molasses from cane and beet—Estimation of the value of raw sugar.

Lecture 4.—Monday, December 18.

The refining of sugar, the complete cleansing of it—Melting or blowing up—Filtering, charcoaling, boiling, filling out, draining, liquoring, stoving—Utilisation of syrups—Treacle.

These Lectures are open to Members, each of whom has the privilege of introducing two friends to each Lecture. Tickets for this purpose will be issued with the *Journal.*

A Course of Cantor Lectures, " On Vitreous Colours and Pigments," will be delivered by Professor Barff, M.A., F.C.S., and Fellow of the Cambridge Philosophical Society, during the Session, the dates and particulars of which will be announced in the *Journal.*

THE LIBRARY.

The following works have been presented to the Library :—

Proceedings of the Scientific Association of Trinidad. Part VIII. December, 1869.

O'Gorman's Intuitive Calculations. Presented by the Editor, Professor Young. 2 vols.

A Systematic Handbook of Volumetric Analysis. By F. Sutton, F.C.S. Presented by the Author.

United States Patent Office Reports, 1868. Vols. 1, 2, 3, and 4.

Solutions Sociales. Presented by the Author.

Final Report of the Refugees' Benevolent Fund. Presented by Francis Bennoch, Hon. Secretary.

Transactions of the Royal Society of Victoria. Presented by the Society.

The Effect of Migrations in Disturbing Local Rates of Mortality. By T. A. Wilton, F.S.S. Presented by the Author.

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* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

INSTITUTIONS.

The following Institution has been received into Union since the last announcement:—

Hull, Church Institute.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF INSTITUTIONS.

Salford Working Men's College.—The annual distribution of prizes in connection with the Salford Working Men's College took place on October 27th, in the Salford Town-hall. Mr. Alderman Barlow was in the chair. The prizes were distributed by Mr. G. Osborne Morgan, Q.C., M.P. Mr. Plant, the hon. secretary, read the report. The college had been the agent through which, by its connexion with the Science and Art Department, the Society of Arts, and the Lancashire and Cheshire Union of Institutes, had been acquired 1,358 certificates or book prizes, and in substantial value in money the sum of £200. The following is a summary of the honours obtained during the year:—One gold medal, 13 money prizes, value £30; 27 Queen's and art prizes; four honours certificates; 11 first-class certificates; 25 second-class certificates; and 212 third and elementary; total, 293. Mr. G. Osborne Morgan, previous to distributing the prizes, addressed the meeting, after which, Mr. C. E. Crawley, M.P., moved—"That the Working Men's College is an institution worthy of its founders; and its labours to impart practical and technical education to the artisan entitle it to claim again the sympathy and support of all friends of education." Dr. Morgan seconded the motion, which was supported by Mr. Alderman Walthew, of Stockport, and passed. Mr. W. T. Charley moved—"That the best thanks of the college be given to the honorary and other teachers, as it is by their zealous labours that the college has progressed so satisfactorily." On the motion of Dr. Syson, seconded by Mr. Henry Rawson, a vote of thanks was passed to Mr. Morgan for distributing the prizes; and a similar compliment to the chairman concluded the proceedings.

THE INDUSTRIAL CLASSES ABROAD.

(*Continued from page 779.*)

BRAZIL.

Mr. T. C. Cobbold, writing from Rio de Janeiro, observes that few English labourers are at present employed in this province. The workmen engaged in road-making, construction and repair of railroads, and for agriculture, are for the most part Portuguese, who, being very economical and sober, contrive, with a daily pay of from 3s. to 4s., to economise at least the half. The Company Uniao and Industria, which is a large employer of labour in road and railroad making, and in some kinds of cultivation, also waggoners, drivers, and mechanics, pay their workmen on the railroad from 2,000 to 2,400 reis per diem.; their waggoners, and those employed in cutting grass, &c., 30 to 40 milreis a month, and their food. The mechanics of this company, employed in their workshops at Juiz de Fora, earn wages varying from 2,500 reis to 4,500 reis per diem. The latter are all German, as are also the coachmen and some of the road labourers. The less enervating highlands of the mining districts are better suited to the Englishman, and especially to the Cornishman. In June, 1867, there were 86 miners and 55 workmen and mechanics employed at the Morro Velho mine, where, being well paid and cared for, they ought to be able to put by considerable sums of money. It is difficult to estimate the exact relative value of money, with reference to the position of the labouring class, in two countries in which not only prices but commodities, and, above all, requirements differ so essentially, as in the present case. On the whole, however, there can be little doubt that, upon equal money wages, the real remuneration obtained by an artizan in this country would be inferior to that received on a like footing in England. It is, in fact, doubtful whether an English mechanic would not enjoy as much comfort on £15 per month in his own country as on £20 per month in Rio de Janeiro.

The population of the two extreme northern provinces, Para and Amazonas, according to Mr. Consul Drummond-Hay, is composed of several distinct classes or races of man, namely, the Tapuyo (or civilised Indian), the white man (descendent of the Portuguese, Europeans, and foreigners from all countries, the negro, and, lastly, the several lineages which have sprung from the free mixture of all these races, and amongst whom, especially in the lower orders of the towns, black blood appears to predominate. The immense area included in these two provinces may be roughly computed at about 400,000 square miles, and the existing population at not more than 350,000. The proportion of slaves is small as compared with other provinces in the empire, hardly amounting to 20,000. Their number is yearly decreasing, for nowhere in Brazil is the feeling that the abolition of slavery is necessary and imminent greater than in those provinces. The proportion of available labourers is very small, probably about one-tenth of the population, as, though there is some poverty, there is little suffering, for nature is prodigal, though men are inert; yet, from this very cause, is the want of labourers in the fields and towns severely felt; labourers and workmen are clamoured for, enabling the few to make up, to a certain limit, their own daily, and often exorbitant, stipulations for wages. The European who emigrates to this country, and by temperate habits becomes acclimatised, competes successfully with the native, suffering no further ills from the climate than others of the white or dark race who are born and bred here. So far as agricultural labour is concerned, should proper encouragement be given, by the offer of good land and other early conveniences, to the gradual and voluntary immigration of an industrious race, who would not allow the extraction of rubber, or the simple gathering of nature's produce to absorb their attention over all other labour, there is no doubt that, in the course of a little time, comfort and wealth would be enjoyed by the production of cotton, sugar, rice, cocoa, and other numerous articles indigenous to these provinces, and the condition of a country yet in the very infancy of civilisation materially enhanced. Food, or the necessary aliment of man, is cheap and abundant, but luxuries are dear, being double and treble the price in England.

There are no manufactories on any large scale. Cotton is neglected, and the small manufactories, for bricks, soap, or the like, for home consumption, or, again, workshops and workmen, are all yet in the very cradle of progress, and offer little assistance for forming correct statistics as to class, workmanship, or bodies of workmen. Wages vary from 5s. to 8s. 4d., and even 11s. 9d. per day. The regular hours of labour are usually from six in the morning till four in the afternoon, from which time one hour or one hour and a-half is taken for a mid-day meal.

Mr. Drummond-Hay observes that any intelligent, skilful, and sober artisan would be, and is, certain of remunerative employment in Para. He would have difficulties at first to contend with, such as the language, house accommodation, and occasional slight illnesses, until he became acclimatised and accustomed to the usages of the country. But if he were a persevering man, not wasteful in his expenditure, not too urgent in his want of society, and lived with regular, quiet habits, avoiding the many vices which affect strangers in Para, he would, as a rule, be able considerably to better his circumstances, and rise in a brief period in reputation even above his class in England. Unhappily, however, the greater portion—not the whole—of English artisans who have hitherto appeared, seeking employment, have been sadly wanting in some of these qualities, especially in their extraordinary addiction to drink, and, in consequence, have but in few cases realised their wishes, or reflected credit on their countrymen resident in the place, who feel such discredit in their daily intercourse with Brazilians and natives of other countries, who are generally of far more temperate habits.

PERU.

The purchase-power of money in Peru is stated by Mr. Mathieson, the manager of the Lima and Callao railways, to be not more than one-half what it is in England; provisions, lodging, wearing apparel, and, indeed, all the necessaries of life, are much dearer than at home; washing is also an expensive item, and the high rate of wages is so far modified by the greater cost of living. Much may be done, however, to lessen this disadvantage, by workmen bringing out clothing and other articles from England in sufficient quantity to serve them during the period of their agreements. These contracts are usually for three or four years, with the condition of free passage to the coast, and passage home again, should they determine to return at the expiration of their term. If a workman brings a good outfit with him, and is provident and temperate in his habits, he can always save. Assuming that a mechanic receives four dollars (12s. 2d.) per day, his expenses, in food, lodging, &c., will be about sixty dollars (£9 2s. 6d.) per month; he can thus lay by at least forty dollars (£6) per month. This refers to men who provide themselves with board and lodging. In some instances the agreements made in England with mechanics includes the items, the employers finding the workmen with dwelling and board, and the wages, of course, are subject to a corresponding reduction. The largest employers of English workmen are the Pacific Steam Navigation Company. They have, in their factory in Callao, 150 skilled mechanics on an average, who are lodged and provisioned on the premises. The arrangements made for the health and comfort of these men are admirable in every respect. The contracts are usually for three years, in some cases four years, with passage out, and house at the expense of the companies. The rate of wages vary from £120 to £144 per annum; and assuming £130 as the average pay, these men may, with prudence and care, save from £80 to £90 a-year, provided they have with them a sufficient stock of clothing for the term of their contract. The gas and water companies of Lima and Callao, which are under English management, adopt to some extent the system of providing their workmen with house accommodation and food. Arrangements of this nature are favourable to the men, for the reduction in wages is fully compensated by the advantage of good and healthy lodgings, and the care and supervision exercised as to the diet and living of the workmen. There seems, however, no reason to believe that the power of preserving the health in this climate is, under ordinary circumstances, less than it is in England, provided temperance and sobriety are adhered to; but when attention to these is neglected, health and vigour decline more rapidly than in England. The climate of Peru is very benignant, and is favourable to out-door work; but much exposure to the sun is injurious and debilitating. The diet of the workmen is about the same as in England, except, perhaps, during the summer months, when there is less inclination for animal food. Spirits and stimulants of all kinds are hurtful, and they are not needed, for a mechanic can do as much work, and can undergo as much exhaustion without serious risk, as he can do at home, provided he eats good, wholesome food, and abundance of this can always be had in Lima.

PERSIA.

From the opinions expressed in the reports from Ispahan, Shiraz, Koum, Hamadan, and Kermanshah, and from the views of those most competent to decide upon this subject, Mr. Jenner, writing from Teheran, states that he is led to express a positive judgment to the effect that no immigration of workmen seeking employment as individuals would lead to anything but disappointment and ruin. With the exception of one or two branches of industry, such as the manufacture of carpets and shawls, in which the Persian workmen excels our own, there is no demand for skilled labour. One or two workmen from each craft might succeed in making a fortune, if they would induce their employers to pay them; but a dozen or two would glut the market. There is, however, one way in which an emigration to Persia might be profitable to those engaged in it. Self-supporting colonies, composed of 500 to 1,000 or more members of both sexes, might thrive, if engaged either in working some of the numerous mines to be found scattered all over Persia, or in manufacturing cotton stuffs of a quality corresponding to that of the chintzes which form the chief article or importation to the country, or silk stuffs for use and exportation, for both of which manufactures the raw material could be procured in abundance and at cheap rates upon the spot. Colonies engaged in these or other pursuits, and so constituted, like those of Germans in Odessa, or of Swedes and Norwegians in the United States, as to be enabled to till their own land, make their own roads, and provide in every respect for their own wants, would, in the opinion of many persons qualified to judge, be likely to meet with success. Before such a colony can be established, it will be necessary to overcome many prejudices on the part of the rulers, which at present are so deeply rooted as to render success almost hopeless. From the people, far from meeting with opposition, Mr. Jenner believes such colonies might expect the welcome everywhere bestowed upon those who lower the prices of food, and increase the value of labour.

When the winter diet of the workman consists almost entirely of bread, rice, and bad cheese, with a small quantity of tea in the form of a decoction, and the summer diet of bread and *sayfi*, or summer produce, *i.e.*, melons, cucumbers, vegetable-marrows, egg-plants, and various forms of edible gourds, it would be idle to compare the purchase-power of the wages with those paid to English workmen. In Persian towns, large caravanserais, built in former times to accommodate a far more numerous population, are generally to be found; these buildings, though generally in a more or less ruinous condition, can still furnish shelter for a large number of workmen, whilst the court yards of mosques, and sheltered corners in various parts of the town, are the refuge of a large number of the still poorer classes. In the manufacture of shawls and carpets, in brass work, in enamel, in gold or silver, in every species of ornamental work where a good effect is sought for rather than excellency of finish, the Persian work may be said to be good. The ignorance of the workmen in many other branches is not altogether the result of their want of opportunity of improvement. The love of tradition is very strong, and the only change to be noted is that which is produced by the gradual deterioration which, by a universal law, comes upon nations which do not progress. No artisan takes a pride in excelling in his work. The laziness of the Persian character is so great, that the workman can never be brought to do more than what is sufficient to earn the price of his labour. There is, however, one numerous and powerful fraternity which is never tired of attempting to surpass. Those who belong to it, and they form in two or three instances the population of entire districts, are ever striving to excel; they devote every leisure moment to this purpose, and are stimulated to constant endeavours by the fame of those who have attained to eminence in their difficult art. Few Persians of any position but have arrived at a certain skill in this accomplishment; and prime ministers, and even sovereigns, have owed the greater portion of their celebrity to their extraordinary aptitude in penmanship. The Murzas are the only "class of workmen who take a pride in their work, and endeavour to excel from the sense of honour they have in executing it." Mr. Jenner remarks that, to say that the chief artistic talent of Persia is applied to such a purpose, is equivalent to saying that it is directed to the least profitable channel it could possibly pursue. If the years of constant study and patient application wasted upon this thankless pursuit were bestowed upon any other art, science, or even handicraft, Persia might hold a high rank amongst civilised nations.

Mr. Consul-General Herbert, writing from Bagdad, states that, so far as he can learn, from careful inquiry and general estimation, the artisans and industrial classes bear the proportion of about 60 per cent. to the other classes. The latter may be said to comprise government employés, ulemas, landholders, merchants, petty traders, dependents, and beggars. The former are armourers, bakers, barbers, blacksmiths, bleachers, boat-builders, boat-trackers, bookbinders, braziers, bricklayers, butchers, carpenters, coppersmiths, dyers, embroiderers, engravers, farriers, goldsmiths, locksmiths, matmakers, muleteers, needlewomen, pipemakers, porters, potters, shoemakers, spinners, tailors, tanners, tinmen, water-carriers, watchmakers, weavers, &c., and field-labourers. As regards the nature of their engagements with their employers, there is no investment of capital in their case—no manufactories. A master artizan works himself with his journeymen and apprentices; the labour-market is well supplied, and artisans are, for the most part, so comfortably provided that they are indifferent to extra work, and are content with that which they know must come to them. They are unwilling on any occasion to hurry themselves, or put themselves out of their way, to accommodate a customer. Mr. Herbert is of opinion that there is no opening at present for the introduction of foreign labour, and that English artisans and workmen should not be encouraged to come independently to the country. But the most promising openings are opened for capitalists, both agricultural and commercial; and should it be possible to attract to it the attention of such, their service would offer occasions for the employment of Englishmen as superintendents, engineers, overseers, and skilled workmen, and probably, in the course of time, for that of subordinate workmen and labourers. Under the present law, foreigners can hold land in the Ottoman dominions, and should it be possible to direct the attention of monied enterprise to this part of them, there can be no doubt that, when rapid and easy communication may be established with east and west, as may be hoped in a few years, should her Majesty's government, in concert with that of the Porte, encourage the scheme of a railway to connect the Mediterranean Sea and Persian Gulf, large fortunes are to be made. Persons or corporate bodies investing money in land would need machinery for irrigation, tillage, for preparation of cotton, fibres, &c., and would necessarily employ Englishmen, and, as their works advanced, the numbers of these would increase in a corresponding manner.

SANITARY PRINCIPLES OF SCHOOL CONSTRUCTION.

By Edwin Chadwick, C.B.

Now that new school boards are preparing for the construction of new school-rooms, it is of importance that they should be apprised of the sanitary defects that require amendment in the greater proportion of those existing for the elementary schools in this country. Medical officers of health have concurred in declaring that the common elementary schools, as now constructed and conducted, are the frequent centres of childhood epidemics. An excess of upwards of 7,000 deaths in the metropolis, and of upwards of 50,000 annually throughout England and Wales, in the school stages of life, were pronounced by them, on the observation of the working of particular schools within their province, to be largely attributable to the structural condition of the school-rooms, and to the modes in which the children are kept in them.

The chief sanitary defects of these schools are, in my view—(1) Defective ventilation; (2) Defective warming; (3) Bad drainage and foul latrines; (4) Want of means of maintaining personal cleanliness; (5) Bad lighting; (6) Bad arrangements of desks and seats; (7) Want of proper means of gymnastic exercises; (8) Insufficient, and ill-paved play-grounds. I would submit that it is important that school boards should require, in the competition for plans, that these evils should be first specially considered and provided for, and that the architectural designs and elevations be made of secondary consideration.

I will, in the first place, treat of the warming of the schools, as that largely influences their ventilation. To me it has always been most painful to observe the condition of children in the common schools, in winter time, going there in cold and wet, in driving sleet and snow, frequently ill-shod, and commonly ill-clothed—kept in the school during excessively long hours under any conditions for children, with feet and hands painfully cold—fingers often so benumbed as to be scarcely able to hold their slates and pencils; the open fires at one end of the school, not freely to be approached, and when approached, the warming or heating on one side, "roasting in front and freezing behind," so as to give inflammations or colds from the disturbed and unequal circulation. The confinement of the children for five or six hours in such conditions, overtasked mentally, and painfully constrained bodily, are surely evil conditions requiring active intervention for their relief.

One consequence of the defective warming is, that doors and windows are shut to keep out the cold. Then comes the pernicious effect of confinement of the children in the atmosphere polluted by their breaths and by transpiration from their skins—usually unwashed, or only hands and face washed—and from dirty clothes. As a relief, some of the windows are in part opened, and the cold air is let in for ventilation. The corners where this is done have been called "rheumatism holes." Sometimes when the windows are kept closed, the confined air is heated to an extent that creates perspiration, even in winter time. Eruptive diseases are often consequences of precedent functional derangements, and when there are outbursts of epidemics in children's institutions or in large schools, they frequently occur among the children grouped at one end, and the first case observed is a new comer, who has been for a time the centre of the group attacked, the infected breath having been pumped out on the surrounding children for several days before the eruption has appeared on the new comer. In general hospitals, it is known that if they are well ventilated, cases of typhus fever may be put in every second or third bed, with an interval of about four feet between each bed. Cases of scarlatina—it is considered as settled—must be placed at wider intervals, as of every seventh bed. But if the ventilation be defective and confined, a foul atmosphere is created which will endanger the nurses. By adequate dilution with fresh air the poison is rendered innocuous. By crowding and additional doses of foul air it is made destructive. Obstruct the ventilation, or crowd the cases still more, and an atmosphere is created which endangers the medical attendants. Thus in the ill-warmed schools, in which windows and doors are kept closed to keep out the cold air, the foul atmospheres, poisoned by the incipient disease common amongst the poor, are created for the children. In some weathers and school conditions, a mother in sending her child to such schools is sending it into a preparation of fever, or into measle-mixtures, or of small or chicken pock, or of some form of disease. Children, thus infected in the schools, frequently bring the infection into crowded and ill-ventilated homes, where several sleep in the same bed. If surprise is expressed at the sudden extensive outbursts of epidemics in crowded habitations, there is one contributory source of them. Compulsory attendance in ill-warmed and ill-ventilated long-time schools is commonly compulsory, bodily deterioration. Such conditions endanger, and frequently ruin, the constitutions of teachers. It is proper to mention, as respects the higher class of female schools, boarding schools as well as in second class schools, that great pain is inflicted, and bodily disorder occasioned, by heads kept heated by unduly protracted mental labour, and feet kept cold by bodily inaction.

By graded schools, as I have shown, especially by half-time schools, three children may be taught well in half the time in years, for the expense now commonly incurred for teaching one comparatively ill. The school board for London have set an important example in the adoption of large school organisation. But such provision entails the necessity of sanitary precautions, for if they be neglected, especially as respects the classes of children to be brought in by compulsion, considerable bodily injury will frequently be occasioned. I submit that the first object is to improve the method of warming as involving the method of ventilation.

Of the modes of warming, those by hot water pipes and iron surfaces are of inferior, and sometimes, when for high heats, are of pernicious effect, and are very expensive. Besides, they are apt to warm only the sides of the rooms, or the upper parts of them, and to leave the feet cold, unless an inconvenient and objectionable degree of heat is created over the whole room. It is, moreover, matter of considerable experience that warming by earthenware surfaces, or stone surfaces, especially by heat diffused over wide earthenware or concrete surfaces, is more agreeable and more salubrious than any warming by iron surfaces.

Observing some ragged boys at night grouped upon a particular street-pavement, and apparently enjoying themselves, in very inclement weather, I found that the pavement on which they were assembled was warmed by a baker's oven beneath. It is observable that market women, with a foot-warmer, sustain very inclement weather. The like facts, which I might multiply, appear to me to lead to the conclusion that there are no means of applying warmth that are so economical as by applying it to the feet. There is extending experience of this in the use of hot-water bottles, and vulcanised macintosh hot-water bags.

The class of facts on this topic lead me to recommend that we should adopt the practice of two empires, of Rome and of China.

The Roman plans of floor-warming are displayed in the remains of villas found in the chief seats of their occupation in this country. Their hollow floors were mostly made by square slabs of stone, or of large tiles, supported by stone pillars a foot or eight inches high, or more, set upon a lower stone floor. The upper floors were covered with concrete, and often ornamented by tesseræ. Some of their hollow floors in this country were evidently warmed by coal, from the remains of coal soot, in others they were warmed by wood. The fire-place for the coal-warmed flooring was mostly a small cylinder of red earthenware, containing a mere hatfull of coal, through which the air was led by a down-draft through the hollow of the floor, the draft being created by an upcast flue, on the side of the chamber opposite to the fire-places, the tall chimney-flue acting as the longer leg of an inverted syphon. In some of the largest Roman constructions of this species, the heat appears to have been led underneath the long, distinct channels. But in some the warming was by the diffusion of heat through the floors amidst the uprights, which, I conceive, would be done by low heat, led slowly, but long applied.

I have been unable to get any detailed accounts of the Chinese methods of construction for the purpose, and I shall be much obliged to any one who will give me some, but the testimony is strong and decided that the floor-warming there is the most comfortable that has been experienced by Europeans. Marco Polo, the early traveller, notices it as extraordinary. The warming is effected with a comparatively inconsiderable amount of almost any sort of fuel.*

I am informed that in the barracks of China, constructed on the English principle of the open fires, men were frost-bitten, whilst the Chinese, with their mode, were perfectly unharmed. The Army Sanitary Commission of the United States adopted the principle of this method of warming for field hospitals. A trench, covered with wide slabs of stones, was led from one end of the tent to the other. On the outside, at one end, a fire-place was sunk at the mouth of the trench; at the other end a chimney was erected of clay, held together by empty barrels piled on end. In this way a draught was created underneath the stone floor of the tent, warming it in the most equable and agreeable manner. Americans attached to the ambulance corps applied the same principle, with complete success, to the warming of the field hospitals in Paris. General Duff, of the United States Army, informs me that he applied the principle by rough and ready methods, for the warming of field tents for his soldiers. The abuse of the method of warming will obviously be in getting up unduly high heats for the whole of the air of a room. The warmed floor, in its proper use, however, appears to me to have the peculiar advantage in enabling a colder, and thence a more condensed air—a better quality of air breathed than any heat-expanded air.

To those who have not had occasion to attend to the subject, it may be observed if a given quantity of air, with a given quantity of oxygen, at a given temperature, be expanded in bulk by heat—say by a fourth—the inspirations of the lungs must be quickened in proportion, to obtain in the same time the same quantity of oxygen. In newly warming the Palais de Justice, at Paris, a warmed surface was placed for the feet of each judge. If the warmth were applied to the whole body so as to raise it to the same temperature given by the foot-warmer, the air breathed being more expanded would, I consider, be inferior in quality for the health.

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* A later traveller, Father Ripa, says:—"By the European method of warming houses, our heads may be hot while our feet are cold, whereas, in Pekin, the feet are always well warmed, and a moderate heat alike pervades every part of the room. Wood is very scarce, but there are mountains in the neighbourhood which appear entirely composed of coal, like that of England, and this is the fuel in general use. While I was living in Pekin, some Muscovites arrived, who had never been there before. They built themselves stoves of the European kind, supposing they were to be preferred, but, soon perceiving their error, they pulled them down, and adopted those of the Chinese. They likewise discovered that the expense of heating their own stoves exceeded that of the Chinese a hundred-fold, for in their own, they were obliged to use a great deal of wood, which, at Pekin, is exceedingly dear, whereas the cost of fuel for the Chinese stove is a mere trifle, the coals being very cheap, and the chimney not more than a foot square, and two deep. In the southern part of China, the land being universally cultivated, there is but little wood, and, as the expense of conveying coals would be very great, dry leaves, grass, weeds, and even the dung of animals, are used for fuel." The timber flooring in use in England obstructs the application of the principle; but Mr. Alfred Beaumont, when exercising his profession as an architect, applied it with perfect success to the warming of the stone floors of several offices, and without smoke, dust, and dirt, and a great economy of fuel. He says, "A perfect combustion having extracted the whole of the caloric from the fuel, the next point is to secure the delivery of the caloric in the apartment to be heated, and there only. This is done by extending the smoke beneath the floor of the apartment desired to be heated for such a length as shall deliver all the heat from the draught, save and except just enough to carry the draught up the chimney. In these ways, all the caloric producible from the fuel is distributed only in the place desired to be heated [in the large offices he led it to the standing places of clerks, at a distance from the fire-place] and a required degree of warmth of the purest kind is enjoyed."

Before it became a practice to use foot-warmers in railway carriages, the passengers were accustomed to close the windows as completely as they could. Since foot-warmers have been introduced, windows are allowed to be more widely opened.

The effect of foot-warming, then, is to enable the body to sustain, with less discomfort, the impact of cooler currents of air. Foot-warming will, of itself, allow of doors and windows to be opened with less annoyance, and of itself will be conducive to freer ventilation. Indeed, Mr. Blackburn's method of ventilating cattle sheds, by an open diaphragm along the roof, would in some instances suffice. In many others I would propose, in addition to the warmed floor, the introduction of open fire-places, on Captain Galton's principle of warming with air pumped in that is fresh as well as warm, and the more active removal of vitiated air through the smoke chimneys.

I have long advocated the principle of floor-warming, but I find it expedient to propose particular means for the purpose, which I will describe hereafter, as architects may not have access to plans of the Roman methods of floor-warming.

Next to the foul air from overcrowding—from the breath—there is the foulness arising from congregation of dirty skins as well as of dirty clothes. Medical officers, who have to do the work of vaccination with children of the lower and middle class, are aware how small is the proportion of them who are ever properly washed, and how painful, and, at times, how dangerous, is the duty of operating upon numbers of them consecutively in confined rooms. The great sanitary success of the district orphan schools is largely due to the daily ablution of the children, and to the cleanliness maintained in the clothing as well as on the persons. On visiting the Central District School I always found the female children's pinafores most perfectly clean, as if they had just come fresh from the mangle. On expressing a doubt whether this was not an expensive luxury of cleanliness, I was corrected by the answer that 300 soiled pinafores made an appreciable difference in the atmosphere. The answer expressed the sanitary principle of the importance of cleanliness—clean clothes, clean skins, clean air—as proportioned to the numbers aggregated. But the massing of numbers together, however cleanly, would be, in some stagnant conditions of the atmosphere, injurious, even if they were massed together in the open air. Troops marched in close column carry their own atmosphere with them. In epidemic periods it has been found that the proportion of attacks has been diminished by marching them in open columns or widely apart. People faint in crowds, not from the pressure of the crowd, but from the atmosphere generated by the crowd. Of course this evil is aggravated by filthy personal conditions. In one ragged school the health of the teacher was frequently overcome by the stench of the scholars, and fever was frequent and rife upon them. In self-defence, he forced the boys to wash in an adjoining room; but this thinned his school, for the washing was with cold water. Cold water washing is found to be a mistake in district schools where the children are under control. The circulation of children of the poorest classes is very low, and cold water is peculiarly painful to them; besides, washing with water which is hard as well as cold does the work of washing imperfectly. It has been found that tepid water is necessary for the purpose. The master of the ragged school to whom I have referred as having failed when he insisted upon the pupils being washed with cold water, got steam passed through the water and warmed it, and he then succeeded. The washing ceased to be disagreeable; indeed, it was made, as it always ought to be, agreeable; and the scholars came, the atmosphere became tolerable, and fever was reduced, if not entirely abolished.

In the larger children's institutions, where children are boarded, the effects of progressive sanitary improvement have been distinctly marked. In one, where the death-rate had been about twelve per thousand, the foul air from cesspools and bad drains was excluded, the latrines were mended, and the ventilation was improved, when the death-rate was reduced to eight in a thousand. Next, regular tepid ablution, and, in summer time, cold water bathing, and careful skin-cleanliness was introduced, and the death-rate was reduced to four in a thousand.

If you go into even first-class elementary schools in England whilst simultaneous class-teaching is going on, you commonly see dirty hands held up. If you go to a school of the like class in Holland, you see very clean hands held up. There, the moral as well as the sanitary duty of personal cleanliness, as far as I saw of it, is well maintained. The children in the female schools are from time to time examined, and the duty of maintaining the cleanliness of their children is enforced upon the mothers. If any mother is frequently negligent, marked observations are made upon her, which are unpleasant, and they are avoided. By due exertion in this direction the object is very generally obtained. But there are cases where the children have no proper mother's care. In some places, the poor people are absolutely destitute of the means of cleanliness, or of proper supplies of water. Accidents constantly occur to little children, and they fall down in the muddy streets, or dirty themselves in playing on unpaved courtyards and roadways. To deal with these cases, there is, in well-appointed schools in Holland, usually a female attendant on the schoolmistress, some old woman, who takes the dirtied children into an apartment and washes them, the schoolmistress herself being of an occupation of a quality above such service.

On such experience, it is to be insisted upon that every elementary school should be provided with a retiring-room or closet, with warm water, with the proper appliances for the cleansing of children. It is a provision of a very high order of importance for the infant schools of the lower districts.

Of the lessons they may be taught in schools, the practice of cleanliness is of the highest order of importance. The clergy who neglect to enforce the precept, "wash and be clean," fail in the enforcement of Christian duty. A filthy population is everywhere a low moral population, but it is futile to enforce the duty in the absence of proper appliances for its practice. Of these, all large schools should have one bath for teaching and practising swimming. For ordinary schools, a swimming bath 30 ft. long by 10 ft. wide and 3 ft. deep may be made to suffice, and it should be constructed for about £50. But for one of the larger schools, there should be a bath 60 ft. long, and 25 ft. wide, and 3 ft. deep, which should be made for about £200. Besides, in crowded districts, several schools might be united for the use of one swimming-bath in turns, as well as for one drill-ground. The objection to such appliances on the score of expense is an objection to the means of economy, for all efficient sanitary appliances are means preventive of waste. The general economical waste of productive force in this country, as I have expressed it, is as if a farmer, in order to obtain one working horse, had to raise two colts, and as if the horse, when raised, had only half its natura and proper working ability. The economical fact should be inculcated that a pig that is regularly washed puts on a fifth more flesh, and that flesh of a better quality, than the pig that is unwashed; and that the same rule holds good with washed, as against unwashed children. Five washed children may be sustained on the food requisite for four that are unwashed, to bring them up in the same condition. Besides, the washing itself is preventive of infections and of contagions, such as the itch and other diseases.

In the proper working of a school, with a due regard to the principles of physiology, as well as of psychology —to the body as well as to the mind—the children ought not to be kept long together. The reduction of school hours to the proper time for efficient teaching, which is demonstrated to be half the usual school time, is in itself followed by marked reductions of non-attendances on account of sickness. They should, moreover, whensoever the weather permits, be turned out frequently into an open space or play-ground for exercise, and in fine weather for lessons. Much may be said for the Irish hedge-row schools, as against the dens in which English children are frequently kept.

The common play-grounds for children are either the natural soil, which is very dirty, or a gravel, which is sharp and wasteful in the excessive wear of shoes and clothes; children fall down upon it and seriously bruise or lacerate themselves, and the sharp grit gets into their eyes or the lungs.

In one institution the managers could not be induced to improve the children's play-ground, which was of gravel, until after the prevalence of opthalmia, when it was flagged, or paved with York landing. It was then found that a saving of one-half the shoe leather was produced by the new paving. But the paving with York landing is very expensive. A Val de Travers asphalted paving would be little more than half the expense, and would, with its peculiar elasticity of feel at the surface, serve much better, especially for gymnasiums. A tile paving, with concrete or celenite tiles would be cheaper still; and these tiles, with the lock-joints I have proposed, and shall hereafter describe, would have the peculiar advantage of not being disturbed by "hop-scotch" or any other form of play. In Germany, smooth concrete paving is used, with considerable saving of shoe-leather. Where very good smooth paving of the quality in question is laid down, I do not see the necessity of children, or at least those of the poorest class, kept in public institutions, wearing either shoes or stockings in dry, summer weather. If the feet be regularly washed and kept clean, I question whether they would not be better bare at such times. In Scotland, children travel bare-foot to school in all weathers, or carry with them their shoes and stockings, which they put on there dry, for which there is good reason. Captain Johnson, one of the Queen's messengers, has well advocated the use of sandals for soldiers, made of matted flax, such as are in use with great advantage by the peasants in the Basque provinces. They only cost a shilling a pair, are light, and can be washed and kept clean.

Miss Nightingale, in her "Sanitary Statistics of the Colonial Native Schools and Hospitals," observes, on the necessity of the careful consideration of habits, as recorded in one of the returns from the Natal schools:—"It might be supposed that one of the most obvious duties in bringing children to school would be to clothe them. But, nevertheless, clothing an uncivilised child requires care. In their natural state they expose themselves to torrents of rain, which runs off them, and they are easily warmed and dried in a hut fire. But it is stated that when clothed in flannel and jersey they get chilled by the rain, and pulmonary diseases come as a consequence." A closet for drying clothes should be provided in elementary schools. In those close neighbourhoods in urban districts where there is absolutely no space for a play-ground to be got, a flat roof should be constructed for the purpose, as is done with excellent effect in one large school near Long-acre.

As the efficiency and economy of teaching, by a division of educational labour amongst trained masters in graded schools, requires the children to be gathered from wider areas than heretofore, often from considerable distances, it will often be necessary to make provision of food for them. In the great middle-class school of the City of London, it has been found requisite to provide cheap dinners for those boys who do not bring their food with them, in what the Rev. Mr. Rogers, the governor, calls their "nose bags." In the great metropolitan Jews' school, which provides for 1,700 children of the poorest class of Jews, and which is, in very important respects, a model of educational administration, I found that its leading supporters, the Baron Lionel de Rothschild and the Baroness, of their own munificent educational grants, have been accustomed to bestow on that one school £800 per annum, to provide a portion of bread and some milk for the very destitute and necessitous children, to enable them to attend. On this subject my excellent and experienced colleague, Mr. Edward Tufnell, in writing to me on part of my draft-paper, observes:—

"In many schools the children bring their dinners, usually miserable enough, and eat them between twelve and one, when there is an interval of school. Now, I think every school should have a small cooking apparatus, in which some girls should be taught to cook cheap soups, stews, &c., and then the children, girls at least, should be kept in school, and given dinners so cooked, which might be done, as I have ascertained, at a penny a head, the parents paying. I mention girls chiefly, as they have often nowhere to go to between twelve and one, their parents being out at work, houses locked, and thus in London at least, they run about in the streets, and sometimes get violated—as I find from the reports of the Rescue Society. Hence you might kill three birds with one stone—teach plain cookery, make the children sit down to their dinners in a Christian-like way, and save the honour of the girls from the dangers of the streets, and the apparatus could easily be made to supply sufficient warm water to wash their face and hands."

Of course, I heartily concur in this suggestion, and can speak of the need of such a provision to keep boys as well as girls from the peculiar dangers of bad associations in the streets.

There is yet a very frequent and serious defect in the constructions of the common schools, which requires to be guarded against, namely, the bad distribution of light. From a paper transmitted to me by the excellent sanitarian, Dr. Varrentrapp, of Frankfort, it appears that from the insufficiency of light, and from the bad distributon of light, in the schools of Germany, nearly a third of those who remain in them during and beyond the secondary stages, are subject to short-sightedness. Professor Leibrich, our most eminent oculist, tells me that the injury is always done by the front light, and that the light should always be got in from the left side, and that in towns where such light cannot be obtained, it should be got, as the next best, from the back of the desk, and never from the front. A great deal of distortions and curved spines are, as Dr. Varrentrapp shows, occasioned by the wrong adjustment of seats, a topic which, as well as others of the wall-colourings and school-fittings, is beside my immediate purpose. I consider that schools ought to have more of window-space; of windows made with double or with very thick glass, which is economical, as saving heat, and is, moreover, advantageous, as lessening the transmission of sound from the streets.

For the reasons which now prevail in respect to the walls of properly-constructed hospitals and cottages, the walls of schools should be made of impermeable materials, and be washable, and of a proper colour.

The evils common to the schools of this country are transplanted to our colonial possessions. In few of these schools, as Miss Nightingale observes, "is any attempt made at combining the elements of physical education with the school instruction, and even where this is done, the measure is partial and inefficient, being confined to a few exercises, or simply to bathing. The obvious physiological necessity of engrafting civilised habits on uncivilised races with great care, appears to be nowhere recognised, except at New Norcia (Benedictine) School, Western Australia, on the return from which there is there is the following very important statement:—Gymnastics are stated to be necessary to prevent sickness; and the reporter proceeds, 'The idea of bringing savages from their wild state to an advanced civilisation serves no other purpose than that of murdering them.' And the result of the out-door training practised at this school, is said to have been hitherto successful 'in preventing the destructive effects of this error.'"

Enough has been stated to show that the school, properly considered as an efficient implement for training the young, is not the mere barn with a floor and seats and an architectural elevation, according to the common conception, but for the avoidance of serious evil as well as for the attainment of the requisite good, is an implement which must be carefully fashioned by the best practical sanitary science. Enough, too, has been stated to show the deplorable state of the central administration — which, having received warning from school inspector after school inspector, and also from the medical officers of health in the metropolis—which, having the aid of a very expensive medical council, passes over these evil conditions unheeded and unprovided for in the school plans issued as models for local boards, and sends additional masses of children into those insanitary conditions, in violation of clear laws of psychology as well as of physiology. Surely some action ought to be taken for the public protection in respect to such an administration.*

With the advantage of some practical suggestions by the Rev. Canon Cromwell, principal of St. Mark's Training College, I have directed one plan of one school, with the primary requirements for 500 children, to be got out by Mr. Samuel Sharp, the architect, with what I must call the Roman floor warming by hollow tile floors, and with solid concrete walls, with a lavatory, but without a swimming-bath and without a playground, and I am assured that it may be erected at an expense within the cost of the common constructions.

I am not prepared yet with the complete plans of tile constructions, which I will give hereafter. Meanwhile School Boards may call upon their architects or competitors for plans to consider by what means they are at present prepared to apply the various principles propounded.

EDUCATIONAL NOTES.

The London School Board has adopted the principle of compulsion. At the meeting on the 25th ult., after an unsuccessful attempt on the part of some members to induce the Board to consider the question of the payment of fees first, it was agreed to take the bye-laws *seriatim*. The first bye-law, which simply defined expressions, was agreed to; and the Rev. J. Rodgers then moved bye-law No. 2, the compulsory clause, "That the parent of every child of not less than five years, nor more than 13 years of age, is required to cause such child to attend school, unless there be reasonable excuse for non-attendance." The debate was adjourned till the following day, when it was resumed by Mr. Smythies, and, after a somewhat stormy discussion, in the course of which it was contended that it was useless to exercise compulsory powers until the Board had sufficient schools to compel children to be sent to, the original motion, affirming the principle of compulsory education, was carried. Upon the point of the payment of fees in denominational schools, Mr. S. Morley, M.P., proposed, and Mr. M'Arthur seconded, an amendment, to the effect that the Board cannot bind itself to pay fees in schools that are conducted on denominational principles, and that certain alterations for effecting that principle be made in the bye-laws. At this point, the Board again adjourned, and the entire sittings of Friday, Monday, Tuesday, and Wednesday were occupied by a debate on this subject. A very elaborate opinion on the legal bearings of this question was laid before the Board by Mr. Sydney Gedge, their solicitor. He holds that if a Board remit fees in Board schools, and refuse to pay them in other schools, they will deprive themselves of the power of compelling the attendance of the children of indigent parents who may object to send their children to a Board school. Mr. W. Smith, M.P., proposed an amendment as follows:—"That bye-law 8 be withdrawn, and that the Board resolves that remission or payment of fees in public elementary schools shall be made exceptionally on proof of urgent temporary need, each case being dealt with on its own merits, without prejudice to the principles involved on either side." This was seconded by Mr. MacGregor; and, after considerable discussion, principally upon a proposal to substitute the word "may" for "shall" (which was rejected), the amendment was carried by a majority of 28 to 7.

Higher Education for Women.—The London Ladies' Educational Association, working in agreement with the staff of University College, has issued a prospectus for the session now beginning. What is to be done is virtually to open the Faculties of Arts and Science at University College to all women who choose to use the opportunities there given for their higher education. Seventeen professors of the college offer to teach, in distinct classes, and under conditions which secure sufficient separation from the other students, as many ladies above seventeen years old as may be found willing to enter for real study of any kind. There are four-and-twenty courses. The whole staff of the Faculties of Arts and Science and the college lecture rooms are at the service of the women who seek help in the real cultivation of their minds. Single classes may be taken, or several courses may be judiciously combined with a scheme of study. Experience of the last year or two has shown (in the opinion of the promoters of the movement) that there is no better place than the college itself for the teaching, where all that is wanted is at hand; and, in fact, the professors are making this experiment on their own responsibility, with the permission of the council. If it be found by experience that there are many women in London able and willing to take their places as true students in these newly-opened class-rooms, it seems to be but a step from the voluntary action of an entire staff of professors to the formal recognition of these classes for women as a regular department of the college work.

Technical Education.—A competition having been invited by the Turners' Company, who propose to give annually a silver medal and the freedom of the company and of the City of London to any workman or apprentice in the trade who may send in the best specimens of hand-turning for the year; the specimens have been lately exhibited at the Mansion-house. The material to be used will be varied in different years, so as to include wood, ivory, metals, stone, spar, &c. The first exhibition was held last year, and on that occasion the successful competitor was Mr. Alfred Madden, of Peabody-buildings, Commercial-street, Shoreditch. This year, the competition was in wood-turning, and specimens of workmanship were received from all parts of the kingdom, some of them showing great skill in design and execution. The Lord Mayor, in presence of the master, wardens, and court of assistants of the Turners' Company, presented the prize to the successful competitor, Mr. W. H. Ridout, of 7A, Richmond's-buildings, Dean-street, Soho. In doing so, his Lordship said the Turners' Company had the honour of commencing, on a small scale it was true, that system of technical education for which some in that room had long laboured, and of which he had been a humble supporter. If we were not to be left behind in the race of commercial enterprise, we must add the higher branches affecting art and imagination to the qualities we already possessed as a nation. He believed in this respect other nations were exceeding us to a great extent, and it was only true wisdom and true patriotism that we should address ourselves to this question. In some of the larger companies of the City of London it had been moved that steps should be taken in this direction, and he had reason to believe that these companies were not unwilling that such steps should be taken. At present the Turners' and the Painters' and Paper-stainers' Companies were the only ones who had done anything, but if such companies as the Goldsmiths' and Merchant Tailors' were to apply themselves to the encouragement of works of art in their particular callings, he was convinced it would be eminently for the public benefit. His Lordship proceeded to the articles exhibited, and said it would no doubt be satisfactory to the competitors that they had for judges three distinguished men — Mr. Charles Hutton Gregory (past president of the Institute of Civil Engineers), who was well known in the higher walks of science; Mr. Tennant, professor of geology; and Mr. John Jacques, whom they all knew as a practical turner. The Lord Mayor then presented Mr. Ridout with the silver medal in appropriate terms. On the motion of Mr. John Jones, a vote of thanks was accorded to the judges; and Mr. Gregory, in acknowledging the compliment, characterised the movement which they were commencing as one of a very important character. Professor Tennant and Mr. Jacques also spoke, and the former remarked that that day being the 47th anniversary of his coming to London as a poor boy, it was especially gratifying to him to be present at such a ceremony. Mr. F. O. Smithers, the master of the company, moved a vote of thanks to the Lord Mayor, and said that the company intended next year to give additional prizes, feeling that the excellence of the specimens of workmanship sent them demanded recognition of that kind.

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* In illustration of it, I may mention that the Special Committee of the British Medical Association, and of the Health Department of the Association for the Promotion of Social Science, have recently recalled particular attention to the regulations of the duties of the Local Officers of Health, which, after careful inquiry, were adopted by my colleagues of the first General Board of Health, Earl Shaftesbury and the late Dr. Southwood Smith. Amongst the provisions for the prevention of the spread of epidemics, was the following:—"Art. 11. In the case of small-pox or any other contagious or epidemic disease attacking any child who has frequented any school, he (the local officer of health) shall, as early as may be practicable, visit such school, and inquire and examine whether there be symptoms of the infection or prevalence of the disease amongst the other children, and give such instructions and advice as may appear to be necessary for the prevention of the spread of the disease" After the General Board was dissolved this, with other practical regulations for the attack of epidemics at their source, was omitted.

CORRESPONDENCE.

SHEEP-FOLDING.

Sir, — In Britton's description of "England and Wales," A.D. 1801, vol. i., p. 269, the king's Norfolk Farm, then at Windsor, was described. It was stated that the ground, formerly rented at 5s. an acre, produced crops more valuable than even the original fee-simple of the land, and that this improvement had been caused by penning the sheep on the fallows, and that 600 to 800 Wiltshire wethers were kept as a folding stock. In the 17th vol. of the "Transactions" of the London Society of Arts, "the following singular method of folding the sheep in hard or wet weather," was described by Mr. N. Kent, the superintendent, viz.:—"A dry, sheltered spot was selected, and sods of maiden earth, twelve inches deep, were laid over the space of a very large fold. It was then bedded thickly with rushes, leaves of trees, fern, moss, short straw, or stubble, and the flock were put into this warm fold, instead of being penned in the open fields, where hay was given to them in racks, and every night they were so penned the fold was fresh littered. When this plan had been continued at intervals during the winter, a layer of lime, chalk, rubble, or ashes, six inches thick, was spread over the whole surface, and when heated together the whole was turned up about about April, and when mixed it made the best manure for turnips." The plan seems to be excellent.—I am, &c., Chr. Cooke.

London, October 10, 1871.

GENERAL NOTES.

Institution of Naval Architects.—The following lis of subjects, on which communications are desired, has been issued by the Council of the institution:—1. The construction of vessels for coast defence. 2. The effect on naval construction of torpedoes, or other modes of submarine attack. 3. On the results of the best modern practice in ocean steam navigation, with reference to the latest modern improvements—such as surface condensation, super-heating, compound engines, and the like; also the value of each of these taken separately, and especially the results of any actual experiments to test this point. 4. On the friction developed in marine steam-engines of different forms; and on the difference between the gross indicated horse-power developed in the cylinder, and the net effective horse-power available for the propulsion of the ship after working the air-pump, slide-valves, and other moving parts of the engines. 5. On economy of fuel in marine engines, with detailed results. 6. On marine boilers, their form, rate of combustion, and the proportion of their various parts. 7. Information as to the alleged rapid deterioration of marine boilers supplied with water from surface condensers, and the remedies for the same. 8. On methods for starting, stopping, and reversing marine steam-engines of high power. 9. On the life and cost of maintenance of merchant steam-ships. 10. The design and construction of yachts. 11. On the time allowances of yachts. 12. On legislative interference with the construction, stowage, and equipment of ships. 13. The effect upon shipbuilding of Lloyd's rules, the Liverpool rules, and the rules of other similar societies for the classification of ships; and on ships not classed. 14. On methods for the proper strengthening of ships of extreme proportions, and on the precautions necessary to ensure their safety at sea. 15. On the present state of knowledge of the strength of materials as applied to shipbuilding, with especial reference to the use of steel. 16. On the masting of ships, and on iron and steel masts and yards. 17. On the disposition and construction of bulkheads, and on their attachment to the sides of iron ships. 18. On machines for the economising of labour in the construction of ships. 19. On the use of machinery for economising labour on board ship, whether merchant ships or ships of war, and whether for loading or manœuvring. 20. On the best method of clearing vessels of water in the event of a leak, and on any novel form of ship's pump. 21. On the means of accurately measuring the speed of ships. 22. On instruments for measuring and recording the rolling of ships, both as to time and extent of roll. 23. On the measure and amount of resistance opposed to a ship's progress by the water through which it moves. 24. Exact information (either experimental or theoretical) on the efficiency of propellers. 25. On the ventilation of ships by natural and forced draughts, with details of any system in actual operation. 26. Exact information, derived from experience, on the steering of ships fitted with balanced rudders. 27. On methods of steering ships which have been deprived of their rudders. 28. On telegraphic or other communication of orders on board ship. 29. On floating structures for special purposes, such as docks, lighters, tank-vessels, light-ships, telegraph-ships, and others. 30. On the economic value of form and proportion, both in merchant vessels and in ships of war. It is requested that all such communications may be forwarded to the secretary of the institution, not later than the 20th February, 1872; the Council cannot otherwise undertake to find a place for them in their programme of proceedings.

Books Published in Germany.—In Germany, during the year 1870, were published 10,108 works, being 1,200 less than during the preceding year a diminution probably owing to the war. The classification of subjects was as follows:—Theology, 1,470; legislation, politics, statistics, 1,014; education, 997; novels, poems, and dramas, 739; painting, music, and literature, 346; history, biography, and correspondence, 692; natural science, elementary and materia medica, 535; medicine, 412; industry and commerce, 411; classical and Oriental languages, 329; domestic economy, 351; modern language and ancient German literature, 297; encyclopædias and literary history, 271; military science, 242; books for the young, 205; geography, 284; architecture, railways, and nautical science, 192; mathematics and astronomy, 114; philosophy, 103; mines, forests, and banking, 91; freemasonry, 11; popular literature, 271; miscellanies, 389; Slavonian and Hungarian books, 50; maps, 242.

American Views on Patent Laws.—Hon. Charles Mason, an ex-Commissioner of Patents, in a letter to Mr. George Haseltine, says he never had any serious doubt of the wisdom of a judicious system of patent-laws. The public welfare is best promoted by inspiring individual effort in respect to invention through the motive of private gain; and who can more justly claim the exclusive use of any property than he who has brought it into being? The American system of examination is productive of great advantage to inventors and the public, but I doubt the wisdom of lodging in officials the unlimited power of rejection. If the duties of examiners were advisory and adjuvant, reserving to an applicant the ultimate right to a patent, at his own risk, the chief objection to this system would be removed. The fees by all means should be small, barely sufficient to defray the expenses of the patent-office. Inventors are benefactors, and, as a class, poorly compensated for their labour. The imposition of large fees discourages invention, and thereby checks the progress of civilisation. This cannot be sound policy. Experience leads me to the conclusion that patents should be granted for more than fourteen years; but this term, in most cases of merit, is extended by our office to twenty-one, and often by Congress to twenty-eight years. The new law limits the term of a patent to seventeen years, which will, no doubt, be extended hereafter, and I do not think twenty-one years too long a period for the original grant. In one respect I like your system better than ours, your fees are paid in instalments, giving the patentee the option of keeping his patent alive. The French plan of annuities is carrying the matter rather too far. I think the English system better than the French or the American, and all that is needed is a reduced rate of fees. The professional experts are regarded with much suspicion, and their opinions have little weight in our courts; and, therefore, what might be a great evil, carries its own remedy; and the interposition of jurors in patent suits is generally avoided by obtaining injunctions in Chancery, which is our usual remedy for infringements.

The Composition of the French and Foreign Beers consumed in Paris.—M. Monier, in a paper read before the Academy of Sciences in Paris, says:—"With respect to their composition, they may be classed under two heads. 1st. The bitter beers, or those of the North of France, England, and Belgium. 2nd. The sweet beers, which are obtained chiefly from Germany and Austria. Those of the first class are generally more dense, but contain less solid extract than the German beers. It is not an uncommon thing to find seven and a half per cent. of gummy matter in those of the second class, which is almost entirely composed of dextrine and glucose. As dextrine and glucose are obtained by the action of diastase on starch, the German beers which contain them have no injurious effects on the body. Unfortunately, it is not always so, as the products are more often obtained by the action of sulphuric acid on fecula and starch. Then the beer is more difficult to digest, and may even produce bronchial affections. The following table is the result of Mr. E. Monier's examination of the different beers consumed in Paris. Their density varies from 1·008 to 1·023. The glucose was determined by Fehling's solution, and the salts by the incineration of the residue from a certain weight of the beer.

	IN 1,000 GRAMMES.			
	Alcohol (in volume).	Glucose.	Dextrine and albuminous substances.	Salts.
Bitter Beers.	c.c.	grm.	grm.	grm.
North of France	40·00	7·03	31·77	1·60
„	32·50	4·80	31·00	2·10
„	36·00	6·60	33·10	2·20
Pale Ale (Burton)........	60·50	8·35	40·10	2·80
„	55·00	8·30	40·10	2·65
Sweet Beer.				
Munich	56·25	15·10	58·40	2·52
„	56·50	16·20	56·45	2·40
Vienna (Austria)	52·50	11·00	55·30	2·30
Amsterdam	53·75	13·55	51·50	2·65
Paris (called Strasbourg)..	47·00	16·30	45·00	2·65
„ „ ..	45·00	14·45	51·30	2·05
„ „ ..	47·50	11·60	43·40	2·00

From these analyses it will be seen that the bitter beers contain only about one half of the glucose and dextrine contained in the German beers. When glucose has been added, there is always found a greater or less quantity of sulphates, which sometimes rises to 1·5 gramme per litre, whilst in genuine beers these sulphates vary from about four to twenty centigrammes for the same volume. Some water contains a considerable quantity of sulphate of lime, for example, that obtained from the Parisian wells. Great care must be taken be taken not to use them in the breweries. If a water contains a large proportion of bicarbonate of lime, Dr. Clarke's process may be employed with success for getting rid of a large portion of the lime. A water containing one gramme of bicarbonate of lime per litre will, after this operation, contain not more than one or two decigrammes."

MEETINGS FOR THE ENSUING WEEK.

MON. ....British Architects, 8.
London Institution, 4. Prof. Huxley, LL.D., F.R.S., Elementary Physiology (II.)
Royal Institution, 2. General Monthly Meeting.
Anthropological, 8.
TUES. ...Zoological, 9.

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FRIDAY, NOVEMBER 10, 1871.

All communications for the Society should be addressed to the Secretary, John-street, Adelphi, London, W.C.

ANNOUNCEMENTS BY THE COUNCIL.

NOTICE TO MEMBERS.

The One-Hundred-and-Eighteenth Session of the Society will commence on Wednesday, the 15th November, when the Opening Address will be delivered by Lord Henry G. Lennox, M.P., Chairman of the Council, and when the Prince Consort's Prize, awarded at the last Examinations to Mr. Thomas Dawe, as well as the Medals awarded during the past Session, will be presented.

The following are the dates of the Wednesday evening meetings, the chair being taken at eight o'clock :—

1871.	November	—	—	15	22	29
„	December	6	13	20	—	
1872.	January	—	—	17	24	31
„	February	7	14	21	28	
„	March	6	13	20	—	
„	April	3	10	17	24	
„	May	1	8	15	22	29
„	June	—	—	—	26*	

For the Meetings previous to Christmas, the following arrangements have been made :—

November 15.—Opening Address by Lord Henry G. Lennox, M.P., Chairman of the Council.

November 22.—" On the Present State of the Through Railway Communication to India." By Hyde Clarke, Esq.

November 29.—" On Tramways and their Structure, Vehicles, Haulage, and Uses." By W. Bridges Adams, Esq.

December 6.—" On Sewage as a Fertilizer of Land, and Land as a Purifier of Sewage." By J. Bailey Denton, Esq.

December 13.—" Observations on the Esparto Plant." By Robert Johnston, Esq.

December 20.—" On the Study of Economic Botany, and its Claims Educationally and Commercially Considered." By James Collins, Esq.

Each Member is privileged to introduce two friends to every Meeting, and a book of blank Tickets of Admission has been forwarded for this purpose.

Members are reminded that should any of their friends wish to join the Society, the opening of the Session is a favourable opportunity for proposing them.

CANTOR LECTURES.

The First Course of Cantor Lectures for the ensuing Session will be " On the Manufacture and Refining of Sugar," by C. Haughton Gill, Esq., and will consist of four lectures, to be delivered on the following Monday evenings :—

Lecture 1.—Monday, November 27.

Sugar from " cane " and from beet-root is the same—Exists dissolved in water in the plant-cells—Some bodies can pass through moist water-tight membranes—Diffusion—Colloids and crystalloids—Solubility : limits of in cold and in hot water—Crystallisation from hot saturated solutions on cooling—Phenomenon of supersaturation—Evaporation—Boiling—" Boiling point "—Boiling point dependent on pressure on liquid—Solutions of sugar boil at higher temperature than water.

Lecture 2.—Monday, December 4.

Properties of sugar—Its ready decomposibility—Action of a high temperature—Action of dilute acids—Conversion into grape and fruit sugars—Other varieties of sugar; their properties—Winning of cane juice by rollers—Rough evaporation in open pans, and consequent destruction of sugar.

Lecture 3.—Monday December 11.

The sugar-beet—Extraction of juice by diffusion and by presses — Defecation — Carbonation — Preliminary filtration — Concentration — Refiltration — " Boiling " — Separation of syrup from crystals—Treatment of Syrup — Second and third products — Molasses — Nature of molasses—Difference between molasses from cane and beet—Estimation of the value of raw sugar.

Lecture 4.—Monday, December 18.

The refining of sugar, the complete cleansing of it—Melting or blowing up—Filtering, charcoaling, boiling, filling out, draining, liquoring, stoving—Utilisation of syrups—Treacle.

These Lectures are open to Members, each of whom has the privilege of introducing two friends to each Lecture. Tickets for this purpose are issued with this *Journal.*

INDIA COMMITTEE.

A Conference will be held on Friday evening, December 1st. Lieut.-Colonel A. Romaine Wragge will open a discussion on the subject of " Indian Forests and Indian Railways."

National Union for Improving the Education of Women of all Classes.—A general meeting of the above Union will be held at the Society of Arts, on Friday, the 17th of November, at 4 p.m. The Right Hon. Lord Lyttelton will preside.

ANNUAL INTERNATIONAL EXHIBITIONS.

Exhibition of 1872.—A meeting of the General Purposes Committee, appointed by Her Majesty's Commissioners for the Exhibition of 1851, to carry out the current series of Annual International Exhibitions at South Kensington, was held on Wednesday at the Privy Council Office. There were present the Marquis of Ripon (chairman), Sir Francis Sandford, Mr. Cole, Mr. Gibson, and Major-General Scott (secretary).

Rules for Supplementary space in the Annexe for British Exhibitors.

For the convenience of visitors to the Exhibition, and in order to facilitate the knowledge and circulation of new objects selected for their excellence, Her Majesty's Commissioners have decided that exhibitors of British manufactures shall, in addition to the space afforded by the Exhibition proper, have supplementary space in the Annexe allotted to them, for purposes of sale. The exhibitors will not be charged a rental for such space.

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* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

The following are the rules in conformity with which the sale and removal of objects will be allowed:—

1. Exhibitors whose works have been admitted to the Exhibition proper by the Committee of Selection will be awarded further space, where they may display objects belonging to the undermentioned classes chosen for the year 1872, provided that such objects are duplicates of those displayed as manufactures in the Exhibition proper, or correspond as nearly as possible with them.

Class 8.—Cotton and cotton fabrics.

Class 9.—Jewellery—*i.e.*, manufactured articles worn as personal ornament made of precious and other metals, precious stones or their imitations, jet, mother of pearl, steel, iron, &c., but not goldsmiths' and silversmiths' manufactured work of other sorts, which it is intended shall be exhibited in 1876. It is intended that ornamental watches shall be exhibited in 1875, with other horological manufactures. [Fine art in precious metals will be admitted with fine arts.]

Class 10.—Musical instruments of all kinds.

Class 11.—Acoustic apparatus.

Class 12.—Paper, stationery, and printing.

Division III.—Products of inventions and discoveries admitted to the Exhibition proper, capable of being exhibited in a very small compass.

2. As soon as exhibitors have been admitted to the Exhibition proper, and at latest before the 10th of April, 1872, they must submit a catalogue of the objects for which they desire supplementary space in the Annexe, and the prices must be given of each object they desire to supply to the public.

3. Space will be assigned in the Annexe, by official committee, to the various exhibitors, according to the importance of their collections in the Exhibition proper and the space available, which will be very restricted in amount.

4. Exhibitors having supplementary space in the Annexe granted to them will be permitted to fit up their own cases, subject to the approval of Her Majesty's Commissioners, who will prescribe the system of lettering and the form of large notices.

5. The objects sold on each day cannot be removed from the building until after the close of the day's Exhibition, at 6 p.m., and after duplicates have been substituted.

6. The catalogue of each supplementary collection, with prices, must be printed by the exhibitor in accordance with the rules which will be laid down. During the Exhibition no change can be made by him in the nature of the objects displayed, or the prices stated.

MEETINGS FOR THE ENSUING WEEK.

Mon......Royal Geographical Society, 8½. 1. The President's Opening Address. 2. Capt. Frederick Elton, "Exploration of the River Simpopo."

London Institution, 4. Prof. Huxley, "Nervous Matter: its Structure and Properties."

Tues.....Civil Engineers, 8. Mr. Carl Siemens, "Pneumatic Despatch Tubes; the Circuit System"

Wed......**SOCIETY OF ARTS, 8.** Opening Address by Lord Henry G Lennox, M.P., Chairman of Council.

Social Science Association, 10 a m. Central Conference of Chairmen and Vice-Chairmen of Boards of Guardians. Right Hon. the Earl Lichfield in the chair.

Thurs...London Institution, 7 30. Mr. Harry G. Seeley, "The Influence of Geological Phenomena on the Social Life of the People"

Linnæan, 8. 1. Mr. A. W. Bennett, "On the Floral Structure of *Impatiens fulva*." 2. Mr. N. A Dalzell, "On *Dolichos uniflorus*, Lam." Dr. H. F. Hance, "Floræ Hongkongensis supplementum"

Association for Social Progress in India (at the House of the Society of Arts), 8.

Sat.......Science and Art Department (South Kensington Museum), 2.30. Prof. Duncan, "On Elementary Physiography."

CONTRIBUTIONS TO THE READING-ROOM.

The Council beg to acknowledge, with thanks to the Proprietors, the regular receipt of the following Journals and Periodicals during the year:—

DAILY.

Birmingham Daily Gazette.

WEEKLY.

Asiatic.
Architect.
Athenæum.
British Journal of Photography.
Builder.
Building News.
Builders' Weekly Reporter.
Chamber of Agriculture Journal.
Chemical News.
Choir.
Colliery Guardian.
Cosmopolitan.
Cosmos.
Engineer.
Engineering.
English Mechanic.
Farmer.
Gardeners' Chronicle.
Journal of Gas Lighting.
Land and Water.
Les Mondes.
Mechanics' Magazine.
Mining Journal.
Musical Standard.
Nature.
North British Agriculturist.
Photographic News.
Revue Scientifique.
School Board Chronicle.
Sessional Proceedings of the Social Science Association.
Staffordshire Sentinel.

FORTNIGHTLY.

Cotton Supply Reporter.
London Colonial Mail.
Spon's Dictionary of Engineering (in continuation).

MONTHLY.

Art, Pictorial and Industrial.
Artizan.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale.
Bulletin de la Société Imperiale Zoologique d'Acclimatation.
Bulletin du Musée de l'Industrie.
Canadian Naturalist and Quarterly Journal of Science.
Educational Times.
Engineers' Journal (Calcutta).
Food Journal.
Indian Economist.
Journal of Applied Science.
Journal of the Chemical Society.
Journal of the Board of Arts and Manufactures for Upper Canada.
Journal of the Franklin Institute.
Journal of the Horticultural Society.
Journal of the National Life Boat Institution.
Journal of the Pharmaceutical Society.
Journal of the Quekett Microscopical Club.
London, Edinburgh, and Dublin Philosophical Magazine.
Photographic Journal.
Presse Scientifique des Deux Mondes
Revue du Monde Colonial.
St. Crispin.
Symons' Meteorological Magazine.
The Horological Journal.
The Institute and Lecturers' Gazette.
The Portfolio.
The Stationer.

QUARTERLY.

Journal of Mental Science.
Journal of the Geological Society.
Journal of the Linnæau Society.
Journal of the Royal Geographical Society
Journal of the Royal Society.
Journal of the Royal United Service Institution.
Journal of the Statistical Society.
Journal of the Victoria Institute.
Popular Science Review.

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